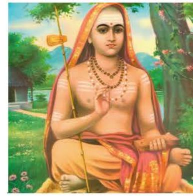
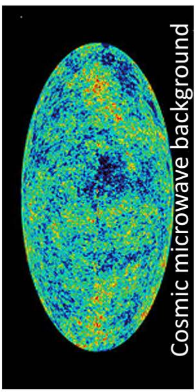
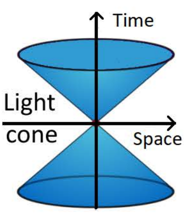
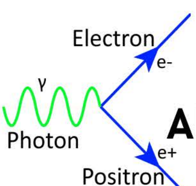
Scientific Evidence Vedantic Light

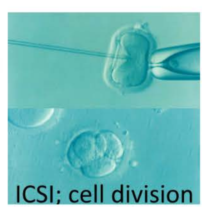








Gleanings from H.H. Jagadguru Śrī **Abhinava Vidyātīrtha** Mahāsvāmin



Scientific Evidence Vedantic Light

Gleanings from

His Holiness Jagadguru Śrī Abhinava Vidyātīrtha Mahāsvāmin

Centre for Brahmavidya
Chennai

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Jagadguru Śrī Abhinava Vidyātīrtha Mahāsvāmin

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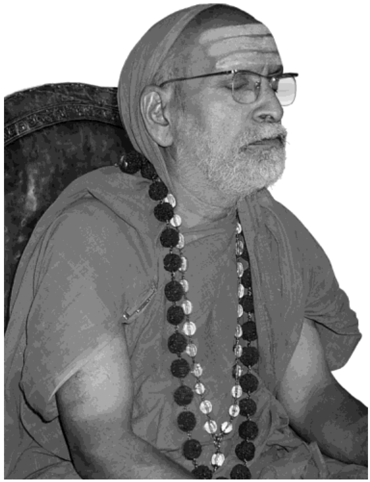

परब्रह्ममायेशकारुण्यसिन्धुं स्वमायाधृताङ्गं सदा बन्धशून्यम् ।
कृताध्यात्मिकाभ्याससिद्ध्याप्तिलीलं भवाचार्यमत्कृत्स्नमेकं प्रपद्ये ॥
नटत्याननरङ्गे हि यस्य साक्षात्सरस्वती ।
नतार्तिशमने दक्षं तं विद्यातीर्थमाश्रये ॥

इमां कृतिं मत्परमपूज्यसद्गुरुश्रीमदभिनवविद्यातीर्थमहास्वामिनां पादपद्मयोः त्वदीयं वस्तु गोविन्द तुभ्यमेव समर्पये इति भावेन सप्रणामं समर्पये ।

(*With the idea, "O Lord, I offer You what is Yours," I offer this work, with my namaskāras, at the lotus-feet of my most worshipful, enlightened and enlightenment-giving Guru,* ***H.H. Śrī Abhinava Vidyātīrtha Mahāsvāmin***.)

दक्षिणाम्नायश्रृङ्गेरीशारदापीठाधीश्वराणाम् अनन्तश्रीविभूषितानां जगद्गुरुशङ्कराचार्याणां श्रीश्रीभारतीतीर्थमहास्वामिनामनुग्रहसन्देशः

अस्मद्गुरुचरणाः प्रातस्स्मरणीयाः जगद्गुरुश्रीमदभिनवविद्यातीर्थमहास्वामिनः अप्रतिमप्रज्ञाशालिन आसन् । स्वीये चतुर्दशे वयसि स्वीकृतपारमहंस्यास्ते अनभ्यस्तलौकिकविद्या अपि अधुनातनविज्ञानविषयान् सम्यगाकलयामासुः। तैस्सह कृतसँल्लापा विज्ञानिनः तदिदं स्वयमनुभूय विस्मयाम्बुधिमग्ना भवन्ति स्म । तदीयं पवित्रं चरित्रं तत्पादसरोजभृङ्गः अस्मत्प्रियतमान्तेवासी उमेशब्रह्मचारी आङ्ग्लभाषया बृहद्ग्रन्थरूपेण व्यरचयत् । तत्र सूक्ष्मतया प्रदर्शितं गुरुचरणानां विज्ञानपाण्डित्यं केषाञ्चित् सहृदयानामपेक्षया विस्तरेण प्रकाशयितुं अधुना पुनरन्यं ग्रन्थं व्यलेखीत् । स चायं प्रकाशयिष्यत इति विदित्वा भृशं प्रसीदामः। अयमपि ग्रन्थः प्राक्तन इव लोकान् रञ्जयिष्यतीति विश्वसिमः। प्रकाशनकार्येऽस्मिन् कृतसाह्यास्समेऽपि श्रेयांसि समश्नुवीरन्नित्याशास्महे ।

इति नारायणस्मरणम्

भारती तीर्थः

श्रृङ्गगिरिः
शोभकृद्वैशाखकृष्णपञ्चमी
सौम्यवासरः 10-5-2023

Benedictory Message of H.H. Bhāratī-tīrtha Mahāsvāmin, the Jagadguru Shankaracharya of the Dakshinamnaya Sringeri Sharada Peetham

Our revered *Guru*, Jagadguru Śrī Abhinava Vidyātīrtha Mahāsvāmin, who is worthy of being called to mind first upon awakening in the mornings, possessed unmatched wisdom. Having become a *paramahaṁsa-saṁnyāsin* when He was going on 14, He did not formally study science in an academic institution. Nevertheless, He acquired clear knowledge of matters relating to contemporary science. Scientists who had occasion to engage in dialogue with Him were surprised to find first-hand how well-informed He was. Our extremely dear disciple, Umesh *brahmacārin*, a bee abiding in His lotus-feet, had described His holy life in a large biographical book in English. He has now penned this book that keeps in mind a set of perceptive persons and aims to bring out in depth what was covered briefly in that book about the revered *Guru's* scientific insight. We are greatly pleased that this book is being published. We believe that like the earlier biography, this book too shall delight people. We bless that all those who helped in publishing this experience happiness.

With the thought of Lord Nārāyaṇa

(S/d Bhāratī-tīrtha)

(Place:) Sringeri
(Year-month-*tithi*:) *Śobhakṛd-vaiśākha-kṛṣṇapañcamī*
(Day and date:) Wednesday; 10.05.2023.

His Holiness Jagadguru Śrī Bhāratī-tīrtha Mahāsvāmin, the reigning 36th Jagadguru Shankaracharya of the Dakshinamnaya Sringeri Sharada Peetham, specifically directed me to write this book and it is in obedience to His directive that I have done so. Further, in response to my requests, His Holiness compassionately gave me some guidelines, specified the page size by mentioning a book, decided the title, chose, with a modification, the cover design from the ones that I submitted to Him for His consideration, and, upon the completion of the book, blessed it with His *śrīmukha* (benedictory message). I offer, with gratitude and reverence, my *namaskāras* to His Holiness.

The biographical work referred to by His Holiness in His *śrīmukha* is: *The Multifaceted Jīvanmukta – His Holiness Jagadguru Śrī Abhinava Vidyātīrtha Mahāsvāmin.*[1] This book, too, was written by me as per the directive of His Holiness, who blessed it with His *śrīmukha* and released it Himself at Sringeri in 2017 on the occasion of the birth centenary of His Holiness Jagadguru Śrī Abhinava Vidyātīrtha Mahāsvāmin, the 35th Jagadguru Shankaracharya of the Dakshinamnaya Sringeri Sharada Peetham. His Holiness told me that though linked to it, the present book must be independently readable.

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[1] This book is available for free download at:
https://svfonline.net/index/
https://centreforbrahmavidya.org/acharyas/sri-abhinava-vidyatheertha-mahaswamiji/the-multifaceted-jivanmukta.html?v=1.3

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ISO 15919 Transliteration Scheme for Devanagari

अ	a	क्	k	ढ्	ḍh	र्	r
आ	ā	ख्	kh	ण्	ṇ	ल्	l
इ	i	ग्	g	त्	t	व्	v
ई	ī	घ्	gh	थ्	th	श्	ś
उ	u	ङ्	ṅ	द्	d	ष्	ṣ
ऊ	ū	च्	c	ध्	dh	स्	s
ऋ	r̥	छ्	ch	न्	n	ह्	h
ॠ	r̥̄	ज्	j	प्	p	ं	ṁ
ऌ	l̥	झ्	jh	फ्	ph	:	ḥ
ए	ē	ञ्	ñ	ब्	b	ऽ	’
ऐ	ai	ट्	ṭ	भ्	bh		
ओ	ō	ठ्	ṭh	म्	m		
औ	au	ड्	ṅ	य्	y		

Note: This scheme has been used. However, except in the few footnotes with His Holiness's joint use of Tamil and Sanskrit in a phrase, 'ए' has been transliterated as 'e' and 'ओ' as 'o'; this is allowed in the case of languages with no short-syllabic forms of these two vowels.

ISO 15919 Transliteration Scheme for Tamil

அ	a	ஐ	ai	ஞ்	ñ	ர்	r
ஆ	ā	ஒ	o	ட்	ṭ	ல்	l
இ	i	ஓ	ō	ண்	ṇ	வ்	v
ஈ	ī	ஔ	au	த்	t	ழ்	ḻ
உ	u	ஃ	ḥ	ந்	n	ள்	ḷ
ஊ	ū	க்	k	ப்	p	ற்	ṟ
எ	e	ங்	ṅ	ம்	m	ன்	ṉ
ஏ	ē	ச்	c	ய்	y		

1. Rebirth: Conundrums and Insightful Solutions

§1.1 This chapter recounts hitherto unasked, nonplussing questions posed by His Holiness on plausible problems in the rebirth of *jīvas* as humans, plants, and worms, and His detailed, definitive, scripture-based answers to them. A few of the questions: Was the *jīva* that animates some human embryo latent earlier in the father's sperm or in the mother's ovum or did it come from elsewhere? In the first option, since any viable sperm could have been the one that fertilized the ovum and the number of sperms that a man sheds into his wife is very large, must very many *jīvas* have been latent in the man? In the second alternative, is it that a female hosts, in her lifetime, many a latent *jīva*, for she is born with lakhs of egg-cells, a few thousands survive till she attains puberty, and any one of those that remain could have been fertilized? If it is supposed that the *jīva* of the embryo was not latent in the father or the mother but entered from elsewhere, then, is it that numerous *jīvas* are ever at hand to promptly animate every human embryo arising naturally, or even *in vitro*, at any place and at any time? His Holiness's account of the details that He obtained about a flatworm (planarian) that has a remarkable ability to regenerate forms Section 1.2; His questions about *jīvas* and rebirth as planarians constitute Section 1.3; His minutiae and rebirth-related questions about the plant kingdom are given in Section 1.4 and those about humans in Section 1.5. His exhaustive answers, with many quotes from the *Vedas*, *Upaniṣads*, *Mahābhārata*, *Rāmāyaṇa, Purāṇas*, *Brahma-sūtras*, and Śaṅkara-bhagavatpāda's *bhāṣyas*, are in Section 1.6, which includes His details on *karma*.

§1.2 On 7th June 1976, when I finished prostrating before His Holiness at Sringeri during His morning *āhnika*, He drew my attention to a lizard that was active on a wall.

His Holiness: Its tail is missing; I first noticed this last week. When in danger of being caught by a predator, a lizard may detach its tail and flee. I have seen a lizard do so once; the detached tail wiggled for minutes. That lizard grew a new tail in a couple of months; this one also will do so. A crab can regenerate a lost leg or claw. A lizard or a crab's capability to regenerate is, however, no match at all to that of a type of worm, a flatworm[1]; even a piece of it can grow into a complete worm, with a head and tail. It was three years ago (1973) that I first heard of this worm and its astonishing capability to regenerate. Hari, the one who informed me, had come to India from America to see his parents. His father and mother had come several times for my *darśana* when I was at Calcutta (in 1967, from 25th March to 21st April); as he was going to Bangalore for some work, they had asked him to make a trip to Sringeri from there. He told me that while academically and by profession, he was an engineer, worms greatly interested him; he read a lot about them and, with equipment purchased by him, studied some of them at his home abroad. I asked Hari which worm he found most intriguing; he mentioned this flatworm (planarian) and joyously spoke about it.

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[1] His Holiness said (in Tamil), '*taṭṭaippuḻu*.' The worm in question is the planarian, a free-living flatworm of the class Turbellaria.

His Holiness (continuing): He said that these flatworms have a head with a brain, eyes, and a tail; they take in food and evacuate through the same opening. There are several species of such flatworms; depending on the species, they dwell in fresh water, the sea or on land and are less than half an inch to several inches long. He said that a species native to the United States dwelt in fresh water, was about half an inch in length, had superb regenerative capabilities, and had been studied by researchers; it was on this species of flatworms that he had privately conducted a few experiments to see for himself their regeneration and responses.[1] If this worm is transversely cut[2] into two, in weeks, the part with the head but no tail grows a full tail, while the part with the tail but no head grows a full head; each of the cut portions becomes a complete worm, not just in appearance but internally too. Even if, by transverse cuts, the worm is divided into multiple segments, each segment, inclusive of the ones that lack both the head and the tail, become complete worms. He told me that he had once cut a worm into seven and had seen seven full, healthy, and active worms form in weeks. If the worm is cut lengthwise into two, even then each half becomes a complete worm, with a brain and two eyes.

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[1] This species is 'Girardia tigrina' (also known as 'Dugesia tigrina'); it has spread to Europe, Japan, Australia and South America.

[2] His Holiness did not use any word to specify the nature of the cut; what He did was to indicate it using His index fingers.

Highlighting the regenerative capabilities of flatworms, he pointed out that a scientist (Thomas Morgan), who studied them in depth at the turn of the century, found that even a 279th part of the worm regenerated.[1] That even such a small part of a flatworm could regenerate was striking. He said that the eyes of this flatworm are rudimentary; they are unfit to perceive forms and are essentially light-sensitive spots. The eyes are able to detect the presence of light and distinguish bright and dim light. The worm, which dwells in dark areas, reacts negatively to light; when its eyes are exposed to light, whether white or of some specific colour, such as red, it turns away; brighter light triggers a greater avoidance reaction. After this, he mentioned that, unlike humans, it is able to detect and react to light to some extent even without its eyes; decades earlier itself, a scientist had, on the basis of experiments, reported that a flatworm's severed portion that lacks eyes but is able to move can react to light, though less accurately than a full worm.[2]

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[1] Thomas Morgan made a scaled cardboard model of a planarian, cut a piece of the planarian as also a corresponding piece of the model and studied the regeneration of the planarian's piece. By experimenting with pieces of different sizes, he determined, with the aid of the model, that the smallest piece that regenerated was 1/279 of the planarian (T. H. Morgan *Experimental Studies of the Regeneration of Planaria maculata, Arch. Entw. Mech. Org.,* vol. 7, pp. 364-397, 1898).

[2] H. E. Walker *The Reactions of Planarians to Light, J. Exp. Biol.,* vol. 5, no. 1, pp. 117-162, 1908.

He proceeded to say that, unlike humans, the flatworm is sensitive to even weak electrical and magnetic fields[1]. By way of evidence, he said that in an experiment that had been reported two years earlier (that is, in 1971)[2], the worm's deviation from its path when exposed to a fixed light was found to vary with the orientation and strength of the magnetic field to which it was subjected. An intriguing piece of information that he then gave me was that a flatworm may develop two heads, each with a brain and two eyes; the scientist (Thomas Morgan) who determined that even a 279th part of the worm can regenerate also reported that sometimes a thin long piece cut from the side of a worm bent and developed two heads, each with two eyes and a brain; because each head, directed by its own brain, sought to move straight ahead, the final movement of such a worm-segment with two heads was rather uneven.[3] He added that a worm may develop two independent heads with a common tail if a lengthwise cut is made that passes between its two eyes and ends beyond its head; he had seen this happen twice. Another intriguing information that he gave me was that as per some experimental reports, when a flatworm is trained and then cut into

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[1] His Holiness said '*durbala-vaidyuta-cumbaka-prabhāva*,' which may be translated as 'weak electrical and magnetic influences.'

[2] F. A. Brown Jr. *Some Orientational Influences of Nonvisual Terrestrial Electromagnetic Fields, Ann. N.Y Acad. Sci.*, vol. 188, no. 1, Part IV, pp. 224-241, 1971.

[3] Morgan 1898 *op. cit.*

two, the part with the head and the part with the tail exhibit, after regeneration into worms, some retention of the learning of the original worm. Hari added that among the accounts that he had read about transfer of learning, the earliest was an article of 1959[1] and the latest was a book of 1970[2] in which the controversies on this topic had been addressed. In response to my question, he clarified that to the best of his knowledge, the worm does not exhibit any sign of pain on being cut, whether partially or fully. He also pointed out that the only way in which some species of flatworms reproduce in nature is by dividing themselves into two, with one segment containing the head and the other the tail. The flatworms of other species have both ovaries[3] and testes; while they can fertilize their eggs with their own sperm, such worms usually lay eggs fertilized by other worms; even such flatworms that produce new worms through eggs may, under some conditions, reproduce by dividing themselves. I asked him, "When a flatworm is cut into three, there must be internal constituents that ensure that the segment with the head develops a tail at the other end, the part with the tail grows a

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[1] J. V. McConnell et al., *The Effects of Regeneration Upon Retention of a Conditioned Response in the Planarian*, *J. Comp. Physiol. Psychol.,* vol. 52, no. 1, pp. 1-5, 1959.

[2] W. C. Corning and D. Riccio, *The Planarian Controversy,* In *Molecular Approaches to Learning and Memory* (ed. W. Byrne), Academic Press, New York, pp. 107-150, 1970.

[3] His Holiness said, '*aṇḍāśaya*.'

head at the opposite end and the portion with neither a head nor a tail forms a head on the side in which the worm's head was and a tail where the worm's tail was. Is my assumption correct, at least to some extent?" Hari said that it was. This led me to pose my main question, "You had spoken of a thin long piece cut from the side of a flatworm curving and forming a head on both ends. This indicates that the internal process leading to the formation of a head at the upper end of the strip and a tail at the lower end was, somehow, muddled. While this happened without the experimenter's intervention, can chemical, magnetic, electrical or some such means be deliberately employed[1] to force a head with a brain or a tail to form on any chosen side of a headless and tailless piece or to cause a worm with cuts to develop multiple heads?" Hari said that while he had not read of this having been reliably accomplished till then, he was confident that with improved understanding of the flatworm and the factors impacting its regeneration, such control over a flatworm's development would be reported.

§1.3 His Holiness indicated to me to wait and silently proceeded to complete His *āhnika*. He then continued.

His Holiness (continuing): Later, with this information about flatworms as the basis, I considered, on my own and as a matter of interest, some transmigration-related

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[1] H.H.: *rasāyana-cumbakaśakti-vidyucchaktyādi-prayoga-dvārā.*

questions and answers to them in line with the scriptures. As per our scriptures, worms have *jīvas* and a human may, on account of *adharma*, be reborn as a worm. For instance, in the *Anugītā*, while listing to Arjuna what those who sin persistently may be reborn as, Lord Kṛṣṇa includes, "*kryādā dandaśūkāś ca kṛmi-kīṭa-vihaṅgamāḥ – creatures that feed on carrion, snakes, worms, insects and birds.*"[1] That a worm has *prāṇa* and, thus, a *jīva* is discernible from the statement, "*ā śvabhya ā kṛmibhya ā kīṭa-pataṅgebhyaḥ – up to (that of) dogs, up to (that of) worms, up to (that of) insects and moths,*"[2] in the *Bṛhadāraṇyaka Upaniṣad* about *prāṇa*'s food. In view of the scriptural statements, which are the means of valid knowledge[3] in such matters, we must accept that the flatworm with amazing regenerative abilities too has a *jīva*. If the worm is cut into, say, five parts, five full worms arise that are replicas of the original worm. Being worms, these must, in the light of the scripture, be seen to be *sa-jīva* (with a *jīva*). If we take it that any of these regenerated worms does not have a *jīva*, that supposition would be discordant with our scripture. It cannot be justifiably contended that the scripture has referred to natural worms only, these are unnatural as their formation is initiated by splitting, and, therefore, the presumption that none of these has a *jīva* would not

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[1] *Mahābhārata* 14.36.23 (Gita Press Edition).

[2] *Bṛhadāraṇyaka Upaniṣad* 6.1.14.

[3] His Holiness: *pramāṇa*.

be incompatible with the scripture. This is because, as revealed to me by Hari, even in nature, there are such flatworms whose mode of multiplication is by splitting. Further, even the flatworms that commonly reproduce by laying fertilized eggs may, under some conditions, reproduce in nature through self-division. Moreover, the worms that form from a cut-out part of a worm are not only indistinguishable externally and internally from other worms, but also behave and reproduce like the latter. Hence, these too should, as said in the scripture, possess *jīvas*. Hari said that the regenerated worms – even those that develop from a segment without a head or tail – can exhibit some retention of what the initial worm learnt.[1] Since the norm is that the one who experiences something is the one who recalls it, does the regenerated worm's retention imply that the *jīva* of a regenerated worm is, in essence, only the *jīva* of the initial worm? Is it that the *jīva* that animated the initial worm animates all the segments into which that

[1] In his account to His Holiness, Hari relied upon the experiments from 1959 to 1970 on the retention of learning in flatworms after decapitation and head-regeneration. These were manually done and some of the experiments failed to be reproduced. However, automated studies performed decades later have provided reliable evidence that trained and then decapitated planarians can exhibit memory retrieval after regenerating new heads (Tal Shomrat and Michael Levin, *An Automated Training Paradigm Reveals Long-Term Memory in Planarians and Its Persistence Through Head Regeneration, J. Exp. Biol.,* vol. 216, no. 20, pp. 3799-3810, 2013).

worm is divided and, in this way, the full worms that form from the segments? There are, however, problems with conceding this. Suppose the initial worm is divided into ten parts and all the ten parts become full worms in a few weeks. At this stage, the initial *jīva* would have to be animator of ten different worms. Suppose that each of those ten worms is divided into ten parts and that, in a few weeks, each of those parts becomes a full worm. At this second stage, the initial *jīva* must be said to animate 100 worms. Proceeding in this fashion, in a matter of months, the initial *jīva* would have to be the animator of thousands and thousands of worms. This is farfetched. Moreover, while the *Yoga-śāstra* makes known that a *yogin* with powers can generate bodies and endow each of them with a mind that functions in accordance with his mind[1], it never gives even a mild hint that ordinary worms can do so. There is, thus, no scriptural support for the assumption that the *jīva* of the initial worm is the animator of all the worms that develop from the initial worm's segments. If, on the other hand, the worms that arise from the parts of a worm are presumed to have their own *jīvas*, which are distinct from the *jīva* of the initial worm, then it must

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[1] *Yoga-sūtra* 4.4 and *Yoga-sūtra* 4.5. That a *yogin* may produce multiple bodies and equip them with minds that conform to his mind is the *Vedāntin's* position too. Thus, Bhagavatpāda has said in His *bhāṣya* on *Brahma-sūtra* 4.4.15, "It is only this that the *Yoga-śāstras* convey about how *yogins* take up multiple bodies."

be accounted how what was experienced by just the initial *jīva* is remembered by the distinct *jīvas* of the regenerated segments. Also, the question arises whether all these *jīvas*, which are distinct from the initial worm's *jīva* and from one another, were present in the initial worm prior to its being segmented? If yes, then, since the initial worm may be cut into many parts that would regenerate and each of these must receive a *jīva* that was latent in the initial worm, the initial worm must have at least as many latent *jīvas* as the parts into which the worm will be cut into later. Suppose that the initial worm has ten latent *jīvas* apart from its own *jīva* and it is cut into ten parts. Then, every part would become endowed with one of the ten *jīvas* but would not have spare, latent *jīvas* within it. What would happen if, after one such segment becomes a full worm, that worm is sliced into ten parts and these, in turn, regenerate into ten worms? How do these ten parts and, hence, the worms that they transform into become animated, for the worm that gave rise to them has just its own *jīva* and not a single latent *jīva* in it to pass on to any part? The scriptural statements about worms having *jīvas* would, of course, be contradicted if it is supposed that these ten parts and the worms they become lack *jīvas*. For these parts to have *jīvas*, it will have to be assumed that the original worm had at least 110 latent *jīvas* and that it passed on 11 of these *jīvas* to each of its ten parts; each of the ten parts was animated by one of the 11 *jīvas* received by it and the remaining ten *jīvas* were latent in it; subsequently, when each of these ten parts became worms and those worms were cut into ten parts each, each worm passed on one of its ten latent *jīvas* to each of its own ten parts. The assumption of 110 latent *jīvas* in the original worm will suffice only up to the second level of segmentation into ten parts. If even a few more such generations of regenerated worms are considered, to cater to them having *jīvas*, it will have to be supposed that the original worm had thousands of latent *jīvas* to start with. All this is the consequence of supposing that the *jīva* that animates a cut-out part is different from the *jīva* of the worm that is segmented and also that this *jīva* of the cut-out part was present and latent in the parent-worm prior to the parent-worm's division. Suppose, as done till now, that the *jīvas* of the parts into which a flatworm is cut are distinct from the *jīva* of the initial worm and from one another, but that these were not present and latent in the initial worm prior to its segmentation. Then, it need not be assumed that the initial worm must have thousands of latent *jīvas* in it to cater to even a few generations of regenerated worms originating from it. However, it will have to be supposed that thousands and thousands of *jīvas* are at hand so that no sooner is any segmentation of a worm carried out, or occurs naturally, anywhere and at any time, each and every one of the parts that arises is straightaway animated by one of these.

His Holiness (continuing): Hari said that a researcher (Thomas Morgan) had found that a long thin segment cut out from the side of a worm curved and developed heads with brains on both ends; also, the curved two-headed, two-brained worm-segment moved unevenly because of attempting to move straight forward in the direction of each of the heads. Does what appears to be incongruent, dual control over the movement imply that the worm-segment with two heads was animated by two *jīvas*? If yes, is it that the number of animating *jīvas* is associated with the number of heads or, rather, the number of brains? Hari mentioned that a cut made in the head of a worm that passed between its eyes and extended beyond its head but was not so long as to sever the worm into two could result in two full heads developing in that worm itself; he had seen two worms, each with two heads and a single tail. Before the cut, such a worm was animated by a *jīva*. Is it the case that, on the analogy of the curved two-headed worm, after developing two heads with brains, this is animated by not one but two *jīvas*? If so, is one of them the earlier *jīva* and the other a *jīva* that was already present but latent, or one that entered after the cut? On the other hand, is it that both in the earlier case and in this one, only one *jīva* is the animator and the uneven movement reported in the earlier case is not due to incongruent, dual control? I thought that with improved knowledge of and control over the flatworm's regeneration in the future, researchers may, through chemical, magnetic, or some other interventions, engender the formation of worms with three or more heads, fully functional and developed worms with a head on two ends but no tail, and such else. Perhaps, they may come across cases of worms with two or more heads giving rise, on being cut, to worms with two or more heads. Continuing with my speculation, I thought that the study of worms with more than one head may, in the future, throw light on whether multiple heads with full brains demonstrably result in disharmony in the worm's behaviour and also on whether the disharmony between the brains would become replaced by their co-operative co-existence. If due to, say, chemical intervention, a worm with one complete head develops two additional heads or, a cut-out segment becomes a worm with three heads and it is distinctly observed that the three-headed worm is trying to move, at one time, in the directions of the three heads, should it be supposed that it is animated by three *jīvas*? If it subsequently moves in one head's direction, should it be conjectured that the three *jīvas* have started to co-operate, with one of them dominant at that time? Or is it that the assumption of multiple *jīvas* in such a worm is uncalled for?

{His Holiness speculated in His last question to Hari that in the future, scientists might be in a position to trigger, by chemical, electrical, or other means, the formation of multiple heads in a planarian. Hari's response that he was confident about this happening possibly motivated His Holiness to build on His conjecture and reflect, as described above, on the *jīva*-related implications of the induced formation of flatworms that have two or more heads with a brain in each and whose movements may be disharmonious. Induced formation of heads has since been reported and instances of incongruous behaviour recorded.

Researchers such as Alejandro Śanchez Alvarado and Peter Reddien have reported that when they inhibited the synthesis of beta-catenin, a multifunctional protein, in a planarian and amputated its tail, a head developed in its rear instead of a tail. Also, heads formed in the places where partial cuts were made in the body of a planarian with inhibited beta-catenin.[1] Inhibition of beta-catenin has led to the formation of planarians with two, three and even dozens of heads.

Identifying membrane voltage's role in head-formation in a planarian, Michael Levin and his group reported[2]

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[1] K. A. Gurley, J. C. Rink and A. S. Alvarado, β–*Catenin Defines Head Versus Tail Identity During Planarian Regeneration and Homeostasis, Science,* vol. 319, issue 5861, pp. 323-327, 18 January 2008. C. P. Petersen and P. W. Reddien, *Smed-*β*catenin-1 Is Required for Anteroposterior Blastema Polarity in Planarian Regeneration, Science,* vol. 319, issue 5861, pp. 327-330, 18 January 2008.

[2] W. S. Beane et al., *A Chemical Genetics Approach Reveals H, K-ATPase-Mediated Membrane Voltage Is Required for Planarian Head Regeneration, Chemistry and Biology,* vol. 18, issue 1, pp. 77-89, January 28, 2011.

that when the head and tail of a planarian are cut off and the fragment is treated with the drug ivermectin to ensure that the voltage on the inside of the cell membrane is positive, then heads invariably form on both the ends.

In a study on the effect of gravity on the regeneration of planarians, the heads and tails of some planarians were amputated; the fragments were sent to the International Space Station, kept in the weightless condition there for five weeks, and brought back. One headless and tailless fragment spontaneously regenerated a full head on both the ends. When, subsequently, this worm's two heads were amputated, its headless and tailless fragment grew into a worm with heads on both ends. The two heads of the latter worm were removed; what developed from the fragment without a head and a tail was, again, a worm with heads on both ends.[1]

There are video recordings of planarians with more than one head trying to move in different directions at once; a planarian with eight heads from Reddien's laboratory can, for example, be seen trying to move simultaneously in the different directions of its heads[2]; as a result of this, no useful movement is achieved in any direction. There are also video recordings of planarians with more than one head moving in a direction due, perhaps, to a

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[1] J. Morokuma et al., *Planarian Regeneration in Space: Persistent Anatomical, Behavioural, and Bacteriological Changes Induced by Space Travel*, *Regeneration,* vol. 5, no. 2, pp. 85-102, 2017.

[2] Pere Estupinya, *Planaria 8 Heads Regeneration*, *YouTube,* 25 April 2008, https://www.youtube.com/watch?v=8Ew3yupNMF8.

brain dominating here or to the brains co-operating. For instance, a planarian in Śanchez Alvarado's laboratory with heads on both its ends can be seen advancing in the direction of one of its two heads, with the other head, which has a separate brain, yielding to what, for it, is an anomalous reverse motion.[1]}

His Holiness (continuing): Hari said that there is some experimental evidence that a flatworm from which the portion containing the eyes has been removed is also able to move to avoid light, though less accurately than a complete worm. Does this imply that a flatworm has *indriyas* (organs) that are absent in humans? As per the *Bhagavad-gītā*, while in a body, a *jīva* presides over the mind and the five sense-organs of hearing, sight, touch, taste and smell and, thereby, experiences objects; when the *jīva* departs from a body, it takes the mind and the five organs with it and proceeds to take up a different body.[2] In the *Brahma-sūtras*[3], a question as to the total number of organs that are allied with a *jīva* is taken up; the conclusion spelt out by Bhagavatpāda in His *bhāṣya* is that the net number is 11, comprising the mind and the five sense-organs of hearing, touch, sight, taste and smell and the five organs of activity (such as of speech).

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[1] HHMI BioInteractive Video, *Identifying the Key Genes for Regeneration*, *YouTube,* 9 November 2017, 00:06:30 – 00:06:42, https://www.youtube.com/watch?v=Bw1U7_Tk0H0.

[2] *Bhagavad-gītā* 15.8-9. H.H. listed the organs as done in Verse 15.9.

[3]*Brahma-sūtras* 2.4.5-6. The *Upaniṣads*, *Bhagavadgītā* and the *Brahma-sūtras* constitute the triple cannon of Vedānta.

If the eyeless flatworm is able to react to light because of some means of sensing distinct from the five sense-organs of hearing, touch, sight, taste, and smell, would this not be incompatible with the position of the *śāstra* that a human may be reborn as a worm, that while in a body, such as that of a man, a *jīva* experiences objects, inclusive of light, by means of these five sense-organs, that it transmigrates with these five and that the total number of organs with a *jīva* is 11, which number would be exceeded were there to be a means of sensing apart from these five and the mind? Hari spoke of a study in which flatworms exhibited sensitivity to weak magnetic fields. Like the eyeless flatworms' reaction to light, is this reconcilable with the stated position of the *śāstras* and, if so, how?

His Holiness (continuing): All these were the questions that I considered just out of interest a day after hearing the interesting information that Hari gave me about this flatworm with an extraordinary regenerative ability. I then readily answered them to myself in the light of the *śāstra*. I shall tell you about this on some other day.

§1.4 On the evening of 7th June 1976, before and partially during His walk in the fields and for a while thereafter, He spoke to me about plants and questions related to *jīvas* in them, as He had done in the case of planarians.

His Holiness: That the members of the plant kingdom are animated by *jīvas* is the clear position of our *śāstras*.

For instance, it is said in the C*hāndogya-upaniṣad*[1] with reference to the Banyan tree (*Ficus benghalensis*), "*sa eṣa jīvenātmanānuprabhūtaḥ – This one is permeated by the jīvātman.*" The *Kaṭha-upaniṣad*[2] refers in general to rebirth in the plant kingdom in the passage, "*sthāṇum anye 'nusaṁyanti – Others enter that which is devoid of locomotion (such as a tree)*." The *Yajñavalkya-smṛti*[3], overtly speaks of rebirth as a grass, as a shrub, and as a creeper (*tṛṇa-gulma-latātvaṁ*).

His Holiness (continuing): There are banyan trees in India that have spread over an acre and are over a 100 years old. For instance, the '*Dodda Alada Mara* (Big Banyan Tree)' near Bangalore covers an area of about three acres and is said to be about 400 years old; the '*Thimmamma Marrimanu*'[4] in Anantpur District of the state of Andhra Pradesh covers around five acres and is believed to be more than 500 years old. Year after year, a banyan tree, which, as I just illustrated, can be very large in size and live for long, produces numerous fruit, with each fruit containing many seeds. The ripe, red-coloured fruit of this big tree is only about half an inch in size and the tiny seeds are so light that even blowing lightly makes them fly away from one's open palm. Each

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[1] *Chāndogya-upaniṣad* 6.11.1.

[2] *Kaṭha-upaniṣad* 2.2.7.

[3] *Yajñavalkya-smṛti* 3.208.

[4] The *Guinness Book of World Records* lists this (since 1989) as the largest canopy of a living tree.

of the many thousands of embryo-bearing, viable seeds[1] that a tree produces, and that too periodically, can, in principle, give rise to a banyan tree. Apart from forming from a seed, a banyan tree can develop from a cut out part of the tree. I have read and heard that in the third century BC, Aśoka's daughter Saṅghamitrā took with her to Ceylon (Sri Lanka) a branch of the Bodhi Tree (the banyan tree under which Gautama Buddha is said to have attained enlightenment), that it was planted there and that it developed into a big banyan tree, which is seen to be alive even after the passage of over 2000 years.[2] Even a small piece of a branch can develop into a banyan tree. During my first tour (from March 1956 to July 1962), I was able to add much to my knowledge of banyan trees from a horticulturist. He loved planting various trees and requested me to plant a cutting from a banyan tree. I told him that while I was ready to do so, I would not be in a position to tend to it as I was to proceed from there in a couple of days. He assured me that if I placed a cutting in a pot, he would personally take care of it and, if it grew well, would later plant it in a suitable place. I agreed. He said he would get me a cutting but I told him that I would fetch one myself and that all he needed to do was to provide me a cutter and

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[1] His Holiness (Sanskrit-Tamil): *vaṭagarbhayuta-vyavahārya vitaikaḷ.*

[2] The *Guinness Book of World Records* lists (commencing in 2011) this banyan tree in Anuradhapura in Sri Lanka as the oldest-known human-planted tree and as planted in 288 BC.

a pot. With him accompanying me, I went to the banyan tree nearby. Unaware that I was proficient at climbing trees, he exclaimed in surprise when I swiftly climbed it. I cut from a branch a piece that I felt would serve my purpose well. Having readied the cutting, I put soil in his pot and duly placed the cutting in it. The piece that I planted was neither hard wood nor a fully green, fresh growth; it had sap and nodes in it and was about nine inches long and about half an inch thick. I catered to it on that day and the next and then handed it over to his care. I later received information from him, first that the cutting had started showing signs of development and, thereafter, that he had planted the sapling in the ground elsewhere and that it was growing well. Hence, it was with some first-hand knowledge that I asserted earlier that a banyan tree can develop even from a small portion of its branch. Pomegranates and sugarcane, have, like the banyan, been mentioned in our sacred texts; for instance, pomegranates are referred to in the *Mahābhārata*[1] and sugarcane in the *Taittirīya-saṁhitā*[2]. Each pomegranate fruit has hundreds of seeds, each of which can, in principle, give rise to a tree. A cutting from a pomegranate tree can also form a fruit-bearing tree; unlike a seed, a cutting yields a tree whose fruits are dependably just like those of the parent tree. As pomegranate trees are sought for their fruit, they are,

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[1] *Mahābhārata* 3.158.45.

[2] *Taittirīya-samḥitā* (of the *Kr̥ṣṇa-yajur-veda*) 6.2.1.5.

and have been for long, propagated from cuttings; the *Bṛhat-saṁhitā*, which was written well over a thousand years ago, speaks of pomegranate-propagation from cuttings[1] and a commentator[2] on the work even quotes a verse of Sage Kāśyapa in this regard. It is by taking out from a cane a piece that contains one of its nodes and planting it horizontally that a sugarcane plant is grown; the sugarcane that develops is akin to its parent. As for growing sugarcane from its minute seed, while this is possible, it is challenging; I have not seen any farmer who cultivates sugarcane in his field by sowing seeds.

His Holiness (continuing): I mentioned that as per our *śāstras*, members of the plant kingdom are animated by *jīvas* and then took up banyan, pomegranate, and sugarcane propagation to illustrate how questions of the kind that I had taken up in relation to the flatworm with superb regenerative abilities may be posed even with reference to various plants. Pieces of the flatworm (planarian) can regenerate into flatworms of the same kind as the original worm; similarly, portions cut out from a banyan tree, a pomegranate tree, or a sugarcane plant can become a full banyan tree, pomegranate tree, or a sugarcane plant akin to the source of the cuttings. Hence, as in the case of the flatworm, there is occasion

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[1] *Bṛhat-saṁhitā* 55.4-5.

[2] Bhaṭṭotpala. The verse of Sage Kāśyapa cited by him explicitly refers to the pomegranate tree and states that its cutting should be planted.

for questions such as, “Are the cuttings and, hence, the plants that arise from them animated by the very *jīva* that animates the source of the cuttings, or by distinct *jīvas*?” and also for the follow-up questions such as, “If each cutting is animated by a distinct *jīva*, was this *jīva* present earlier and latent in the source of the cutting, or did it promptly enter and animate the cutting upon the part becoming separated from its source?”

His Holiness (continuing): Though Hari told me about flatworms laying eggs fertilized by the sperm of other flatworms, in the course of my reflection on the next day, I did not consider *jīva*-related questions centred on the sexual reproduction of flatworms. Such questions can be encompassed in those on the propagation of plants from seeds. I will present them using the pomegranate tree as an example. Like a flatworm with both testes and ovaries, it has flowers that have both male and female parts. It also has purely male flowers. In response to a devotee’s request, I visited his personal orchard. There, two pomegranate trees in bloom drew my attention. I could distinguish two varieties of pretty flowers; one type had a broader base than the other. He said that a decade earlier he had planted two seeds taken from different pomegranates and that these trees had grown from those two seeds. While I was observing the two varieties of flowers, he told me that the ones with a broader base were flowers with male as well as female parts, while the other ones were male flowers. Before

I could stop him, he took out one flower of each type and gave them to me to inspect them at close quarters. Wanting to cut open the flowers to show me their parts, he had a bag with some of his gardening tools brought there quickly. I, however, dissuaded him from cutting the flowers, informing him that I was familiar with the structure of the hibiscus[1], which too has both male and female parts, and with the separate male and female pumpkin flowers. I then asked him, “Did you plant two unrelated seeds to obtain two unrelated pomegranate trees so that the female parts of each tree’s male-cum-female flowers may receive pollen even from the other, unrelated tree’s flowers, resulting in more variety in the fruits?” He said that that was the exact reason for his doing so. He proceeded to describe an experiment that he had performed some years earlier. As flowers were forming, he used cloth meshes to preclude pollinators such as bees from gaining access to ten of a tree’s male-cum-female flowers; he said that while growing, these flowers are shaped like peanut shells and that is how he identified them. From his gardening bag, he took out and showed me a cloth mesh of the kind that he had used. I could see that when suitably tied, it would allow light and air to pass through to a flower but not bees. When the ten flowers had fully bloomed, he first uncovered two of them, pollinated[2] each of them with

[1] His Holiness (in Tamil): *cemparutti.*

[2] His Holiness (in Sanskrit and Tamil): *parāga-sēcanaṁ ceytāṉ.*

pollen[1] from its own male part and then put back its cloth mesh in position. He took out a paint brush from his bag and demonstrated how he had collected and transferred pollen using it; for his demonstration, he worked upon the male-cum-female flower that he had plucked earlier for me to inspect. Having uncovered two other flowers, he pollinated them with pollen from two male flowers of that very tree and then put back the cloth meshes in position. For pollinating four of the remaining flowers, he used pollen from the other tree. He pollinated two of these flowers with pollen from two male-cum-female flowers of the other tree and the next two with pollen gathered from two of the other tree's male flowers. He did not uncover and pollinate the final two of the ten flowers. He later found that, as expected, neither of the two flowers that had been kept covered gave rise to a fruit; this provided him some confirmation that his meshes were effective. Out of the four flowers pollinated with pollen taken from flowers of the same tree, three were replaced by fruit; likewise, three of the four flowers pollinated with pollen from the flowers of the other tree resulted in fruits. He added that over the years, he had seen many bees going from the flowers of one tree to those of the other tree and, hence, was confident that cross-pollination[2], which he had manually experimented with, was taking place naturally. Consider

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[1] His Holiness: *parāga*. Earlier, He said (in Tamil), '*makarantat tūḷ*.'
[2] His Holiness (in Sanskrit-Tamil): *anyōdbhijjapuṣpaparāga cērkkai.*

the occurrence of cross-pollination involving different pomegranate trees, without giving thought to whether natural pollinators or humans play a role in effecting this cross-pollination. Pollen grains from the flowers of a tree reach the female parts of the flowers of another tree; the pollen grains give rise to sperms; sperms unite with the egg-cells in the ovaries of the male-cum-female flowers; pomegranate fruits are formed with numerous embryo-bearing seeds in each fruit. Even though what happens after self-pollination and cross-pollination are equivalent, I purposely emphasized cross-pollination. This is because when the pollen grains and the egg-cells belong to the same tree, the embryo-bearing, viable seeds have just that tree as their source, as do cuttings obtained from that tree; consequently, the *jīva*-related questions that I had presented based on cuttings apply equally to the case of these seeds. On the other hand, there is occasion for some other *jīva*-related questions in the case of embryo-bearing, viable seeds resulting from cross-pollination. Suppose that during a season, a tree bears ten fruits due to cross-pollination and that each fruit has 500 viable seeds; while the number of seeds can vary from much less to much more than 500, for convenience, I picked this acceptable number[1]. A

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[1] In a study based on 48 pomegranates, the number ranged from 201 to 985, with the average being 488 (H. Y. Wetzstein et al., *Characterization of Attributes Related to Fruit Size in Pomegranate, HortScience,* vol. 46, issue 6, pp. 908-912, 2011.

pomegranate tree can, in principle, grow from each of the 5000 embryo-bearing, viable seeds. When a fruit becomes overripe, it cracks open and birds can easily eat it; seeds eaten by birds pass, I learnt, undigested and undamaged through their digestive tracts and are excreted; those that land in places suitable for them to sprout do so. Any one of the 5000 seeds of the tree could be amongst those that are eaten, excreted and end up where they can sprout and do so. A person may arbitrarily extract a seed from one of the ten fruits on the tree and plant it somewhere else to get a new tree. In view of all this, is it that all the 5000 embryo-bearing seeds house *jīvas* and so do the fertilized eggs laid by a flatworm and by, say, a bee, a cobra, and a hen? If not, is it that pomegranate seeds that are without *jīvas* can sprout even at locations that are far from those of the trees that provided pollen grains and egg-cells, and a flatworm's fertilized eggs that are without *jīvas* can develop independently into worms? Such a supposition would, however, be discordant with the statements in our *śāstras* that plants and worms have *jīvas.* On the other hand, if it is admitted that the numerous, viable seeds and all the fertilized eggs of a flatworm do house *jīvas*, then the related questions that straightway arise are, "How do *jīvas* come to inhabit seeds and fertilized eggs? Were they earlier in the sperms that united with egg-cells and resulted in the seeds and fertilized eggs, or were they earlier resident in egg-cells, or did they come in from outside?" Suppose that sperms are the bearers of the *jīvas*. Because sperms arise from pollen grains in flowers, a follow-up supposition would be that sperms receive their *jīvas* from pollen grains. A pomegranate tree produces an enormous number of pollen grains in its lifetime, and any fit pollen grain from any flower on a pomegranate tree may end up on any male-cum-female flower of another tree and result in the fertilization of an egg-cell and seed formation. Hence, if it is supposed that sperms and pollen grains house *jīvas*, will it not follow that a pomegranate tree houses lakhs of *jīvas*? Likewise, as testes produce sperms in large numbers, will it not follow that a flatworm houses a great number of *jīvas*? Let us now pass on to the second of the three options; the supposition that the *jīvas* in seeds and in fertilized eggs resided earlier in egg-cells, not sperms. As a male-cum-female pomegranate flower may have many egg-cells and as an egg-cell in any flower on a tree may be among those that are fertilized, this option too implies that a tree houses a large number of *jīvas*.[1] The third alternative – that the *jīvas* in the seeds come there not via sperms or egg-cells but from outside – seems to presuppose that many *jīvas* are ever at hand and that

[1] Over 2000 ovules (which contain the egg-cells) have been found in a single pomegranate flower (H. Y. Wetzstein et al., *Flower Position and Size Impact Ovule Number per Flower, Fruitset and Fruit Size in Pomegranate*, *J. Amer. Soc. Hort. Sci.,* vol. 138, issue 3, pp. 159-166, 2013).

one of them enters as soon as any egg-cell in any flower on any tree becomes fertilized at any place and at any time.

His Holiness (continuing): Besides seeds and cuttings, grafting[1] is commonly used for propagating plants. *Jīva*-related questions of the kind that I had posed with regard to flatworms with two or more heads may be posed even in the context of grafting. Consider the hibiscus plant. We find hibiscus flowers of various colours, such as red, yellow, purple and white. While hibiscus plants can be grown from cuttings with ease, it is by means of grafting that we can obtain one that bears flowers of different colours. To grow, for instance, a hibiscus plant that concurrently bears red, yellow, and white flowers, start with three plants, one with red flowers, one whose flowers are yellow and one having white flowers. With a sanitized, sharp knife cut out from each of the three plants, a segment of a healthy branch with a flower at its end.[2] Take out the flower and leaves on it and prune it to get a piece that is 3 to 4 inches long and has nodes. Then, with a couple of smooth cuts with the knife make

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[1] His Holiness first used the Hindi term '*kalaṁ bāndhnā*' to denote grafting and, on subsequent occasions, the Tamil word '*oṭṭutal*.'

[2] His Holiness explained the grafting partly in words and partly by illustrating the steps with His fingers; for instance, he used His right index finger to show the movement of the knife, His left index finger to represent the object cut and indicated lengths by suitably positioning the tips of His right thumb and right index finger.

one end of each of the three pieces wedge-like, with the lengths of the slanting, straight edges being about an inch. The plant (the rootstock) to which these three (the three scions) are to be grafted is, say, six months old and has its roots in the soil in a flower pot. Cleanly cut its stem horizontally, about nine inches above the soil. Make three, inch-deep, downward cuts from the circular top surface, with the cuts being on three sides of the top surface. The inch-long, wedge-like ends of the three pieces that are to be grafted should fit snugly in the three cuts made in the rooted plant's stem. With the pieces and the stem properly placed thus in close contact, secure them by taping them with a plastic tape; thoroughly wrap the joint and the top surface tightly with the tape. While tape that is specifically meant for grafting is ideal, an electrical insulation tape and even strips cut from a big plastic cover can be used for the taping. Finally, enclose the grafted pieces and the stem up to a little below the joint in a plastic cover and tie its downward-facing opening closed. This entire grafting procedure can be comfortably completed in less than five minutes.[1] After separation from its parent plant, a branch has no supply of water from a root till such time

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[1] A few weeks earlier, in May 1976, His Holiness performed T-bud grafting on a rose plant in a pot, giving me the opportunity to watch Him. No one else was there when He did so that afternoon, after His *bhikṣā*. He used insulation tape. He completed the procedure in less than five minutes; this included the minute or so that He spent explaining T-bud grafting to me.

that it becomes effectively united with the stem. It is to prevent it from drying up and dying before this that its leaves, through which it can lose water, are removed prior to grafting; the tight wrapping by tape prevents exposure to air that would dry it; the plastic cover helps to shield it from being adversely affected by wind and rain. Remove the protective plastic cover after a month. Sprouting should be seen on the three grafted portions (the three scions). After a few more weeks, carefully take out the tape. The grafted pieces (the scions) and the stem (the rootstock) should be well united by now and leaves should be seen as in normal hibiscus plants. The plant soon becomes beautified by red, yellow, and white flowers. Does this plant with three grafts have four *jīvas* or one or none? The last option is, obviously, discordant with the scriptural position that all living plants are animated by *jīvas*. As hibiscus plants grow readily from cuttings, the portion of the branch that was taken from the plant with red flowers for grafting could have grown into a full plant had it been planted. It was alive and healthy when it was placed in effective contact with the stem of the six-month-old plant and remained so; it was taped and covered to help it stay alive. Hence, as in the case of a live flatworm segment and that of a live cutting from a banyan tree, it can be contended that it has a *jīva*. Similar is the case of what was taken for grafting from the plant with yellow flowers and the one with red flowers. The plant upon which grafting was done must have been animated by a *jīva*, like any other living plant; even after its stem was sliced some inches above the soil, it was alive and quite capable of growing into a complete plant; moreover, but for its continuing to be alive, with functioning roots, the whole plant with three kinds of flowers could not have formed. Hence, is it that the final plant with the stem and three grafts has four *jīvas*? To an extent, the plant functions as multiple plants, with the branch whose source was the plant with red flowers bearing just red flowers, the branch that originated in the plant with yellow flowers giving rise to just yellow flowers, and the branch born of the plant with white flowers producing just white flowers. Does this imply that the four *jīvas* concurrently animate different parts of the plant? Or, is it that only one *jīva* animates the plant, with the other *jīvas* lying latent or having departed upon the grafted parts and the stem uniting? Or, should it be seen as a single plant with a single *jīva* animating it because, exactly as in the unitary plant that bears just red flowers, its roots take in water and nutrients from the soil and provide them, without distinction, to each and every branch, and the leaves on all the branches produce food using sunlight (photosynthesis) for even the stem and the roots? The questions that I posed now about the *jīvas* in the plant with three grafts were without reference to the seeds of this plant and to any cuttings taken from it. If pollen from the male portion of a red or a yellow or a white male-cum-female flower of this plant is transferred to the female part of that very flower, the resulting seed will be similar to a cutting and the *jīva*-related questions centred on cuttings will apply here. On the other hand, if pollen from a red flower on this plant is put on the female part of a yellow or white flower, the resulting seed will on be par with a pomegranate seed resulting from cross-pollination involving the two pomegranate trees considered earlier; hence, the *jīva*-related questions posed earlier in connection with pomegranate seeds will apply even to such a seed of this plant. Incidentally, it cannot be argued that grafting is entirely unnatural[1] and, hence, *jīva*-related questions are out of place. This is because grafting does occur in nature, though far less often than grafting performed by humans. An instance is a natural fusion that occurred between the roots of a sandalwood tree and an Indian blackberry tree[2] (*Eugena jambolana* Lam.), resulting in the blackberry fruits having a sandalwood taste and smell. About two decades ago, an associate of Kadambi, an expert who had formulated the forest management plan for the State of Mysore (for 1941-1961), told me that Kadambi had recorded this.[3]

His Holiness (continuing): I had considered whether an eyeless flatworm's reaction to light implies that it

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[1] His Holiness: *aprākṛtam*.

[2] His Holiness (in Tamil): *nāval maram.*

[3] K. Kadambi, *Instances of Fusion of the Tissues of Different Trees*, *Indian Forester*, vol. 80, issue 11, 726, November 1954.

has some means of sensing other than our five sense-organs and, if so, would that not contradict the position of the *śastra*s about the organs associated with a *jīva.* Consider the sunflower[1] plant. A young plant's flowers face east at dawn; as the sun moves across the sky, they track its movement, turning themselves in the direction of the sun; at sunset, they face west. During the night, they gradually turn from west to east, such that by the next dawn, they once again face east. After the plant matures, the flowers remain facing east.[2] Speaking in terms of the *jīva* animating it and the *indriyas* (organs) that are listed in the *śāstra* as associated with the *jīva*, does the sunflower plant sense light by some means that is different from the visual organ that is specified in the *śāstras*, for the plant lacks eyes and still tracks the movement of the sun? If it is supposed, perforce, that it does, would not the view of the *śāstras* about the *jīva's indriyas* and their net number be contradicted?

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[1] His Holiness: *sūryakānti*.

[2] Heliotropism, the phenomenon of tracking the sun, is exhibited by some plants. Researchers have reported that in the case of the sunflower plant, the growth rate on the plant's eastern side is high during the day and low during the night, while the growth on its western side is high at night and low during the day. This results in the flowers turning from east to west during the day and from west to east at night. After the plant stops growing, the flowers stop turning (H.S. Atamian et al., *Circadian Regulation of Sunflower Heliotropism, Floral Orientation, and Pollinator Visits*, *Science*, vol. 353, no. 6299, pp. 587-590, 5 August 2016).

§1.5 Two days later, on 9 June 1976, His Holiness took up human reproduction and told me, as he had done with regard to planarians and plants, the *jīva*-related questions that He had posed to Himself and answered in the light of the *śāstras*.

His Holiness: A human body forms from a single cell that is the result of the fusion of an egg-cell from a woman's ovary and a sperm. The explicit position of the *śāstra* is that a fetus has a *jīva* and that this *jīva* is distinct from that of its mother. Does this *jīva* reach there through the sperm or the egg or does it come in from elsewhere at the time of the union of the egg and sperm? Suppose that a sperm is the carrier of such a *jīva.* Since any of the sperms that are released into a woman's body by a man and are healthy may, in principle, be the one that manages to reach, enter and fertilize the egg, and since a man deposits crores of sperms into a woman at a time, will it then have to be presumed that the man housed crores of *jīvas*? If the number of sperms deposited by a man in his wife over the course of years be considered, will it not follow that he housed and transferred many crores of *jīvas*? Suppose that the carrier of a *jīva* is not a sperm but an egg. I heard that a female has about 10 lakh eggs at birth, with the number of eggs decreasing as she grows older. Because any one of the eggs that she was born with can be among those that survive till she attains puberty and might be the one that is later released and fertilized, it may, in this case, have to be supposed that she carried lakhs of *jīvas*. I was told that during her life as a fetus, a female has up to a few crores of basic eggs. In view of this, should it be supposed that she housed a few crore *jīvas*, and not just lakhs of them? If it is held that the *jīva* comes to a fertilized egg from outside and not via a sperm or an egg, will it not follow that ever so many *jīvas* are ever at hand to immediately enter every human egg that is fertilized in any woman, at any time and at any place? Entry from outside may have to be conceded even if a sperm is regarded as the carrier of a *jīva* to a fertilized egg. This is because a male is not born with sperms; it is only much later that his testicles start producing them and continue to do so. Even if eggs are regarded as the bearers of *jīvas*, entry from elsewhere at some time may have to be assumed. While a female is born with eggs, how did the *jīvas* come into her eggs? Did they do so from elsewhere when her ovaries formed while she was in her mother's womb, or did they enter from elsewhere into the fertilized egg from which her life began?

His Holiness (continuing): Some additional questions arise if identical twins, triplets, etc., are considered[1]. A doctor came to Sringeri with his wife a month before my *Guru's* disembodied liberation (on 26th September

[1] His Holiness said, in Tamil, '*ore pōla uḷḷa iraṭṭaiyarkaḷ'* and, *'tāy vayiṟṟil oṇṟāka irunta*, *ore pōla uḷḷa, mūṇṟu pēr* (three identical persons who were present together in their mother's womb)' to refer to identical twins and identical triplets.

1954). He respectfully submitted to my *Guru* that he was nearing 50 but was still childless; he and his wife had consulted eminent gynaecologists and, later, two senior *Āyurveda-vaidyas*, but all to no avail. He made a fervent appeal to my *Guru* to bless them with a child; his wife also did so. I was present at this meeting. My *Guru* compassionately said that their desire would be fulfilled and that within a couple of years, they would, by God's grace, have not just one but two children, a pair of twins. He directed them to receive initiation into a *mantra* from me and to perform its *japa* with faith for obtaining progeny. I gave them *mantropadeśa* the next day as per my *Guru's* instruction to me. Less than two years later, the doctor came to see me in the first week of my stay at Kalady (from 13th July 1956 to 27th September 1956). For some unknown reason, I had felt that he would be coming that afternoon and had told my attendant to lead him promptly to my room for a private meeting. Having prostrated in front of me for a long time, he ecstatically informed me that his wife had delivered a pair of male twins 12 days earlier; it had been a normal delivery and both the mother and the babies were doing well. I was surprised when I learnt that he was yet to see his children. He said that both he and his wife were clear that he should first see me, receive blessings and *prasāda* from me for the babies, and then see them. I was also surprised to hear from him that his wife had not seen any gynaecologist during her pregnancy and, as desired by her, delivered not in a hospital under the care of a gynaecologist but in her parents' house in a village, with a local, elderly midwife doing the needful. The unusual reason for this was that she was sure, and he was in full agreement, that her pregnancy was due solely to grace and that, again solely on account of grace, she would give birth successfully. He said that he had no idea if his sons were fraternal twins[1] or identical twins. He started to speak about the two types of twins but stopped midsentence and sought my pardon; he felt that speaking on such matters with me might be inappropriate. I told him to go ahead and tell me about twins and that I was more than willing and happy to hear from informed persons about science, medicine, engineering, agriculture, etc. He said that one egg is what is commonly released from a woman's ovaries per menstrual cycle; a single child stems from the fertilization of such a single egg by a sperm. When not one but two eggs are released and each of these is fertilized by a distinct sperm, the end result is a pair of fraternal twins. Both of these twins may be males or both may be females, or one may be male and the other female; apart from being of the same age, they are on par with siblings born one at a time. Identical twins, on the other hand, stem not from the fertilization of two eggs by two sperms but by the fertilization, as

[1] His Holiness (in Tamil): *orē pōla illāta iraṭṭaiyarkaḷ* (twins who are different).

in the case of a single child, of one egg by one sperm, followed afterwards by a split. Fertilization occurs in a (fallopian) tube, which extends from close to an ovary on one end to the womb on the other; moving through the tube towards the womb, the fertilized egg divides in over a day into two similar, smaller cells; it continues to progressively divide, resulting in a ball of four cells in two days, and in a ball of 12 or some more cells in three days; the embryo begins to connect to the uterus around the sixth day, a couple of days before which it becomes organized as a hollow ball with liquid within and a set of cells at one end. The split that results in a pair of identical twins may occur, at the earliest, at the two-cell stage; following the separation, each of the two parted cells gives rise to one of a pair of identical twins. Identical twins are of the same sex and look alike. When fertilization of a single egg by a single sperm and two splits are involved, the result is identical triplets. Identical quadruplets and quintuplets form from one fertilized egg and three and four splits respectively. I first asked him how researchers had obtained details directly in the case of humans about the fertilization of an egg and what normally happens thereafter in the first week. At the close of his answer, he mentioned that just three weeks earlier, he had seen, in an article that appeared in an American journal and was sent to him by a friend from the United States, photographs of a one-and-half day old human embryo in the two-cell stage and a four-day old one with almost 60 cells.[1] I asked him if it is possible for a women to have triplets, comprising a pair of identical twins from one egg and a child from a second egg fertilized by a distinct sperm. He said that it is but he was yet to read of such a case. I then asked him if he had read of any case of identical quadruplets or identical quintuplets who were delivered without surgery, were normal, and lived past childhood. He replied that he had. He said that about twenty years earlier (that is, in the 1930s), a woman gave birth to five identical female babies at her farmer husband's and her house in Canada. None knew that she was carrying five babies and her doctor expected her to give birth only two months later. All the babies were born in an hour and were delivered by the doctor and two midwives. The prematurely born babies were remarkably tiny and highly underweight but all of them survived and grew to be normal, healthy children and youth. He said that the family name of these famous quintuplets is 'Dionne' and that there are articles and books about them.[2]

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[1] Since the doctor spoke with His Holiness in July 1956, the article is, presumably, the following: A. T. Hertig et al., *A Description of 34 Human Ova Within the First 17 Days of Development*, *Am. J. Anat.,* vol. 98, issue 3, pp. 435-493, May 1956.

[2] The Dionne quintuplets were born on 28 May 1934. A pre-1956 book that the doctor, who mentioned their youth, may have read is: L. Barker, *The Dionne Legend: Quintuplets in Captivity*, Doubleday, New York, 1951. It appears that he did not know that one of the quintuplets passed away in 1954, at the age of 20.

His Holiness (continuing): The next question that I posed to him was whether a partial split of a single cluster of cells stemming from a fertilized egg is possible and, if it is, what is a possible consequence. He answered that it is possible and that conjoined, identical twins may result. He then spoke of a pair of conjoined, identical twins who were born in Italy about 80 years earlier (that is, in the 1870s). Their birth was uncomplicated. Referring to them as the 'Tocci' twins, he told me that they were conjoined at the level of the middle of their ribcages; they had two heads, two necks, two hearts, and two pairs of arms, but only two legs; while their stomachs were separate, they shared a common large intestine and anus; from the navel downwards, they looked just like a single person. Each of the twins had sensations from and control over one of the two legs; each sensed and controlled the two arms on his side. There were times when one slept, while the other was awake and when one was hungry, while the other felt full and burped. One of them was talkative, while the other was quiet. While they generally got along very well, at times, they did fight between themselves. He concluded his short account of these conjoined twins by saying that after being exhibited in several countries in Europe during childhood and then touring the United States as youths and making money, they retired when they were in their twenties and, subsequently, married two women.

His Holiness (continuing): My final question was whether researchers had, as part of their experimental studies on embryos, compelled complete and partial splitting of non-human embryos and, if so, whether such splitting had resulted in independent and conjoined embryos. He said that towards the close of the previous century (the 19th century), a German researcher (Hans Driesch) experimented with a small sea-creature (sea-urchin). This creature's eggs are translucent; the development of the embryos in them can be seen from outside with a microscope. He split embryos at the two-cell stage of development by vigorous shaking. Complete separation resulted in two distinct, normally-developing embryos.[1] Afterwards, another German scientist (Hans Spemann) experimentally investigated embryonic development in an animal (newt, a type of salamander) that dwells in water and on land, as does a frog, and resembles a lizard. By using a child's fine hair as a lasso, he sectioned an egg into two soon after its being laid; two normal embryos developed. Constricting an egg by means of a hair shortly after its being laid resulted in an embryo with two heads and a tail.[2]

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[1] Hans Driesch gave an account of these experiments in English in the Gifford Lectures delivered by him in 1907 (Hans Driesch, *The Science and Philosophy of the Organism,* vol. 1, Adam and Charles Black, London, 1908).

[2] Hans Spemann was awarded the Nobel-prize for medicine in 1935. He described his experiments in: Hans Spemann, *Embryonic Development and Induction,* Yale University Press, New Haven, 1938.

His Holiness (continuing): After spending half an hour with me, during which he presented scientific material for 10 to 15 minutes, he received *prasāda* for his twins and wife. Just before leaving, he told me that he would come to Sringeri with his family for my *darśana* and that if I were to give him permission and the opportunity to present some medical information as on the present occasion, he would feel delighted and blessed to do so.

His Holiness (continuing): He came to Sringeri in 1963, a month after the *kumbhābhiśeka* (consecration) of the shrine of my *Guru* (on 3 March 1963). When I saw his children, I recognized that they were fraternal twins. During his meeting with me, I asked him if he was ready with some medical news to present to me. He said that he was and that he knew for certain that I would not have forgotten the request that he had made years ago and that I would grant it. A piece of information that he gave me was that in 1959, a researcher (M. C. Chang) had extracted eggs from female rabbits and exposed them *in vitro*[1] to sperms of male rabbits; he transferred eggs that became fertilized and developed to the 4-cell stage into the tubes (fallopian tubes) of six independent rabbits; four of these gave birth to 15 healthy rabbits.[2] He then told me about an experimental triumph that

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[1] His Holiness (in a mix of Sanskrit and Tamil): *kācattil.*

[2] M. C. Chang, *Fertilization of Rabbit Ova in vitro*, *Nature*, vol. 184, issue 4684, pp. 466-67, 8 August 1959.

was reported, he said, just the previous year (that is, in 1962). He stated that a researcher (J. B. Gurdon) destroyed the nucleus[1] of a frog's egg-cell by means of ultraviolet light[2]. When he started to explain what a cell's nucleus is, I told him that I knew about it, that it houses DNA and genes, which are strands of DNA, and that it is a cell's control centre, like the brain in a human or the driver of a car. The researcher then took a cell from a tadpole's intestine and extracted its nucleus. He put this nucleus into the egg-cell whose nucleus he had eliminated. A few of such egg-cells began to divide just like normal egg-cells fertilized by sperm and gave rise to healthy tadpoles. Every such tadpole was dissimilar to the frog whose egg-cell was used but was just like the tadpole whose intestinal cell's nucleus was inserted into the egg-cell. Replicas of a tadpole, male or female, were created thus from the nuclei of its intestinal cells.[3]

His Holiness (continuing): When he told me about the fertilization of a rabbit's egg *in vitro*, I presumed that

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[1] His Holiness used the English word 'nucleus.'

[2] His Holiness: UV-*kiraṇam*.

[3] J.B. Gurdon, *The Developmental Capacity of Nuclei Taken From Intestinal Epithelium Cells of Feeding Tadpoles*, *J. Embryol. Exp. Morph.*, vol. 10, part 4, pp. 622-40, December 1962. The experiments were conducted on the frog subspecies *Xenopus laevis laevis* (South African clawed frog). Ten (out of 726) transfers of intestinal nuclei resulted in normal feeding tadpoles. {It was subsequently found and reported by Gurdon in 1966 that such tadpoles became normal male and female frogs that were fertile. John Gurdon was awarded the Nobel Prize for Medicine in 2012 for his work.}

someday, with improved techniques, scientists would be able to do the same with a human egg-cell. When he came next to Sringeri three years ago (in 1973), he told me that that year, a medical team in Australia had extracted an egg-cell from a woman who was unable to conceive, successfully fertilized it *in vitro* with her husband's sperm and, after the fertilized cell became a cluster of eight cells by division, implanted it into her uterus. Unfortunately, however, the pregnancy did not last.[1] He felt sure that a successful human pregnancy involving *in vitro* fertilization would be achieved before long. He also informed me was that nine years earlier (in 1964), researchers had adopted a means to preserve sperm indefinitely by freezing and keeping it at the very low temperature at which nitrogen is a liquid, thawed frozen sperms after one to six months and injected them into women; four of the women delivered babies.[2] He added that till then, there had been no human births from frozen embryos; however, a calf was born that year (1973) from an *in vitro* embryo that was frozen, thawed after some days, and inserted into a cow.[3]

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[1] D. De. Ketzer et al., *Transfer of a Human Zygote*, *Lancet,* vol. 2, issue 7831, pp. 728-29, 29 September 1973.

[2] W. H. Perloff et al., *Conception With Human Spermatozoa Frozen by Nitrogen Vapor Technic, Fertility and Sterility,* vol. 15, issue 5, pp. 501-4, 1964.

[3] I. Wilmut and L. E. Rowson, *Experiments on the Low-Temperature Preservation of Cow Embryos*, *Vet. Rec.,* vol. 92, issue 26, pp. 686-90, 30 June 1973. (The calf was named Frostie.)

His Holiness (continuing): Regardless of whether it is supposed that a *jīva* comes to a fertilized egg-cell via the fertilizing sperm or that it was present in the egg-cell concerned prior to fertilization or that it entered from outside at the time of fertilization, the possibility of the formation of identical twins, triplets, etc., from a single fertilized egg-cell gives room to some questions. Is it that to cater to the possibility of splitting resulting in multiple embryos, each of which is animated by a distinct *jīva*, the number of *jīvas* in a fertilized egg-cell is more than one? For instance, as identical quintuplets can develop, is the number of *jīvas* in a fertilized egg at least five? In case it is possible for ten identical embryos to arise, is the number of *jīvas* in any fertilized egg at least ten to cater to this possibility? Or, is it that a new *jīva* promptly enters whenever and wherever splitting results in an additional embryo? In the instance of the conjoined 'Tocci' twins, the presence of two distinct *jīvas* must be admitted, for they sensed and controlled distinct hands and legs, did not feel hungry or sleep at just the same times, had temperamental differences, with one being talkative and the other quiet, and they sometimes even fought with each other. As there exists the possibility that a partial split may occur and result in conjoined twins with separate brains as in the case of the Tocci twins, is it that a fertilized egg-cell houses at least two *jīvas*? If, as is the norm, no partial splitting occurs, does one of these depart or remain dormant?

His Holiness (continuing): Extending the experimental accomplishments that the doctor informed me about (in 1956, 1963, and 1973), I supposed that someday it would be possible to take the nucleus of a cell from the flesh or skin of a man or woman who has just died, put it into an egg-cell whose nucleus is removed, activate cell division, split the cluster of, say, four cells, into four individual cells, freeze the four cells, preserve them in the frozen state, thaw the four in four different months, insert one cell each in four different women and obtain four babies that are born at different times but all of which are copies of the man or woman whose single flesh or skin cell's nucleus was taken. While I had been told only about the transplantation of the nucleus of an intestinal cell, I assumed that the cell from another part of the animal's (newt's) body could also have been used and, hence, considered a cell from a person's flesh or skin. While I did recognize that the case of an egg-laying, lizard-like animal that dwells in water and land is quite different from that of a human, I thought that scientists would, in due course, experiment with and succeed in nucleus-transfer in animals that give birth. I knew that skin from human cadavers had been grafted successfully on burn wounds and, hence, thought that even the yet-to-die skin-cell of a person who has just died would be sufficient. I did not suppose at that time that all of this would be actually done in the case of humans, disregarding moral and ethical considerations and experimenting with humans as with flatworms. I did, however, presume that embryo-splitting, insertion of a flesh or skin cell's nucleus into an enucleated egg-cell, freezing and subsequent thawing of sperm, egg-cells and embryos, and other such procedures would someday be used even commercially in the case of animals to obtain, say, identical cows or a young version of a dear pet animal that is moribund or has just died. What, I presume, will someday be possible in respect of even human reproduction prompts some *jīva*-based questions. If the skin-cell whose nucleus is extracted is the bearer of the *jīva* or *jīva*-group that passes into the egg-cell into which the nucleus is put, then, since any one of the donor's healthy skin-cells could have been used, is it that the person has crores and crores of *jīvas* in his or her skin? What is more, is it that crores and crores of *jīvas* are present even in a dead one's skin-cells to cater to the possibility of the nucleus of any one of the yet-to die cells being taken to give rise to an embryo? Suppose that a *jīva* enters, not by means of a skin-cell and its nucleus, but from outside into the egg-cell into which the nucleus is inserted. This egg-cell is induced to divide like a common egg-cell fertilized naturally by sperm and forms, as assumed in the example, a cluster of four cells that can develop into a child. This cluster of four cells is frozen. What happens to the said *jīva* if the budding embryo is kept indefinitely in a frozen state without thawing and placing it into a woman's uterus?

Does it just remain latent there indefinitely or does it depart after some time? In case it departs after some time and the budding embryo is thawed subsequent to that, inserted into a woman, and arrives in the world as a normal baby, how does that baby have its own *jīva*? With reference to the example, I mentioned only the questions that are not included in the ones that I took up earlier, such as in the context of identical twins. While I did presume that someday, *in vitro* fertilization and even the insertion of a specific sperm into a specific egg-cell would successfully result in the birth of healthy children, I noted that *jīva*-related questions pertaining to these are covered in the ones that I spoke of earlier. It was in 1973 that I mentally posed in one session and answered in the light of the scripture, the *jīva*-related questions centred on flatworms, plants, and humans.

{Some contextually relevant, post-1973 developments:
(1) *In vitro* Fertilization (IVF): The first human birth as a result of IVF, which involves placing an egg with many sperm in a petri dish, was that of a female, Louise Brown, on 25 July 1978, in England. Millions of pregnancies have, since then, been initiated by IVF.
(2) Intracytoplasmic Sperm Injection (ICSI): It was on 14 January 1992 that the first child was born (in Belgium) from the fertilization of an egg by injecting a single sperm into it. ICSI has since made possible many a pregnancy.
(3) Cryopreservation: The first human birth from a frozen embryo was that of a female, Zoe Leyland, in Australia, in 1984. Her mother's ovum was fertilized *in vitro* with

her father's sperm; the embryo was frozen, thawed after two months, and put into the woman's uterus. There is no limit to how long an embryo, egg or sperm can be cryopreserved. An embryo was frozen in 1992, thawed after 27 years, and inserted into a woman in her 20s; a normal female child, Molly Gibson, was born in 2020. (4) Embryo-splitting: The birth of many identical pairs of animals such as sheep, cattle, and horses has been realized by either surgically bisecting an embryo or extracting a subset of its cells with a micropipette in order to get two embryos in the place of one. For instance, in 1981, the extraction of a cell from a two-cell bovine embryo and the transfer of the resulting two embryos into two cows fructified in the birth of a pair of identical calves. Experimental studies have been reported (since October 1993) on the splitting of budding human embryos, but, to date (2023), no split embryo has been put into a womb. (5) Cloning: The cloning of mammals by 'Somatic Cell Nuclear Transfer (SCNT)' took off with the birth of Dolly the sheep in 1996; cats, dogs, cattle, camels, horses, and even monkeys have been cloned. Cells from the ear of a bull, '86', were frozen in 1985; in 2000, a cell's nucleus was put into an enucleated egg; a male calf, '86 Squared', was born that year. A pet dog, Dylan, was cloned using a skin cell that was collected twelve days after its death in 2015; Dylan's body had been refrigerated, not frozen. In 2014, subsequent to the transfer of the nuclei of two men's skin-cells into enucleated eggs, eight-cell embryos and even blastocysts developed. However, no embryo due to SCNT has been put into a womb till now (2023).}

§1.6 His Holiness started on His second all-India tour on 1 November 1976 and returned to Sringeri on 7 January 1978. In May 1978, during my stay at Sringeri, He told me a portion of the scripture-based answers that He had thought of in 1973 to the *jīva*-related questions (centred on flatworms, plants and humans) that He had posed to Himself (and spelt out to me in 1976). He deferred telling me some parts of His answers till He had graced me with the opportunity of learning from Him Bhagavatpāda's *bhāṣyas* on the *Bhagavad-gītā*, *Taittirīya-upaniṣad* and *Brahma-sūtras* and parts of Bhagavatpāda's *bhāṣyas* on the *Chāndogya* and *Bṛhadāraṇyaka Upaniṣads*. What He told me on this topic in the period 1978-81 has been merged here.

His Holiness: In the *Mārkaṇḍeya-purāṇa*, in the *Devī-māhātmya (*also known as *Durgā-saptaśatī)*, it is said:
palāyana-parān dṛṣṭvā daityān mātṛgaṇārditān /
yoddhum abhyāyayau kruddho raktabījo mahāsuraḥ //
raktabindur yadā bhūmau pataty asya śarīrataḥ /
samutpatati medinyāṁ tatpramāṇo mahāsuraḥ //
yuyudhe sa gadāpāṇir indraśaktyā mahāsuraḥ /
tataś caindrī svavajreṇa raktabījam atāḍayat //
kuliśenāhatasyāśu bahu susrāva śoṇitam /
samuttasthus tato yodhās tadrūpās tatparākramāḥ //
yāvantaḥ patitās tasya śarīrād raktabindavaḥ /
tāvantaḥ puruṣā jātās tadvīrya-bala-vikramāḥ //
te cāpi yuyudhus tatra puruṣā rakta-saṁbhavāḥ /
samaṁ mātṛbhir atyugraśastrapātātibhīṣaṇam //
(*Devī-māhātmya* 8.40-45; *Mārkaṇḍeya-purāṇa* 88.39-44)

– Seeing the Asuras, who were afflicted by the group of Mothers (mātr̥s), fleeing, the enraged, mighty Asura, Raktabīja, arrived to engage in battle. Whenever a drop of blood fell on the ground from his body, there arose a powerful Asura of the same measure as him. With mace in hand, the mighty Asura (Raktabīja) fought with Indra's Śakti (counterpart Aindrī). Then, Aindrī struck him with her thunderbolt. Much blood flowed out fast from him, who was hurt by the thunderbolt. From it arose warriors who looked just like him and equalled him in valour. As many drops of blood fell from his body, that many persons arose, equalling him in prowess, strength, and heroism. Even those blood-born persons fought the Mothers ferociously, striking with terrifying weapons.

From this account, it is clear that, though identical in appearance with Raktabīja, the beings who arose from his drops of blood were distinct from him. There is no scope whatsoever provided by the text to suppose that Raktabīja actively created, by yogic powers, the bodies of the new beings and endowed them with minds that were subservient to and attuned to his mind; none of the commentaries that I have read states or even drops a hint that, as per the text, the blood-born entities were not distinct individuals. As the text refers to the blood-born entities by the words *puruṣa* and *asura*, it cannot be supposed that the entities were mere automations and, thus, unanimated by and bereft of *jīvas*. The upshot of all this is that the *jīva* that animated Raktabīja's body was different from the *jīvas* that animated the bodies of the beings that arose from his blood; also, the *jīva* in a blood-born body was not the *jīva* in another blood-born body.

His Holiness (continuing): In the light of the story of Raktabīja and the Asuras born of his blood presented in the *Devī-māhātmya*, flatworms that develop from small portions of a flatworm, plants that stem from cuttings taken from a plant, and persons whose birth may, in the future, be initiated by the extraction of nuclei from cells in the skin or some other bodily part of a person may all be presumed to have distinct *jīvas*. As per the narrative in the *Devī-māhātmya*, Raktabīja's animosity towards the Mothers and his ability to wield weapons appeared straightaway in the blood-born Asuras; Raktabīja's *jīva* was, nonetheless, not the one that animated the Asuras who arose from his blood. Hence, even though there may be, as experimentally observed, transfer of learning from a flatworm to the flatworms arising from its parts, there is no need to suppose that the *jīva* of the original flatworm is the one that animates the latter flatworms.

His Holiness (continuing): A sarcastic objection may be that Raktabīja is a fictitious character in a fanciful story and that drawing conclusions on transmigration based on him is like, for example, turning to the well-known *Pañcatantra* tale of the monkey and crocodile in which they converse to contend that dogs and cats actually converse and that too in the same language as did the monkey and crocodile.[1] There is, however, justification for relying upon, as was done, the portion of the *Devī-māhātmya* about Raktabīja and the blood-born Asuras. Suppose that a scholar authors a fictitious story, with several subplots, with the key intention of illustrating interestingly that one reaps in one's present life the fruits of *karma*, good or bad, that one performed in one's earlier lives and that one who leads a virtuous life will definitely experience happiness in the future. This writer cannot include, in any subplot, an account of, say, a good man's *jīva* ceasing to be upon his being killed, for this would be incongruous with the overall theme of definite fruition of *karma* and rebirth. As for the *Devī-māhātmya*, its internal consistency is patent; none of the commentaries on it that I have read has noted or tried to account for any inconsistency in the text. It is a revered work with potent *mantras* and is replete with statements that are in line with those of the *Upaniṣads* and the *Bhagavad-gītā*.[2] The text's opening and ending are rebirth-related. Thus, irrespective of whether one takes the story of Raktabīja to be a literal or embellished account of what occurred in another epoch of creation, or as figurative or as just fictitious, there is no ground to suppose that anything explicit or implicit here might be out of line with the rest of the text and the teaching of the scripture about *jīvas* and rebirth.

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[1] *Pañcatantra* 4.1

[2] His Holiness cited portions of the *Devī-māhātmya* to illustrate this.

His Holiness (continuing): With respect to the Maruts, the presiding deities of 49 winds, the *śruti* says "*sapta-gaṇā vai marutaḥ – There are indeed seven groups of Maruts*."[1] Each of these seven groups consists of seven Maruts. The *Rāmāyaṇa* and the *Purāṇas* contain similar accounts of their birth. According to the *Rāmāyaṇa*[2], Viśvāmitra told Rāma and Lakṣmaṇa at Viśālā that ages ago, distraught at the death of her sons, the Asuras, at the hands of the Devas, Diti pleaded with her spouse, Sage Kaśyapa, for a son who would kill Indra. Though Kaśyapa consented to fulfil her request, he stipulated that she would have to scrupulously maintain purity for a specified, long period. When she became pregnant, he left to resume his austerities. Indra came to Diti and served her dedicatedly. Shortly before the end of the specified period, Diti faltered once in her observance of the norms of purity and slept in a way that she should not have. Making use of this opportunity, Indra cut her fetus into seven; the parts did not, however, die. He then apologized to Diti and told her that he had done this to save his life. Diti forgave him, holding that the fault was hers. Wishing that what he had done become favourable to both of them, she said that the seven should become the guardians of the seven groups of seven winds, be well-known as the Maruts, and be led by him. The term '*marut*' reflected Indra's words, "*mā*

[1] *Taittirīya-saṁhītā* 2.2.11.1.
[2] *Rāmāyaṇa* 1.46.1-1.47.12 (Gita Press Edition).

(do not) *rudaḥ* (weep)" to them as he split up Diti's fetus. Viśvāmitra then told Rāma that the city of Viśālā was founded by Viśāla, a son of Ikṣvāku (the first king of the solar dynasty to which Rāma belonged), at the place where Diti had engaged in austerities to obtain her desired offspring and Indra had served her. I read in the *Viṣṇu-purāṇa*, *Bhāgavata-purāṇa* and *Vāmana-purāṇa* similar accounts about the origin of the Maruts; an additional point in these *Purāṇas* is that after Indra divided Diti's fetus into seven, he split each part into seven, resulting in seven groups of seven Maruts each.[1] The story of the Maruts originating from the division of Ditis's fetus by Indra is recounted even in the *Veda-bhāṣya* (Sāyaṇa's authoritative commentary, *Vedārtha-prakāśa*, on the four *Vedas*). In hymns in the *Ṛg-veda*, the Maruts have been referred to as the sons of Rudra (Śiva) and Rudra has been spoken of as the father of the Maruts. The *Veda-bhāṣya* explains this by stating that as per a narrative of yore, Indra slayed the Asuras; desirous of a son who would kill Indra, their mother, Diti, obtained, on account of her husband and by means of austerities, a fetus; becoming aware of this, adopting a subtle form, Indra entered her womb and divided her fetus into seven; he then divided each of these into seven; emerging from Diti's womb, they wept; Pārvatī asked Śiva to make them whole, male children for her

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[1] *Viṣṇu-purāṇa* 1.21.30-41; *Bhāgavata-purāṇa* 6.18.23-77; *Vāmana-purāṇa* 71.18-42.

delight; Rudra (Śiva) transformed them into identical looking persons bedecked with similar ornaments and gave them to Pārvatī saying, "May they be your sons." Hence, states the *Veda-bhāṣya*, in Vedic hymns on the Maruts, they are praised as the sons of Rudra and in Vedic hymns on Rudra, He is eulogised as the father of the Maruts.[1] As per the *Rāmāyaṇa*, *Purāṇas* and *Veda-bhāṣya*, Diti bore a fetus that was to become a single individual who would kill Indra; it follows that that live fetus was animated by one *jīva*. After that fetus was divided into parts, each part, which was alive, finally became a full, distinct, pro-Indra individual; it follows that each part and the pro-Indra individual it became was animated by a *jīva*, that this *jīva* was different from the *jīva* of the original fetus, and that this *jīva* was not the animator of any other live part and the complete, distinct individual that that other part developed into. In view of this, it may be presumed that if a flatworm is completely divided into two or more fragments, the flatworms that arise from these parts are animated by distinct *jīvas*; the case of a flatworm that divides itself would be on the same footing. Likewise, if, in the future, two or more live human fetuses result from *in vitro* embryo-splitting, they would be animated by distinct

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[1] After saying this, His Holiness went to another room, brought a volume of the *Ṛg-veda* with the *bhāṣya*, and read out a portion of the commentary on *Ṛg-veda-saṁhītā* 1.114.6. It was clear that what He had said offhand earlier was a faithful rendering of this in Tamil.

jīvas. Two or more fetuses that are the result of the natural splitting of an embryo in a woman's womb are also animated by distinct *jīvas*; it is, in any case, definite that identical twins, triplets, etc., are distinct humans.

His Holiness (continuing): The story of the genesis of Pṛthu – the king after whom the earth is said to be called *pṛthivī* – from a part of King Vena's corpse is narrated in the *Mahābhārata*[1] and the *Purāṇas.* It is written in the *Śānti-parvan* of the *Mahābhārata* that Lord Kṛṣṇa freed Bhīṣma from pain, blessed him with omniscience, and asked him to teach Yudhiṣṭhira. As part of his answer to a question of Yudhiṣṭhira, Bhīṣma recounted that King Vena was in the grip of likes and dislikes, flouted *dharma*, and ill-treated his subjects. *Ṛṣis* proficient in the *Vedas* used *kuśa*-grass powered by *mantras* to end his life. Then, chanting *mantras*, they churned the right thigh of Vena's corpse. This resulted in the emergence of a dwarf who looked like a burnt wooden post. They then churned Vena's right hand. A magnificent person originated. As he stemmed from a part of Vena's body, he is referred to in the text as Vena's son ('Vainya'). This story of Pṛthu finds a place in several *Purāṇas* such as the *Agni-purāṇa*, *Brahma-purāṇa*, *Padma-purāṇa*, *Viṣṇu-purāṇa* and *Bhāgavata-purāṇa*, with a little less or more information, but with the core preserved. For instance, the *Agni-purāṇa* omits the churning of Vena's

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[1] *Mahābhārata* 12.59.93-126.

thigh; the *Bhāgavata-purāṇa* additionally makes known that Vena's mother, Sunīthā, preserved Vena's body by some means and it was this preserved body that the *ṛṣis* worked upon.[1] As it was only from parts of Vena's corpse that the *ṛṣis* brought forth two persons, the *jīva* that had dwelt in and animated that body during Vena's lifetime was different from the *jīvas* that animated the two bodies that emerged; buttressing this difference is report of the *Viṣṇu-purāṇa* that Vena's *jīva* was saved from dwelling in *naraka* by the birth of his son, Pṛthu.[2] In the light of the said narrative in the *Mahābhārata* and the *Purāṇas*, it may be presumed that a distinct *jīva* is the animator of a fetus, be it human or non-human, resulting from a cellular nucleus or some other element of even a dead body. A secondary point is that as per the texts, Vena's sinfulness passed to the person first produced from a portion of his corpse[3]; in view of this and the distinctness of this one's *jīva* from Vena's *jīva*, it may be presumed that though some transmission of learning may occur from a flatworm to one stemming from a part of it, the two need not have the same *jīva*.

His Holiness (continuing): Narratives in the *Rāmāyaṇa* and the *Mahābhārata* about the genesis of persons have been relied upon in the context of transmigration in the authoritative *Brahma-sūtras* themselves. Explaining the

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[1] *Agni-purāṇa* 18.11-14. *Bhāgavata-purāṇa* 4.14.35; 4.14.42-43.

[2] *Viṣṇu-purāṇa* 1.13.39-42.

[3] *Viṣṇu-purāṇa* 1.13.37. *Bhāgavata-purāṇa* 4.14.46.

Brahma-sūtra, "*smaryate 'pi ca loke – Moreover, it (the attainment of a body without the role of a woman) is recorded in the smṛti* (*Mahābhārata* and *Rāmāyaṇa*),"[1] Bhagavatpāda has written in His *Brahmasūtra-bhāṣya*, "*droṇadhṛṣṭadyumnaprabhṛtīnāṁ sītādraupadīprabhṛtīnāṁ cāyonijatvam – (It is recorded in the smṛti that) those such as Droṇa and Dhṛṣṭadyumna, and those such as Sītā and Draupadī did not take birth from a womb.*" As per the *Mahābhārata*, Droṇa arose from just the seed of Sage Bharadvāja, while Dhṛṣṭadyumna and Draupadī directly emerged from fire; the *Rāmāyaṇa* chronicles that Sītā manifested in the earth.

His Holiness (continuing): Bhagavatpāda has mentioned at a few places in the *Brahmasūtra-bhāṣya* some views about reproduction that were subscribed to in those times but which we now know to be incorrect. Towards the end of His exposition of the aforesaid *Brahma-sūtra* (*"smaryate 'pi ca loke*"), He writes, "*balākāpi antareṇa eva retaḥsekaṁ garbhaṁ dhatta iti lokarūḍhiḥ – It is a popular belief that a female crane conceives without receiving any seminal discharge.*" A statement of His in the *bhāṣya* on the *Brahma-sūtra* "*devādivad api loke – Also*, *(Brahman creates the world without external aids) like the Devas, etc., (as seen) in the śāstra*"[2] is "*balākā ca*

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[1] *Brahma-sūtra* 3.1.19.

[2] *Brahma-sūtra* 2.1.25. The word '*loke*' in it has the etymological meaning, "in the means of seeing" and refers to Vedic *mantras* and *artha-vādas* (corroborative passages), *Itihāsas*, and *Purāṇas*.

stanayitnu-rava-śravaṇād garbhaṁ dhatte – Further, a female crane becomes pregnant from hearing the sound of thunder." In His *bhāṣya* on the *Brahma-sūtra*, "*dr̥śyate tu – However, it is seen,*"[1] He has said, "*dr̥śyate hi loke cetanatvena prasiddhebhyaḥ puruṣādibhyo vilakṣaṇānāṁ keśanakhādīnām utpattiḥ, acetanatvena ca prasiddhebhyo gomayādibhyo vr̥ścikādīnām – It is seen in the world that from beings such as men who are known to be sentient stem insentient hair, nails*, *etc., and from cow dung and such else that are known to be insentient arise sentient creatures such as scorpions*." Actually, however, a female crane cannot give rise to a young crane by itself, without the involvement of a male crane's sperm; it lays eggs and does not bear a fetus ('*garbhaṁ dhatte*'); thunder neither causes any crane to conceive nor fertilizes a crane's egg.[2] A female scorpion retains her fertilized eggs within her without laying them, and her young emerge from the eggs, come out of her body, and climb on to her back; no scorpion originates from cow dung. The biological incorrectness of these instances does not, however, affect what they were meant to illustrate. Moreover, biologically sound, equivalent examples are available to serve the purpose. A flatworm stemming from a piece of another flatworm without any involvement of sperm is equivalent to the

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[1] *Brahma-sūtra* 2.1.6.

[2] Pairs of Saurus cranes (widely found in India) build big nests and breed mainly, but not only, in the rainy season.

example of the crane and serves the latter's purpose. An extracted nucleus of a cell and an enucleated cell are, like cow dung, not sentient entities. I first learnt in 1963 that the nucleus of a tadpole's intestinal cell put into an enucleated egg-cell gave rise to live tadpoles. This can be presented as equivalent to the insentient-dung-live-scorpion example. What is primarily pertinent in the present context is that even the supposed origin of a creature from a single creature with no part played by sperm, and of a live creature from an insentient entity were not only not seen by Bhagavatpāda as posing any difficulty to the scriptural position on rebirth but were mentioned by Him while elucidating *sūtras* that state the *Vedāntin's* definitive position (*siddhānta*). The glosses on Bhagavatpāda's *Brahmasūtra-bhāṣya* such as the *Bhāmatī*, *Bhāṣya-ratna-prabhā*, *Nyāya-nirṇaya*, *Prakaṭārtha-vivaraṇa*, and *Brahmavidyābharaṇa*, and the glosses on glosses such as the *Vedānta-kalpataru* and *Parimala* do not note any rebirth-related difficulty on account of these.[1] I referred earlier to the compatible

[1] *Bhāmatī* is the influential sub-commentary of Vācaspati-miśra; the *Bhāṣya-ratna-prabhā* of Rāmānanda-sarasvatī is a gloss that is traditionally studied and relied upon; the *Nyāya-nirṇaya* is the sub-commentary of Ānanda-giri, the respected commentator on the various *bhāṣyas* of Bhagavatpāda; the *Prakaṭārtha-vivaraṇa* is authored by Anubhūti-svarūpa, a teacher of Ānanada-giri; the *Brahmavīdyābharaṇa's* author is Advaitānanda-sarasvatī. The *Vedānta-kalpataru* of Amalānanda is a gloss on the *Bhāmatī*, while the *Parimala* of Appayya-dīkṣita is a gloss on the *Vedānta-kalpataru.*

accounts in the *Mahābhārata* and the *Purāṇas* about the origin of Pr̥thu from the right hand of Vena's corpse; neither the *Caturdharī* (Nīlakaṇṭhā's traditional gloss on the complete *Mahābhārata*) nor the *Bhāvārtha-bodhinī* (Śrīdhara's valuable gloss on the *Bhāgavata-purāṇa*) mentions any transmigration-related problem caused by such genesis of a being from a corpse's part.

His Holiness (continuing): Some scriptural material is germane to the issue of whether a flatworm with two or more heads, or a plant comprising grafts, or a pair of conjoined twins may be associated with two or more indwelling *jīvas*. As per the scripture, the body of Virāt-puruṣa, a *jīva*, is the cosmos. For instance, it is stated in the *Puruṣa-sūkta*, "*tasmād virād ajāyata virājo adhi pūruṣaḥ*"[1]; the first part conveys that from the Supreme Being (*tasmāt*) arose *virāj*, the cosmic body; the word *virāj* has the etymological sense of 'that in which various (*vividhāni*) objects shine (*rājante*)'; the cosmos is *virāj*; the next part conveys that there arose a Puruṣa over (*adhi*) – presiding over and identifying with – the cosmic body (*virājaḥ*); an etymological derivation of the word *puruṣa* is 'he who dwells (*śete*) in the body (*puri*)'; this Puruṣa – Virāt-puruṣa – is a *jīva* who has the cosmos as his body. From his primal body, manifested everything, inclusive of the sun, moon, earth, and beings such as the Devas and humans. The Supreme Being is the one who

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[1] *R̥g-veda-saṁhitā* 10.90.5; *Taittirīya-āraṇyaka* 3.12.2.

appears as Virāt-puruṣa and is the material and efficient cause of everything; though appearing, in part, as the world, He is truly untouched and transcendent; that all this is endorsed by the *Puruṣa-sūkta* is explicated in the *Veda-bhāṣya.* Virāt-puruṣa is referred to in the scripture even as 'Virāj' and as 'Prajāpati'. The *Bṛhadāraṇyaka-upaniṣad* says that at first he experienced fear, promptly realized the non-dual Truth, and became free from fear[1]; it also expresses that in an earlier life, he destroyed, prior to others, all the obstacles to his becoming Virāt-puruṣa[2]; thus, the *Upaniṣad* patently presents him as a *jīva*. It also puts across that while remaining the same Virāj, he partitioned himself into two and proceeded to manifest the host of male and female creatures; having done so, he discerned, "*aham vāva sṛṣṭir asmi – I am indeed all this creation*."[3] Thus, Virāt-puruṣa is a *jīva*, and his body includes many a body animated by a *jīva*. The sun and the earth are parts of Virāt-puruṣa's body; one prescribed form of meditation involves conceiving the sun as his eye and the earth as his feet.[4] We know from the scripture that there is a *jīva* whose body is the sun and another whose body is the earth. The *Atharva-veda-saṁhitā* has a beautiful hymn – the *Bhū-sūkta* – addressed to the goddess with the earth for her body.

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[1] *Bṛhadāraṇyaka-upaniṣad* 1.4.2.
[2] *Bṛhadāraṇyaka-upaniṣad* 1.4.1
[3] *Bṛhadāraṇyaka-upaniṣad* 1.4.3-5.
[4] *Chāndogya-upaniṣad* 5.18.2.

Two descriptive verses of this *Bhū-sūkta* are: "*yasyāṁ samudra uta sindhur āpo yasyām annaṁ kṛṣṭayaḥ saṁbabhūvuḥ / yasyām idaṁ jinvati prāṇad ejat sā no bhūmiḥ pūrva-peye dadhātu – May the Earth (goddess identified as the earth), wherein seas, rivers, and other waterbodies exist, wherein food and humans came to be, and wherein what lives and stirs obtains enjoyment bestow upon us precedence in what is fit to imbibe.*"[1] "*girayas te parvatā himavanto 'raṇyaṁ te pṛthivi syonam astu – O Earth (goddess of the earth), may your hills, snow-clad mountains, and woods be pleasing (to us)*."[2] It can be seen that a goddess – and not an inert object – is reverentially addressed here and also that she is described as having seas, rivers, mountains, and forests, all of which, we know, are located in our familiar earth; clearly, the earth is presented here as the goddess's body. In, especially, the *Itihāsas* and *Purāṇas*, she is also portrayed as having the form of a glorious female with hands and legs and with a size far less than that of the earth. This is, however, not incompatible with her being a *jīva* with the whole earth as her body; Lord Kṛṣṇa, for instance, had the form that was seen in the battlefield

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[1] *Atharva-veda-saṁhitā* 12.1.3. His Holiness chanted this and gave the meaning of some of the words. For instance, He said that as per the *Nighaṇṭu*, the word *kṛṣṭayaḥ* in the *Veda* means humans. Unfortunately, I could not properly hear the meaning that He gave for the word, "*pūrva-peye* (translated by me here as 'precedence in what is fit to imbibe')" due to an abrupt, loud disturbance.

[2] *Atharva-veda-saṁhitā* 12.1.11 (first part).

as seated in Arjuna's chariot and also the cosmic form (*viśva-rūpa*) that He enabled Arjuna to behold. Rivers that are in the body of this Bhū-devī are, in turn, the bodies of goddess such as Gaṅgā and Yamunā, who are *jīvas.* In the *Mahānārayaṇa-upaniṣad,* a *mantra* that, as per the *Veda-bhāṣya*, is meant to be chanted while standing in navel-deep water for a bath and which we chant during *pūjā* to invoke the presence of holy rivers in the water to be used for the Lord's *abhiṣeka* is: "*imaṁ me gaṅge yamune sarasvati śutudri stomaṁ sacatā paruṣṇiyā / asikniyā marudvṛdhe vitatastayārjīkīye śrṇuhyā suṣomayā – O Gaṅgā, O Yamunā, O Sarasvatī, O Śutudrī, O Marudvadhā, together with Paruṣṇī, Asiknī, Vitastā, Ārjīkīyā and Suṣomā, hear this hymn of mine and (entering this water) become coupled (with me)*."[1] Goddesses identified with rivers are addressed here and not inert, flowing waters. As per the *Rāmāyaṇa*, while crossing the river Gaṅgā, Sītā offered prayers to Goddess Gaṅgā, addressed her as "*devi subhage – O goddess, O blessed one*"[2] and even referred to deities "*tvat tīravāsīni – dwelling on your banks*."[3] Later, while crossing the Yamunā in a raft, she prayed to Goddess

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[1] *Mahānārāyaṇa-upaniṣad, anuvāka* 1. The *Mahānārāyaṇa-upaniṣad* constitutes the final part (*prapāṭhaka* 10) of the *Taittirīya-āraṇyaka.* This *mantra* occurs in the *Ṛg-veda* in the *nadī-stuti-sūkta* (*Ṛg-veda-saṁhitā* 10.75.5). A modern view is that the river Vitastā is the Jhelum; Śutudrī, the Sutlej, and Paruṣṇī, the Rabi.

[2] *Rāmāyaṇa* 2.52.85.

[3] *Rāmāyaṇa* 2.52.90.

Yamunā, saying, "*svasti devi tarāmi tvāṁ – O goddess, may all be well. I am crossing you.*"[1] It is clear that Sītā viewed the flowing waters of the Gaṅgā and Yamunā as the bodies of the deities, for, while addressing them, she said, "your banks" and, "I am crossing you." Hence, as revealed by the scripture, the body of a river-goddess, a *jīva*, is a part of the body of the earth-goddess, a *jīva*, and that body is a portion of the cosmic body of Virāt-puruṣa, a *jīva*. Apart from rivers, the *Bhū-sūkta* speaks of the ocean as a part of Bhū-devī's body. There is a *jīva* whose body is the big ocean (*samudra*). The *Rāmāyaṇa* conveys that Samudra-deva rose up entirely from the waters of the ocean, stood in front of Lord Rāma, and humbly stated that, by nature, "*agādho 'ham aplavaḥ – I am fathomless and (hence) not fordable*."[2] These words of his are about his body, like that of a person who says with reference to his body, "I am a human." The text states that Samudra-deva emerged from the ocean accompanied by serpents, had lotus-petal-like eyes, and was adorned with various ornaments. Having stated that in Bhū-devī's body, there is a *jīva* whose body is the ocean, I opted to show that as per the Rāmāyaṇa, Samudra-deva is fathomless as the ocean and also has a godly form far smaller than the ocean just to illustrate that the scripture does present such dual aspects as compatible for the deities of the earth, ocean, and rivers.

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[1] *Rāmāyaṇa* 2.55.19.

[2] *Rāmāyaṇa* 6.22.27.

Apart from rivers and the ocean, the *Bhū-sūkta* plainly mentions – and I cited this part (‘*araṇyam te pṛthivi*’) – forests as a part of Bhū-devī’s body. As forests consist of trees, and trees have, says the scripture, *jīvas*, there reside in Bhū-devī’s body, *jīvas* whose bodies are trees.

His Holiness (continuing): A fetus is animated by a *jīva* and so is a woman. Hence, in the case of a woman with a fetus in her womb, there are two *jīvas* abiding within her; as in the case of the *jīvas* of Virāj and Bhū-devī, the domains of these two *jīvas* are not identical. After Indra divided Diti’s single fetus into 49, there were 49 distinct fetuses and, thus, 49 *jīvas* within her body, which was animated by a separate *jīva*, that of Diti herself; here too, the domains of the *jīvas* were not identical. In the *Antaryāmi-brāhmaṇa* of the *Bṛhadāraṇyaka-upaniṣad,* Uddālaka tests Yājñavalkya by asking him two profound questions. Before this, he tells him how he first heard these questions and their answers. He says: “*madreṣv avasāma patañcalasya kāpyasya gṛheṣu yajñam adhīyānās tasyāsīd bhāryā gandharvagṛhītā tam apṛcchāma ko ’sīti so ’bravīt kabandha ātharvaṇa iti so ’bravīt pātañcalam kāpyaṁ yājñikāṁś ca vettha nu tvaṁ kāpya tat sūtraṁ yenāyaṁ ca lokaḥ paraś ca lokaḥ sarvāṇi ca bhūtāni sandṛbdhāni bhavantīti so ’bravīt patañcalaḥ kāpyo nāhaṁ tad bhagavan vedeti – We dwelt in Madra in Patañcala Kāpya’s home, studying the scriptures on sacrifices. His wife was possessed by a Gandharva. We asked him, ‘Who are you?’ He replied, ‘I am Kabandha,* *Atharvan's son.' He questioned Patañcala Kāpya and those learning the texts on sacrifices saying, 'Kāpya, do you know that sūtra (literally thread, referring here to Hiraṇyagarbha, the cosmic prāṇa) by which this world, the other world, and all beings are strung together?' Patañcala Kāpya said, 'Venerable sir, I do not know it.'*"[1] Kabandha, the Gandharva, then asked Kāpya whether he knew about that '*antaryāmin'* who controls all from within. Kāpya said that he did not know. Kabandha then highlighted the greatness of the knowledge of the *sūtra* and the *antaryāmin* and, "*tebhyo 'abravīt – He described both these to them.*"[2] From this account, it is inferable that the Gandharva's *jīva* entered into and controlled the whole of the body that belonged to another *jīva*, that of Patañcala Kāpya's wife; the entry was not into a dead body but into one wherein Kāpya's wife's *jīva* continued to be; the Gandharva remained in and held control over Kāpya's wife's body for only a while with the aim of imparting the profound, invaluable teaching to Kāpya and his pupils. Unlike the case of the fetus and a woman where there are two *jīvas* present within the woman's body but with different spheres of influence, here, for a while, the whole of a woman's body was the common domain of two *jīvas*, but with one exercising full control over it and the other willy-nilly quiescent. In the *Anuśāsana-parvan* of the *Mahābhārata*, Bhīṣma,

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[1] *Bṛhadāraṇyaka-upaniṣad* 3.7.1.
[2] *Bṛhadāraṇyaka-upaniṣad* 3.7.1.

blessed with omniscience, is said to have recounted to Yudhiṣṭhira the story of Vipula.[1] Devaśarman knew that attracted by his wife Ruci's great beauty, Indra longed to copulate with her; he successfully kept Indra at bay. When he was to leave to perform a sacrifice, he told his dear disciple Vipula to safeguard Ruci from Indra during his absence; Vipula promised to do so. He spelt out to his disciple how Indra could, by his power of illusion, assume just about any form, and then departed. Vipula reflected on how to counter every possible approach of Indra. He concluded that shielding Ruci from outside would not be infallible and that he needed to enter into Ruci's body to rule out all scope for Indra defiling her. He was an adept at *yoga* and had the ability to leave his body and move into another one. He assessed the implications of occupying his *Guru's* wife's body. Not discerning any other infallible means to thwart Indra, and firm that he must, at any cost, carry out his *Guru's* instruction to safeguard Ruci, he passionlessly entered Ruci's body in its entirety. Taking up an extraordinarily handsome form, Indra came to where Ruci was. He saw nearby Vipula's body, with eyes fixed and without any sign of life. Ruci was struck by his handsomeness and wanted to rise and enquire who he was. However, she found that she was unable to get up because Vipula, who was within her, held her body in check. She was

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[1] *Mahābhārata* 13.40.16 – 13.41.35. H.H. accurately presented the story in Tamil without citing the verses concerned.

unware of Vipula's presence in her body. All she knew was that she wanted to rise but could not do so. Indra told her who he was and that he had come to her full of desire for her. Vipula heard this. Noticing from signs in her body that she wanted to rise and speak to Indra, he restrained her body and all her senses by his power of *yoga.* Distressed at finding her unresponsive, Indra repeatedly asked her to come to him. She wanted to respond to him. However, the words that came from her mouth were not those that she wanted to utter. Vipula spoke through her mouth and disapprovingly asked Indra, "What is the point of your visit?" Ruci was pained to find that she said this. Indra became sad. The linguistic refinement in what he heard from Ruci led him to realize that the words were not those of Ruci. With his divine vision, he then saw that Vipula was in Ruci's body. Observing that Vipula was endowed with intense *tapas*, he was overcome with fear. Vipula quit Ruci's body and returned to his own body. He then severely reprimanded Indra; he added that as he found him wretched, he did not wish to punish him; he told him that his sagacious *Guru* possessed tremendous power and warned Indra in no uncertain terms that his *Guru* would annihilate Indra if he showed up before him. Without saying a word, Indra fled in fear. A *muhūrta* (48 minutes) later, Devaśarman returned to his *āśrama.* Vipula prostrated before him. After his *Guru* had rested and was seated with Ruci, Vipula reported all that had transpired. Devaśarman approved of and appreciated what Vipula had done and specially blessed him. In this case, for some time, there were two *jīvas* – those of Ruci and Vipula – in a single human body; both were simultaneously, independently, and even incompatibly active, with Ruci and Vipula having different thoughts, feelings, and intentions; unlike the *jīvas* of a woman and a fetus, both had the same domain, Ruci's full body. A narrative in the *Taittirīya-saṁhitā* is: *"devāsurāḥ saṁ-yattā āsan te devā bibhyato 'gniṁ prāviśan tasmād āhur agniḥ sarvā devatā iti te agnim eva varūthaṁ kṛtvāsurān abhyabhavan – The Devas and the Asuras were set for war; scared, the Devas entered into (the body of) Agni; hence, it is said, 'Agni is all the Devas.' Making (the body of) Agni their fortification, they vanquished the Asuras*."[1] The import of the statement, 'They (Devas) entered into Agni *(te agniṁ prāviśan*)' is clarified in the *Veda-bhāṣya*; by recourse to the *yogic* means to enter into the body of another, the Devas, that is their *jīvas*, left their bodies and went into Agni's body. Here, though independent, the *jīvas* in Agni's body fully cooperated and, using that fiery body, achieved their end of defeating the Asuras.

His Holiness (continuing): Thus, as per the scripture, inside one *jīva's* body, there can be the body of another *jīva*, with the experiential domains of the two *jīvas* being their own bodies, one of which includes the other; for

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[1] *Taittirīya-saṁhitā* 6.2.2.6-7.

instance, Bhū-devī's body and sphere of experience, the earth, is within Virāt-puruṣa's sphere of experience and body, the whole cosmos. Further, there can be, as in the cases of Kabandha and Kāpya's wife, Vipula and Ruci, and the Devas and Agni, two or more *jīvas* dwelling in and having for their domains one and the same body, in its entirety. It is also contextually relevant that the bodies of two distinct *jīvas* can be partially distinct and partially united. There is scriptural support for this. I shall present it in two parts to cover two kinds of union. When a river such as the Gaṅgā merges with the ocean, it no more has the form of a river or its own name. An example in the *Praśna-upaniṣad* is, *"yathemā nadyaḥ syandamānāḥ samudrāyaṇāh samudraṁ prāpyāstaṁ gacchanti bhidyete tāsāṁ nāma-rupe samudra ity evaṁ procyate – Just as rivers flowing towards the ocean reach the ocean and disappear, their names and forms cease to be, and they are referred to as just the ocean…"*[1] The *Muṇḍaka-upaniṣad* has this example: *"yathā nadyaḥ syandamānāḥ samudre 'staṁ gacchanti nāma-rūpe vihāya – Just as rivers flow on and disappear into the ocean, relinquishing names and forms…"*[2] An example presented in the *Chāndogya-upaniṣad* is: "*imāḥ somya nadyaḥ purastāt prācyaḥ syandante paścāt pratīcyastāḥ samudrāt samudram evāpiyanti sa samudra eva bhavati – Good-natured one, these eastward rivers flow to the*

[1] *Praśna-upaniṣad* 6.5.

[2] *Muṇḍaka-upaniṣad* 3.2.8.

east and the westward ones to the west. Their fountain-head is the ocean (by way of evaporation, clouds, and rain) and they merge into the ocean itself. They become just that ocean."[1] A river ceases to be a river and loses its identity upon its fully merging with the ocean; the *Upaniṣads* take this as a given. It follows that where the river Gāṅgā becomes one with the ocean, the river-body of Goddess Gaṅgā, a *jīva*, unidentifiably dissolves into the body of Samudra-deva, a *jīva*. I shall now consider the case of a river uniting with another river. The river Yamunā unites with the river Gaṅgā at Prayag; this is observable and is spoken of even in the *Rāmāyaṇa*, the *Mahābhārata*, and the *Purāṇas*. That the Gaṅgā flows to the ocean and the Yamunā is a tributary of the Gaṅgā is evidenced, for instance, by Lord Rāma referring to the river Gāṅgā as "*sāgaraṁ-gamām – she who attains the ocean*"[2] and the *Rāmāyaṇa* pointing out, "*gaṅgāṁ yamunābhipravartate – The river Yamunā flows to the Gaṅgā.*"[3] The river that flows after the confluence of the Gaṅgā and the Yamunā at Prayāg is not at all called Yamunā and is known as just Gaṅgā. Nevertheless, there are a few significant differences between the merger of the Yamunā with the Gaṅgā and the merger of a river with the ocean as highlighted in the *Upaniṣads*. After a river merges with the ocean, it loses its riverine form

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[1] *Chāndogya-upaniṣad* 6.10.1.

[2] *Rāmāyaṇa* 2.52.3.

[3] *Rāmāyaṇa* 2.54.2.

(*rūpa*) and just the ocean, which is not a river, persists; on the other hand, even after the merger of a river with another river what continues is a river only. Importantly, the scripture speaks of even tributaries of rivers as going to the ocean. Thus, it is stated in the *Mahābhārata*, in the *Vana-parvan*, "*samudragā mahāvegā yamunā yatra pāṇḍava – O Pāṇḍava* (*Yudhiṣṭhira*), *the fast-flowing Yamunā, which attains the ocean, is present there.*"[1] The *Matsya-purāṇa*, *Mārkaṇḍeya-purāṇa*, and the *Brahma-purāṇa* list the rivers originating in the Sahyādri range (Western Ghats); the Godavari, Krishna, Tungabhadra, and Bhima rivers are listed by all of them. For instance, the list of the *Matsya-purāṇa* is: "*godāvarī bhīmarathī kṛṣṇaveṇī ca vañjulā / tuṅgabhadrā suprayogā vāhyā kāverī caiva tu / dakṣiṇāpatha-nadyas tāḥ sahyapādād viniḥsrutāḥ – The Godāvarī, Bhīmarathī (=Bhima), Kṛṣṇa-venī (=Krishna), Vañjulā, Tuṅgabhadrā, Suprayogā, Vāḥyā, and the Kāverī are rivers of the south having their source in the Sahya-mountains*."[2] We know that the Godavari, Krishna, and Kaveri do flow into the sea; that the Tungabhadra is a tributary of the Krishna, joins the latter from the south, and is itself the outcome of the confluence of the Tunga and the Bhadra; and that the river Bhima is a tributary of the Krishna and joins the latter from the north. It is significant that the *Matsya-purāṇa, Mārkaṇḍeya-purāṇa*, and the *Brahma-purāṇa*

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[1] *Mahābhārata* 3.90.3. H.H. cited the second half of the verse.
[2] *Matsya-purāṇa* 114.29. H.H. said that He liked verses on rivers.

unanimously go on to assert, after giving a few more lists of rivers, that every one of the rivers listed reaches the ocean. For instance, the *Brahma-purāṇa* declares: *"sarvāḥ puṇyāḥ sarasvatyaḥ sarvā gaṅgāḥ samudragāḥ – All of them are sacred, are like the Sarasvatī and the Gaṅgā, and go to the ocean."*[1] In line with the scriptural position that tributaries attain the ocean, Bhagavatpāda has mentioned the Yamunā along with the Gaṅgā in His *bhāṣya* on the cited passage of the *Praśna-upaniṣad: "tāsāṁ cāstaṁ gatānāṁ bhidyete vinaśyete nāma-rūpe gaṅgā-yamunetyādi-lakṣaṇe – The names and forms, such as Gaṅgā and Yamuṇā, of those rivers that have become merged (into the ocean) come to an end."*[2] Even after the rivers Tunga and Bhadra meet, neither loses its name, for the river that continues after they join is, as mentioned in the scripture itself, 'Tuṅgabhadrā'. Hence, while upon a river merging with the ocean, it no more has its form (*rūpa*) as a river or its name (*nāma*), when a river joins another, what results is a river and, further, it can even be that both their names continue, as in the case of the rivers Tunga and Bhadra. Since the scripture makes known that the rivers such as the Gaṅgā and the Yamunā are the bodies of *jīvas* and that even after a river unites with another, it too proceeds to the ocean, and since it is known that a single river continues from the confluence of two rivers such as the Gaṅgā and the

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[1] *Brahma-purāṇa* 27.39. Verses on nature were etched in H.H.'s mind.
[2] *Bhāṣya* on *Praṣna-upaniṣad* 6.5.

Yamunā, it follows that distinct *jīvas* may have bodies that are partially distinct and partially combined.

His Holiness (continuing): The bodies of conjoined twins are partially distinct and partially shared. For instance, the 'Tocci' twins about whom I first heard in 1956 had different heads, necks, arms, hearts, and stomachs but looked like one person below the navel and shared an undivided large intestine and anus. What the scripture has made known about two distinct *jīvas* with watery bodies that are partially distinct and partially combined can be applied to and serve as an analogy for conjoined twins. Thus, with the scripture in mind, we accept that conjoined twins such as the Tocci twins have different *jīvas*. As we admit two distinct *jīvas* in conjoined twins, we readily appreciate the possibility of conjoined twins having their own personalities, thoughts, feelings, and views; not falling asleep and awakening simultaneously; being at odds at times, and usually co-operating with each other; the case of Vipula and Ruci is illustrative of discordance between two *jīvas* in a body, while the case of the Devas and Agni is illustrative of the *jīvas* in a body co-operating. In the course of my first stay at Calcutta (in 1964, from 25th March to 21st April), I heard from a senior doctor about a strange case of conjoined twins. A boy born in Bengal in the 18th century had two heads; but for the second head, he looked like a normal person with one head, one face, one neck, one torso, two arms, and two legs; the second head, with a full face, was coupled to the top of the other head, was inverted, and ended in a neck-like stump unlinked to the torso. The inverted mouth attempted to suck when the boy's mother placed her breast to it; the eye movements in the two heads were generally independent; when the boy slept, the eyes in the abnormal head could be open and move; the expressions in the two faces were not the same, with, for instance, a smile in the normal face not being mirrored in the other one. The inverted and the normal head housed brains that were independent. When four years of age, the two-headed boy died due to being bitten by a cobra. On the day after he told me all this, the doctor showed me a sketch of the boy that had been originally published years ago; the inverted head with a dead-ended, partial neck was astonishing.[1] As a contrast to this case, he mentioned that a pair of conjoined twins born in Thailand in the 19th century were two full persons joined by a band of tissue at the base of their chests; they shared sensations only in its middle.[2]

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[1] This two-headed boy of Bengal was born in May 1783. His case was detailed by Everard Home, who also published a sketch of the boy (E. Home, *An Account of a Child With a Double Head, Phil. Trans. R. Soc. Lond.,* vol. 80, pp. 296-305, 1790; E. Home, *Some Additions to a Paper, Read in 1790, on the Subject of a Boy With a Double Head, Phil. Trans. R. Soc. Lond.,* Vol. 89, pp. 28-30, 1799).

[2] Chang Bunker and Eric Bunker were born in 1811 and died in 1874 within hours of each other. They married two sisters and fathered 21 children. A book on them: Yunte Huang, *Inseparable – The Original Siamese Twins and Their Rendezvous With American History,* N. W. Norton and Company, New York, 2018.

The presence of two *jīvas* is readily presumable in the case of the twins born in Thailand; a pair of rivers that are the bodies of two *jīvas* and join at almost the end of their courses towards the ocean may be invoked as a scripture-based analogy for these conjoined twins who shared only a short band of tissue, and more specifically, the middle of that band. In the radical case of the two-headed boy, the presence of two *jīvas* may be admitted by invoking as a scripture-based analogy either a fetus borne by a woman or a river merging with the ocean. Lacking a heart, lungs and stomach, the inverted twin was dependent for survival upon the main twin, like a fetus on its mother. Taking into consideration factors such as that the inverted skull was fused with the main skull and there was skin-continuity, the primary twin's body can be thought of as subsuming the inverted head. Therefore, on the scripture-based analogy of the fetus' *jīva's* body being within and nourished by the mother's *jīva'*s body, it is presumable that in the case of the two-headed boy, there were two *jīvas*, that of the secondary twin and that of the main twin, with the former *jīva's* body, the odd head, being within and nourished by the latter *jīva's* body. If the secondary twin's body, the odd head, is viewed as uncontained in the primary twin's body, the presence of two *jīvas* may be presumed based on the two-*jīva* river-ocean analogy. Like a river joining the ocean, the secondary twin's body joined the primary twin's body and, like the ocean providing water to the river via, as recognized in the scripture, evaporation, clouds, and rain, the primary body provided sustenance via blood to the secondary body.

His Holiness (continuing): The scripture makes known that worms have *jīvas* and provides different instances – such as of Virāt-puruṣa and Bhū-devī, a mother and a fetus, Kabandha and Kāpya's wife, Vipula and Ruci, the Devas and Agni, the river Gāṅgā and the ocean, and the river Yamunā and the river Gaṅgā – of the possibility of there being more than one *jīva* in a body, of a *jīva's* body containing and nourishing another *jīva*'s body, of dominance, discordance and co-operation among *jīvas* in a body, of a *jīva's* body merging with another *jīva's* body, and of *jīvas* having partially distinct and partially shared bodies. Hence, as in the human cases of the Tocci twins, the twins from Thailand, and the two-headed boy of Bengal, we presume, with the scripture as basis, that flatworms with two or more heads with distinct brains house two or more *jīvas* and recognize the possibility of some conflicting and mostly non-conflicting behaviour in such worms.

His Holiness (continuing): I shall now take up the case of *jīvas* in grafted plants. Unlike humans and flatworms, plants have no heads, brains or nerves; also, conflicting behaviour such as that of a two-headed worm trying to move in two directions simultaneously is not noticed in plants. However, the scripture not only explicitly says

that plants have *jīvas*, as do humans, but also that, like a *jīva* in a human body, the *jīva* in a plant experiences joy and unhappiness. It points out the effect of a tree's *jīva* withdrawing from a part of the tree. Also, it draws several parallels between humans and trees. It is said in the *Chāndogya-upaniṣad: "asya somya mahato vṛkṣasya yo mule 'bhyāhanyāj jīvan sraved yo madhye 'bhyāhanyāj jīvan sraved yo 'gre 'bhyāhanyāj jīvan sravet sa eṣa jīvenātmanānuprabhūtaḥ pepīyamāno modamānas tiṣṭhati / asya yadekām śākhāṁ jīvo jahāty atha sā śuṣyati dvitīyāṁ jahāty atha sā śuṣyati tṛtīyāṁ jahāty atha sā śuṣyati sarvaṁ jahāti sarvaḥ śuṣyati – Amiable one, if one were to strike at the root of this big tree, it would, living on, exude fluid; if one were to hit its middle, it would, being alive, exude fluid; if one were to strike its top, it would, still living, ooze fluid. Being pervaded by the jīvātman, this tree stands, freely drinking (water and nutrients through its roots) and experiencing joy. If the jīva discards one (diseased or damaged) branch of this tree, that branch dries up; if it leaves a second branch, that dries up; if it abandons a third branch, that dries up. If it leaves the tree completely, the whole tree dries up*."[1]
Tree-human parallels in the *Bṛhadāraṇyaka-upaniṣad*: *"yathā vṛkṣo vanaspatis tathaiva puruṣo 'mṛṣā / tasya lomāni parṇāni tvag asyotpāṭikā bahiḥ // tvaca evāsya*

[1] *Chāndogya-upaniṣad* 6.11.1-2. The 'big tree' spoken of here may be taken to be a banyan tree since it is said in a subsequent passage, "*nyagrodha-phalam ata āhara - Fetch a banyan-fruit from this (tree)*."

rudhiraṁ prasyandi tvaca utpaṭaḥ / tasmāt tad āṭṛṇṇāt praiti raso vṛkṣād ivāhatāt // māṁsāny asya śakarāṇi kināṭaṁ snāva tat sthiram / asthīny antarato dārūṇi majjā majjopamā kṛtā // yad vṛkṣo vṛkṇo rohati mūlān navataraḥ punaḥ / martyaḥ svin mṛtyunā vṛkṇaḥ kasmān mūlat prarohati //… yat samūlam āvṛheyur vṛkṣaṁ na punar ābhavet / martyaḥ svin mṛtyunā vṛkṇaḥ kasmān mūlat prarohati //… vijñānam ānandaṁ brahma – It is true that as is a large tree[1]*, so is a person. His hairs are its leaves; his skin is its outer bark. Blood flows out from his skin; sap oozes out from its bark; thus, like sap issuing from a tree that is cut, blood comes out from a person who is wounded. His flesh is its inner bark. His tendons are its inmost layer of bark; both are tough. His bones, which are inner to the tendons, are its wood, which is within the inmost part of its bark. His marrow is on par with its pith. If a tree is cut through, it grows up anew from its roots. From which root does a person spring up again (in a new life) when cut down by death? ... If a tree is taken out with its roots, it does not grow again. From which root does a man arise after he is cut down by death? ... (The Upaniṣad's answer to the question:) Brahman, which is absolute consciousness and bliss*."[2]

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[1] The words *'vṛkṣo vanaspatiḥ'* of the cited text literally mean 'a tree that is a *vanaspati*'; a '*vanaspati'* is, as defined in texts such as the *Amarakoṣa*, a tree that bears fruits without bearing visible flowers; a banyan tree is an instance of a 'tree that is a *vanaspati*.'

[2] *Bṛhadāraṇyaka-upaniṣad* 3.9.28.1-4; 3.9.28.6-7.

As made known by the *Chāndogya-upaniṣad*, unlike a branch that is animated by a tree's *jīva*, a branch that the *jīva* quits dries up. It is indisputable that the drying up of a branch that has been vacated by the *jīva* is not instantaneous; it is gradual, depending on factors such as the ambient temperature, humidity and breeze. As the scripture has spoken of a tree's *jīva* giving up even an unseparated, damaged branch, surely, the *jīva* leaves a branch that is severed from the tree; such a branch too starts to dry up. If duly planted before it dries out, the cut-out branch might begin to develop into a tree and be animated by a distinct *jīva*; after all, as per the scripture, every living plant is animated by a *jīva.* While a branch that has been planted may become animated by a *jīva*, nowhere does the scripture state or suggest that in and of itself, a chopped out branch is animated by a *jīva*. If it were the case that even a severed branch is enlivened by a *jīva*, it would be on par with an uncut, live branch of the tree; however, it is comparable to a *jīva*-forsaken, unseparated branch that starts to dry up. The *Manu-smṛti* and the *Mahābhārata* have likened a dead human body to a piece of wood and a clod of mud;[1]

[1] *Manu-smṛti* 4.241; *Mahābhārata* 13.111.13. His Holiness cited just the portion, "*mṛtaṁ śarīram utsṛjya kāṣṭha-loṣṭa-samaṁ – Having discarded the dead body, which is akin to a piece of wood and to a clod of earth…*" This is common to the two texts. His elucidation of the analogy is compatible with Kullūka-bhaṭṭa's gloss, *Manvartha-muktāvalī*, on the verse of the *Manu-smṛti.*

a corpse is unanimated by and bereft of a *jīva* and so is a piece of wood that is not a part of a tree, and a clod of mud. Unlike a branch that is chopped off from a tree and discarded by the tree's *jīva*, a live stump of a tree with the roots intact in the ground and in a position to regrow into a tree continues to be animated by the tree's *jīva*; accordingly, in the *Bṛhadāraṇyaka-upaniṣad*, after comparing a tree and a human body, it is pointed out that a tree that is cut through leaving a stump with the roots intact and is alive regrows from its roots into one with a fresh form. Similarly, in the case of grafting that I had given earlier, the branches that are cut out, for being grafted, from three hibiscus plants that bear red, yellow and white flowers are discarded by the *jīvas* of the three plants, while the hibiscus plant that is cut through a few inches above the soil and onto which the grafting is done continues to be animated by that plant's *jīva.* After the portions obtained from the three hibiscus plants are coupled to this plant, its *jīva* itself begins to animate the three grafts. The grafted portions become integral parts of this plant and it then bears red, yellow and white flowers in different branches; the whole plant is animated by this one *jīva.* As in this case, a bud taken from a rose plant is unanimated by that plant's *jīva* but becomes animated by the *jīva* of the rose plant to which that bud is properly grafted. Similarly, a branch that is cut from a tree and grafted to a branch of another tree is animated by the latter tree's *jīva* as a part of that tree.

His Holiness (continuing): I had mentioned an instance of grafting occurring in nature; a sandalwood tree and an Indian blackberry tree had some coupling between their roots and, consequently, the blackberry fruits had a sandalwood taste and smell. In cases of natural grafts such as this one, the scriptural analogy that is applicable is that of two rivers combining. Like any other tree, this Indian blackberry tree had its own *jīva* and so did the sandalwood tree; like two independent rivers joining at almost the ends of their courses, the bodies of these *jīvas* were distinct except for the coupling at the level of the roots; the case of the conjoined twins of Thailand who were attached by just a band of tissue is a rough human parallel. A long-used method of grafting in the case of mangoes[1] is as follows. A hardy mango plant is grown in a pot and taken near a tree that yields the desired variety of mangoes, such as Banganapalli. A branch of the mango plant in the pot is partially sliced lengthwise for a few inches and the same is also done on a low-lying branch of the tree that yields the desired mangoes. The pot is placed such that the two exposed portions are accurately aligned; they are duly pressed against one another and bound. In due course, the two branches become joined. After this, the branch of the tree is separated from the tree by cutting it below the joint; the consequence is that the branch is thereafter coupled to, and a part of, just the potted mango plant,

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[1] Approach grafting.

which, when planted in the ground, grows and yields fruits of the desired variety. In this case, the two plants are fully separate initially and animated by separate *jīvas*. When a part of one's branch and a part of the other's branch are conjoined, the analogy of two rivers that join is applicable, with the two *jīvas* having bodies that are largely separate and partially common. After its separation, the branch that was initially animated by just the *jīva* of the tree and was then associated with both the *jīvas*, becomes a portion of just the potted mango plant and is, from then on, animated by just that plant's *jīva.*

His Holiness (continuing): I had told you that I learnt from Hari that some response to light had been seen in flatworm-segments without eyes and that flatworms had been found to be sensitive to weak electric and magnetic fields[1]. With regard to plants, I described the instance of sunflowers facing east at dawn, following the sun and turning from east to west during the day, and turning from west to east during the night so as to once again face the east by morning; the sunflower plant, like every other plant, lacks eyes. In such cases, some sense-organs other than those of hearing, touch, sight, taste and smell appear to be involved; however, as per the scripture, the *jīva* transmigrates associated with just these five sense-organs, five organs of action

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[1] His Holiness: *durbala-vaidyuta-cumbaka-prabhāva.*

such as that of speech, and the mind.[1] I shall, with some examples, go into the basis and scope of the scriptural classification and how such data becomes included in it. Sage Kaṇāda classifies *karma* (activity) in the *Vaiśeṣika-sūtra, "utkṣepaṇam avakṣepaṇam ākuñcanaṁ prasāraṇaṁ gamanam iti karmāṇi – Propelling upwards, throwing down, contraction, expansion, and movement constitute action*."[2] Considering the potential objection that this fivefold classification of activity does not cover many other forms of activity, Praśastapāda explains in his esteemed *bhāṣya: "gamanagrahaṇād bhramaṇa-recanasyandanordhvajvalanatiryakpatananamanonna-manādayo gamanaviśeṣā eva na tu jātyantarāṇi – As gamana (movement) is mentioned, rotation, evacuation, flowing, flaming upwards, falling obliquely, prostrating, rising, etc., are all included as varieties of movement, not something disparate*." Lord Kṛṣṇa tells Arjuna that four kinds of pious people worship him: *ārta*, one who is afflicted (such as by disease or thieves); *arthārthin*, one who seeks wealth; *jijñāsu*, one who seeks to know (the Lord in reality); and *jñānin*, the knower of the Truth.[3] It is not that the devotees who seek progeny or heaven or a means of enjoyment are left uncovered, for, as is pointed out in a sub-commentary (*'Bhāṣyārthaprakāśa*') on Bhagavatpāda's *bhāṣya* and in commentaries based

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[1] *Bhagavad-gītā* 15.8-9; *Brahma-sūtra* 2.4.5-6.

[2] *Vaiśeṣika-sūtra* 1.1.7.

[3] *Bhagavad-gītā* 7.16.

on the *bhāṣya* such as those of Madhusūdana-sarasvatī and Śrīdhara, such devotees are covered under the head '*arthārthin*, the seeker of *artha*, wealth'; it is pertinent that the *Bṛhadāraṇyaka-upaniṣad* includes the means to attain a higher world under '*vittaiṣaṇā*, the desire for wealth.' Thus, in these instances, the classifications do encompass even what might seem to have been left out. The *Vedānta-śāstra* says that the Supreme's *māyā* or *prakṛti* (root-nature) has no existence apart from the Supreme, manifests as everything material, inclusive of the five sense-organs and the mind, and has three '*guṇas*'; the three *guṇas* are '*sattva*,' '*rajas*,' and '*tamas.*' The word '*guṇa*' here is, as Bhagavatpāda has pointed out in His *Bhagavadgītā-bhāṣya*[1], a technical term[2] and does not refer to a quality or attribute different from and inhering in *prakṛti*. *Māyā* and *prakṛti* (root-nature) are spoken of in the *Śvetāśvatara-upaniṣad* as one and as wholly subservient to the Lord: "*māyāṁ tu prakṛtiṁ vidyān māyinaṁ tu maheśvaram – Know that māyā is prakṛti and that the great Lord is the master of māyā.*"[3] The *guṇas* are referred to in this *Upaniṣad* in, as per the *bhāṣya* that has been ascribed to Bhagavatpāda, the following *mantras* that describe the Lord and the *jīva*: "*sarvam etad viśvam adhitiṣṭhaty eko guṇāṁś ca sarvān viniyojayed yaḥ – He who directs all the guṇas,*

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[1] Bhagavatpāda's *bhāṣya* on *Bhagavad-gītā* 14.5.

[2] His Holiness (in Sanskrit): '*pāribhāṣikaḥ śabdaḥ.*'

[3] *Śvetāśvatara-upaniṣad* 4.10.

He singly rules over this entire universe"[1] and *"sa viśva-rūpas triguṇas trivartmā, prāṇādhipaḥ sañcarati sva-karmabhiḥ – He has various forms, is associated with the three guṇas, has three paths, presides over prāṇa, and transmigrates in keeping with his karmas."*[2] In the *Bhagavad-gītā*, the Lord has explicitly named the three *guṇās* and described their role, inclusive of in mental functions, in terms of the predominance of one or the other of the triad of *guṇas*. The interaction between a magnet and iron is referred to in an example in the *Śānti-parvan* of the *Mahābhārata: "abhidravaty ayaskāntam ayo niścetanaṁ yathā / svabhāvahetujā bhāvā yadvad anyad apīdr̥śam – Just as an inert piece of iron promptly goes to a lodestone, so do the nature-born inclinations and all such else of a life become associated with the jīva in the next life*."[3] While it is not stated anywhere in the scripture that the three *guṇas* are involved in any magnet's influence, nonetheless, because it is specified in the scripture that *māyā* or *prakr̥ti* is what turns into everything and is characterized by these three *guṇas*, it follows that even a magnetic field should be deemed to involve the *guṇas*. This is discernible even from Lord Kr̥ṣṇa's pointing out to Arjuna in the *Anu-gītā* after speaking extensively about the three *guṇas:* "*paryāyeṇa pravartante tatra tatra tathā tathā / yat kiñcid iha*

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[1] *Śvetāśvatara-upaniṣad* 5.5.

[2] *Śvetāśvatara-upaniṣad* 5.7.

[3] *Mahābhārata* 12.211.3.

loke 'asmin sarvam ete trayo guṇāḥ – These three guṇas characterize whatever there is in this entire world; they act serially everywhere and in all the circumstances."[1] Just as Sage Kaṇāda's classification of *karma* (activity) under five heads is, as properly understood, all-inclusive and the Lord's fourfold grouping of devotees is, as duly discerned, comprehensive, so is the fivefold scriptural classification of sense-organs; just as the universality of the three *guṇas* and their inherence in a magnetic field are inferable from the scriptural teaching that the Supreme's *māyā* or *prakṛti* manifests as the entire world and that it is characterized by the three *guṇas*, it can be known from the scriptural accounts of the five elements that the said five sense-organs are sufficient.

His Holiness (continuing): The *Taittirīya-upaniṣad* states that the element '*ākāśa* (space)' arose from *Brahman*, and then, in causal succession, the elements '*vāyu* (air)', '*agni* (fire)', '*āpas* (water)' and '*pṛthivī* (earth).[2] Each of these has one characteristic quality; the characteristic qualities of these five elements are, in order, '*śabda*, (sound)', '*sparśa* (touch)', '*rūpa* (colour)', '*rasa* (taste) and '*gandha* (smell)'; also, an element gets the qualities of the elements causally preceding it. This is spelt out in, for instance, the *Śānti-parvan* of the *Mahābhārata* in an account of Sage Vyāsa's instruction to Sage Śuka.[3]

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[1] *Mahābhārata* 14.39.21.
[2] *Taittirīya-upaniṣad* 2.1.1.
[3] *Mahābhārata* 12.232.5-8.

The five subtle elements that stem from the Supreme cannot be apprehended by means of the sense-organs. From what is stated in the *Chāndogya-upaniṣad*[1] about the Supreme combining subtle fire, water, and earth to give rise to gross fire, water, and earth and, thereby, the sun, moon, etc., and from the fact that the subtle elements 'space' and 'air' are also listed in the *Taittirīya-upaniṣad*, it is admitted that five gross elements arise, via combinations, from the five subtle ones and make up the familiar world, with the perceptible attributes of the objects in the world being but the five attributes – *śabda*, (sound)', '*sparśa* (touch)', '*rūpa* (colour)', '*rasa* (taste), and '*gandha* (smell)' – of the five elements. Each of the five sense organs is capable of grasping exactly one of the five perceptible attributes of the objects of the world; this is spelt out, for instance, by Lord Kṛṣna in the *Anu-gītā*.[2] Thus, from the scriptural accounts of the five subtle elements, their five attributes, and the five sense-organs, it follows that every kind of sensory perception in the world by every living entity, be it a worm, a plant or a human, is accounted for via these five sense-organs, just as all activities are covered in the *Vaiśeṣika-sūtra* under its five heads, the four-fold classification of devotees made in the *Bhagavad-gītā* is comprehensive, and as everything material, inclusive of a magnet's field, is viewed as based on three *guṇās.*

[1] *Chāndogya-upaniṣad* 6.3.2-6.4.7.

[2] *Mahābhārata* 14.43.29-33.

His Holiness (continuing): In the *Mahābhārata*, in the *Śānti-parvan*, there is an in-depth account of a dialogue between Bharadvāja, the disciple, and Sage Bhr̥gu, the *Guru*; this occurs in the *Nārada-purāṇa* too. As part of a question, Bharadvāja remarks that trees lack sense-organs.[1] Sage Bhr̥gu teaches him, with examples as an aid, that a tree does have a *jīva*, has five sense-organs and that that *jīva* experiences pleasure and pain; for instance, he says that trees do sense and are affected by heat, with the withering of their leaves and flowers.[2] Thus, the scripture conveys, even explicitly, that plants and trees do have *jīvas* attended by five sense-organs. While the scripture does refer to functions that seem to call for additional sense-organs in trees and plants, it categorizes sense-organs into five only; it follows that the scripture includes, at least implicitly, such functions in the ambit of its fivefold classification of sense-organs. While the case of sunflowers following the movement of the sun in the sky from east to west is not mentioned in the scripture, the case of lotuses blooming at sunrise and closing upon the sun setting is referred to therein. For instance, the blooming of the lotus upon sunrise is referred to in the *Mahābhārata's Śānti-parvan* itself, before and after the portion containing Sage Bhr̥gu's answer to Bharadvāja about the sense-organs in plants.[3]

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[1] *Mahābhārata* 12.184.8; *Nārada-purāṇa* 1.42.65.

[2] *Mahābhārata* 12.184.11-17; *Nārada-purāṇa* 1.42.67-72.

[3] *Mahābhārata* 12.29.7 and 12.228.21.

Besides, Sage Bhṛgu himself indicates, with the aid of an example, that plants can, through the organ of sight, sense light.[1] Thus, the scripture recognizes that though lacking eyes, plants can sense and respond to light and does so without positing that a plant's *jīva* is associated with more than the said five sense-organs. The *Aitareya-upaniṣad* pithily refers to *jīva*-animated life-forms on earth under four heads, while the *Chāndogya-upaniṣad* does so under three heads;[2] one head is '*aṇḍaja*, born of an egg' and another is '*jarāyuja*, born of a womb'; all members of the plant kingdom are referred to in both these *Upaniṣads* by means of the term '*udbhijja*', whose literal meaning is "born of that which penetrates upwards." In the *Anu-gītā*, where also earthly life-forms with *jīvas* are mentioned under four heads, Lord Kṛṣna refers to all members of the plant kingdom through the term '*udbhijja*' and explains it thus: "*bhittvā tu pṛthivīṁ yāni jāyante kālaparyayāt / udbhijjāni ca tāny āhur bhūtāni dvijasattamāḥ – O best amongst the twice-born, those entities (plants) are called udbhijja as, in due course, they separate the earth (soil) and come forth*."[3] A seed sown in the soil produces a shoot that grows in the upward direction through the soil and emerges from the ground; this characteristic of plants is referred to in their appellation, '*udbhijja*.' Soil is opaque and a seed

[1] *Mahābhārata* 12.184.13; *Nārada-purāṇa* 1.42.70.

[2] *Aitareya-upaniṣad* 3.1.3; *Chāndogya-upaniṣad* 6.3.1.

[3] *Mahābhārata* 14.42.36cd-37ab.

sown in and fully covered by it is, in contrast to a lotus in bloom, not exposed to light. Still, even a seed that has been sown without regard to its orientation gives rise to a shoot that grows in the direction of the surface and a root that develops in the opposite direction; this fact is recognized even in the scripture. For a seed that has been sown without regard to its orientation and is fully covered by opaque soil to produce a shoot that heads in a direction that is the opposite of that of the earth's gravitational pull[1] and a root that, on the other hand, grows in the direction of the earth's gravitational pull, plants must be able to sense and respond growth-wise to gravity. By asking an agricultural scientist, I confirmed that such is the case; he also said that the phenomenon has been experimentally studied since the last century (19th century) and described some of the experiments to me; one of the points that I gathered is that if the ends of the roots (the root-caps) are cut off, the direction of root-growth ceases to be that of the pull of gravity.[2]

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[1] His Holiness (in Sanskrit): '*bhumer ākarṣaṇam.*'

[2] In 1806, Thomas Knight reported an experiment in which he placed seedlings on a circular disc and rotated the disc at 150 rpm for a few days; the roots grew outwards and the stems inwards, evidencing that, in nature, plants sense and use gravity to guide growth, with roots growing in the direction of the pull of gravity (showing 'positive gravitropism') and stems growing in the opposite direction ('negative gravitropism'). In 1880, Charles Darwin published evidence of root-growth ceasing to be gravity-sensitive after root-caps are removed. His Holiness was presumably told about experiments such as these.

Not only in the *Upaniṣads* and the *Mahābhārata* but also in the *Purāṇas*[1], the word '*udbhijja*' is preferentially employed to refer to the members of the plant kingdom when grouping life-forms animated by *jīvas*; the upward growth of a shoot from a seed sown in the ground is, thus, a scripturally underscored characteristic of plants. For a shoot to grow in a direction opposite to that of earth's gravitational pull, some means of sensing other than the five sense-organs (of hearing, touch, sight, taste and smell) seems to be called for but the very scripture that pointedly mentions such growth never recognizes, even tacitly, the existence of any additional sense-organ. Moreover, with regard to the upward-directed growth of a creeper that entwines a tree-trunk, the scripture points, in the form of Sage Bhṛgu's teaching, to the need for a means of sensing direction and to one of the five sense-organs, not one other than the aforesaid five.[2] Thus, though the scripture does not overtly say anything about the role of a sense-organ in the upward-directed growth of a shoot stemming from a seed planted in the ground, there is justification to take it that the scripture implicitly accepts the role of a means of sensing here also but not of one distinct from the five sense-organs spoken of by it. Sage Bādarāyaṇa devotes a *Brahma-sūtra*[3] to elucidating what the word '*udbhijja*' occurring

[1] For example: *Nārada-purāṇa* 1.77.88; *Liṅga-purāṇa* 1.86.19.

[2] *Mahābhārata* 12.184.13; *Nārada-purāṇa* 1.42.70.

[3] *Brahma-sūtra* 3.1.21.

in the *Chāndogya-upaniṣad's* classification of life-forms encompasses and, while expounding this aphorism in the *Brahmasūtra-bhāṣya*, Bhagavatpāda brings out the etymological sense of the word '*udbhijja*.' However, He does not see any difficulty whatsoever in the number of sense-organs associated with a *jīva* being just five, as clearly ascertained by Him earlier in the *Brahmasūtra-bhāṣya*, and a sprout arising from a seed sown in and covered by soil being reliably able to grow, as implied by the word '*udbhijja'*, in the upward direction. At this point, I thought (in 1973, while thinking of *śāstra*-based answers to the self-posed questions about worms, plants and humans,) of the possibility of scientists someday finding that, like gravity, magnetism can influence the growth of plants from seeds.[1] As the *śāstra* classifies all that falls within the ken of the senses under five heads and specifies exactly one sense-organ for each of these five categories of sense-objects, there will be no need to posit any additional sense-organ to account, in the

[1] There is now evidence that magnetic fields can impact plant-growth. For example, in an experimental study, cress seedlings were placed horizontally in a µ-metal shield in the dark. Some of them were then subjected to a weak sinusoidal magnetic field, while others were not. The roots of seedlings unexposed to the magnetic field grew in the downward direction, in the direction of gravity, while those subjected to the magnetic field even grew upwards (E. L. Kordyum et al., *A Weak Combined Magnetic Field Changes Root Gravitropism*, *Advances in Space Research,* vol. 35, pp. 1229-1236, 2005).

terms of the scripture, for plants sensing magnetism just as there is no requirement to do so for plants sensing the direction of gravitational attraction or sensing light. Likewise, in the light of the scriptural classification of sense-objects and sense-organs under five heads each, no additional sense-organ need be admitted to account for any sensitivity to light displayed by a flatworm in the absence of eyes or by it to electric and magnetic fields.

His Holiness (continuing): I had posed to myself (in 1973) correlated questions of the following kind on the number of *jīvas* possibly involved in the actual and potential births of flatworms, plants, and humans: “If a worm is cut into several parts, each of which regenerates into a worm, do the parts become animated by *jīvas* that were latent in the first worm or by *jīvas* that entered the parts from elsewhere? If it is supposed that the *jīvas* were latent in the initial worm, it will have to be presumed that the initial worm had very many *jīvas* latent in it since the worms arising from the parts of the initial worm can, in turn, give rise to worms upon being sectioned, and the latter worms can, in their turn, give rise to worms, and the *jīvas* animating all such generations of worms must be those that were latent in and passed on from the initial worm. If it is presumed that the *jīvas* enter the segments of a worm from elsewhere, then it would have to be supposed that ever so many *jīvas* are ever at hand to enter and animate every regenerating segment of every flatworm that is sectioned or divides naturally at any place and at any time. Is the *jīva* that animates a planted cutting one that was earlier latent in the tree from which the cutting was taken? If yes, that tree must house numerous latent *jīvas* in it for it to be able to pass on *jīvas* to animate every tree-forming cutting that is ever taken from it. Alternatively, are very many *jīvas* at hand to enter and animate growing cuttings obtained from any plant at any time and at any place? Was the *jīva* that animates some human embryo latent earlier in the father's sperm or in the mother's ovum or did it come from elsewhere? In the first alternative, since any viable sperm could have been the one that fertilized the ovum and the number of sperms that a man sheds into his wife is very large, it may have to be supposed that very many *jīvas* were latent in the man. In the second alternative, it may have to be supposed that a female hosts, in her lifetime, many a latent *jīva*, for she is born with lakhs of egg-cells, a few thousands of these survive till she attains puberty and any one those that remain could have been the fertilized ovum. If it is supposed that the *jīva* of the embryo was not latent in either the father's sperm or the mother's ovum but entered from elsewhere, then it may need to be supposed that many *jīvas* are at hand to straightaway animate every human embryo arising naturally, or even *in vitro* in a laboratory, at any place and at any time. Similar are the options and their implications in the case of flatworms arising from the union of one worm's ovarian egg-cell and another worm's sperm and the case of a plant developing from a seed that results from an egg-cell-containing flower of a plant receiving sperm-yielding pollen from a flower of another plant." My response to myself (in 1973) to the questions was directly based on what is revealed by the scripture about *jīvas*, such as their number and how and why they acquire a specific body.

His Holiness (continuing): As per the *Garuḍa-purāṇa: "nānāvidhaśarīrasthā anantā jīvarāśayaḥ – Infinite are the jīvas, which occupy different kinds of bodies."*[1] That the kinds of bodies are very many but amongst them, the human body is what is uniquely suitable for a *jīva* to attain liberation from transmigration is taught therein thus: "*caturaśītilakṣeṣu śarīreṣu śarīriṇām / na mānuṣaṁ vinānyatra tattvajñānaṁ tu labhyate – Among the 84 lakh kinds of bodies dwelt in by jīvas, the realization of the Supreme Reality is attained only in a human body.*"[2] The scripture recognizes *jīva*-animated organisms that are too minute to perceive; for instance, it is said in the *Mahābhārata*, "*sūkṣmayonīni bhūtāni tarkagamyāni kānicit – These are creatures that are so minute that their existence is only inferred.*"[3] If there are many lakh different kinds of bodies and these include those that are too tiny to see, the number of individual bodies with

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[1] *Garuḍa-purāṇa* 2.49.3 (Nag Publishers Edition).
[2] *Garuḍa-purāṇa* 2.49.13.
[3] *Mahābhārata* 12.15.26.

jīvas must be very much greater. In fact, nowhere does the scripture accept that the number of *jīvas* is finite[1]. No *jīva* has, as per the scripture, any beginning or end. This is ascertained in the *Brahma-sūtra*, "*nātmāśruter nityatvāc ca tābhyaḥ – The jīvātman* has no origin, for *the Upaniṣads do not refer to its origin and because its eternality is known from them.*"[2] The cycles of creation and dissolution too have no beginning or end. It is said in the *Brahma-sūtras, "upapadyate cāpy upalabhyate ca – Also, this is logical and is stated in the scripture."*[3] In His commentary on this aphorism, Bhagavatpāda has, cited the *Veda* and the *Bhagavad-gītā* and then written, "*purāṇe cātītānāgatānāṁ ca kalpānāṁ na parimāṇam astīti sthāpitam – Furthermore, it is established in the Purāṇas that the previous and future cycles of creation are endless.*"[4] Suppose the number of *jīvas*, which have no origin, is finite in a cycle of creation. In each cycle, some *jīvas* do attain liberation; this is discernible even from the words of the scripture that at the close of a cycle, the *jīvas* in *Brahma-loka* attain absolute bodiless liberation along with Hiraṇyagarbha.[5] Hence, the finite number of transmigrating *jīvas* must keep decreasing and the cycles of creation cannot continue forever. This

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[1] His Holiness: '*paricchinna*.'

[2] *Brahma-sūtra* 2.3.17.

[3] *Brahma-sūtra* 2.1.36.

[4] *Brahmasūtra-bhāṣya* on *sūtra* 2.1.36.

[5] *Kūrma-purāṇa* 1.12.273.

implication of the supposition that the number of *jīvas* is finite is discordant with the scriptural position that the cycles of creation and dissolution are endless and has been mentioned in the *Brahma-sūtras* themselves.[1] The upshot of all this in the context of the questions is that no matter which of the alternatives mentioned is considered, the number of *jīvas* is never insufficient to satisfy it.

His Holiness (continuing): It is in keeping with its *karma* that a *jīva* animates or quits a body and never arbitrarily; the scripture is clear about this. A flatworm-segment or planted cutting or embryo is enlivened only by a specific *jīva* and not by just some *jīva* from among many. Even where the scripture refers to the passing of a *jīva* from a man into a woman, it speaks of only a particular *jīva* doing so. The passing of a *jīva*, via semen, from a man into a woman is spoken of in the *Chāndogya-upaniṣad* and *Bṛhadāraṇyaka-upaniṣad* in the specific case of the *jīvas* returning from a heavenly realm to this world and being reborn here. These *Upaniṣads* and Lord Kṛṣṇa in the *Bhagavad-gītā* detail two paths; after describing the paths, the Lord tells Arjuna, "*ekayā yāty anāvṛttim anyayāvartate punaḥ – By one*, a *person attains the state of non-return (by reaching Brahma-loka and finally attaining liberation there) and going by the other, he (reaches a heavenly realm and subsequently) returns*

[1] *Brahma-sūtra* 2.2.41.

again."[1] The Lord later says about persons who perform Vedic sacrifices, acquire *puṇya*, and go by the second path to heaven: "*te taṁ bhuktvā svargalokaṁ viśālaṁ kṣīṇe puṇye martyalokaṁ viśanti – Having enjoyed the extensive world of heaven, upon the exhaustion of their puṇya, they pass into the world of mortals.*"[2] A part of what the *Chāndogya-upaniṣad* says about how a *jīva* comes back from a heavenly realm and takes a human birth is: "*abhraṁ bhūtvā megho bhavati megho bhūtvā pravarṣati ta iha vrīhiyavā oṣadhivanaspatayas tila-māṣā iti jāyante 'to vai khalu durniṣprapataraṁ yo yo hy annam atti yo retaḥ siñcati tadbhūya eva bhavati – After becoming (associated with) a white cloud, he becomes (associated with) a rain-bearing cloud and descends as rain. The returning jīvas become (associated with) paddy, barley, herbs, trees, sesame, beans, etc. Release from these is indeed more difficult. He becomes one with (becomes associated with) whoever eats food and sheds semen into a female.*"[3] As ascertained in the *Brahma-sūtras* and explicated by Bhagavatpāda in His *bhāṣya* thereon and in His *bhāṣya* on the *Chāndogya-upaniṣad*, what the passage conveys is not that a *jīva* returning from a heavenly realm literally becomes an '*abhra*, a bearer of water but not a producer of rain[4],

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[1] *Bhagavad-gītā* 8.26.
[2] *Bhagavad-gītā* 9.21.
[3] *Chāndogya-upaniṣad* 5.10.6.
[4] H.H. (quoting the *Chāndogya-bhāṣya*): '*abbharaṇamātrarūpaḥ*.'

a white cloud' but that it merely becomes associated with such a cloud; it, likewise, only becomes associated with a '*megha*, what is capable of pouring down[1], a rain-bearing cloud', with rain, and then with a plant such as rice, barley or sesame; the plant is not animated by this *jīva* and what animates it is a different *jīva* that abides and functions there in keeping with that *jīva's* fructifying *karma*; in contrast to the *jīva* that animates the plant, the returning *jīva* is latent and, being akin to an unconscious person, experiences no pleasure or pain regardless of what happens to the plant. When a man eats what is got from the plant such as cooked rice or barley, the *jīva* passes into and becomes associated with him; here too, the *jīva* is dormant and experiences no pleasure and pain in that person's body, which is animated by a distinct *jīva* due to that *jīva's* fructifying *karma*. In the passage, this person is specified as the one who '*annam atti*, eats the food' and '*retaḥ siñcati*, discharges semen into a woman.' It is only after passing, via the discharged semen, into a woman that the *jīva* proceeds to obtain and animate, by virtue of its *karma* fructifying, its own body. The latent *jīva*'*s* return journey up to the stage of association with a plant and from the plant to the eater and shedder of semen is, as succinctly stated in the portion "*ato vai khalu durniṣprapataraṁ – Release from these is more difficult*," fraught with many

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[1]H.H. (quoting the explanation of *'megha'* given in the *Chāndogya-bhāṣya*): '*secana-samarthaḥ.*'

a difficulty. The difficulties are strikingly illustrated in the *bhāṣya* on the *Chāndogya-upaniṣad.*[1] Rain with which a returning *jīva* comes down from a rain-bearing cloud to the ground may fall on a precipice on a mountain, on a desert or on the ocean; the *jīva*-bearing water may be drunk by some animal or be carried by a river into the ocean; in every such case, as the water with which the *jīva* is associated would be unavailable to a plant such as barley or sesame, the latent *jīva* would not pass into the plant; if it ends up in the ocean, it would have to wait till it rises up with water evaporating from the ocean, becomes associated with a rain-bearing cloud and then comes down once again as associated with rain to pass into a plant such as barley. Passing from a plant to the right person is, as per the *Upaniṣad*, even more difficult. The plant may be eaten by an animal, or food, such as rice, obtained from it may be eaten by a child, a life-long celibate, a very aged man or a eunuch. In all such cases, the *jīva* would fail to end up in that person via whose semen it passes into a woman. The *Chāndogya-upaniṣad's* next passage is, in part, "*tad ya iha ramaṇīya-caraṇā abhyāśo ha yat te ramaṇīyāṁ yonim āpadyeran brāhmaṇa-yoniṁ vā kṣatriya-yoniṁ vā vaiśya-yoniṁ vā – Among them (returners from a heavenly realm), those who were doers of virtuous karmas in this world* (*in an earlier birth as a human being) quickly attain a*

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[1] Bhagavatpāda's *bhāṣya* on *Chāndogya-upaniṣad* 5.10.6. This is the basis of His Holiness's account of the potential difficulties.

good birth, as a Brāhmaṇa or a Kṣatriya or a Vāiśya."[1] It is in a human birth that one is able to perform fresh *karma* and acquire merit and demerit*;* accordingly, the performance of *karma* is spoken of in this passage as having been done "*iha*, here, in this world." By the word '*abhyāśaḥ*, quickly', the *Upaniṣad* conveys that following association with the said male, the *jīva* that has returned from heaven with *karma* that is to fructify attains its own body soon.[2] The *jīvas* spoken of in this passage are those that experienced in a heavenly realm the fruit of, and exhausted, the *karma* responsible for their stay in that realm and return to this world with residual *karma* that bears fruit here. That *jīvas* return from a heavenly realm with residual *karma* has been ascertained in the *Brahma-sūtra, "kr̥tātyaye 'nuśayavāṇ dr̥ṣṭasmr̥tibhyāṁ yathetam anevaṁ ca – On its virtuous karma (ensuring its stay in heaven) being exhausted, the jīva (returns to this world) with residual karma, as is known from the śruti and the smr̥ti, along the path by which it went there and differently also."*[3] A *smr̥ti*-passage instanced by Bhagavatpāda in His *bhāṣya* on this *Brahma-sūtra* is the following *Dharma-sūtra* of Sage Gautama*: "varṇā āśramāś ca svakarma-niṣṭhāḥ pretya karmaphalam anubhūya tataḥ śeṣeṇa viśiṣṭa-deśa-jāti-kula-rūpāyuḥ-*

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[1] *Chāndogya-upaniṣad* 5.10.7.

[2] This is in line with the following clarification in Ānandagiri's gloss on the *Chāndogya-bhāṣya: "retaḥsigyogānantaraṁ…kṣipram eva."*

[3] *Brahma-sūtra* 3.1.8.

śruta-vṛtta-vitta-sukha-medhaso janma pratipadyante – Persons of different castes and orders of life who dedicatedly perform the karmas prescribed for them enjoy after death the fruits of their karmas (in heaven) and then, through their residual karmas, are reborn in first-rate environments, castes and families, endowed with good looks, long lifespans, much learning, proper conduct, affluence, happiness and great intelligence."[1] The norm is that a virtuous and a sinful *karma* do not mitigate or cancel each other and that each of them distinctly yields its fruit. Thus, it is quite possible for a person who goes to heaven on account of his having performed virtuous *karma* to return and experience the fruit of his sinful *karma* through birth as an animal. The *Chāndogya-upaniṣad* teaches: "*atha ya iha kapūya-caraṇā abhyāśo ha yat te kapūyāṁ yonim āpadyeran – Among them (returners from a heavenly realm), those who were performers of sinful karmas in this world* (*in an earlier birth as a human being) quickly attain a pitiful birth*" and mentions, by way of illustration, rebirth as a dog or as a pig. It is said in the *Purāṇas*: "*avaśyam eva bhoktavyaṁ kṛtaṁ karma śubhāśubham – One has to experience the fruit of every virtuous or sinful karma done by one*"[2] and "*nābhuktaṁ kṣīyate karma kalpa-koṭiśatair api – Without its fruit being experienced (by the one that performed it), no karma comes to an end*

[1] *Gautama-dharma-sūtra* 11.29.

[2] *Nārada-purāṇa* 1.31.70; *Brahmavaivarta-purāṇa* 2.37.17, etc.

even with the passing of hundreds of crores of cycles of creation."[1] That the fruit of a virtuous or sinful *karma* done by a person in a life unerringly accrues to him in a subsequent life and not, due to any mix-up, to some other *jīva* is expressed in the *Mahābhārata* thus: *"yathā dhenu-sahasreṣu vatso vindati mātaram / tathā pūrva-kṛtaṁ karma kartāram anugacchati – A calf identifies and goes to its mother in the midst of very many cows; likewise, the karma done by a person in an earlier life follows him.*"[2] From all this, it is clear that on returning from heaven, the *jīva* animates nothing else, be it a plant or an animal, other than the body that it acquires because of the fructification of the residual *karma* with which it returns; regardless of how great or many the potential difficulties might be in its passing into a plant such as barley and into a man through whose semen it reaches a woman, the *jīva* definitely obtains the body that it is to animate; as illustrated in the *Chāndogya-upaniṣad* by the mention of rebirth as a *Brāhmaṇa* soon (*abhyāśaḥ*) after the *jīva* becomes associated with a man and in the *Gautama-dharma-sūtras* by the mention of place, caste, family, and appearance, there is nothing arbitrary about which man it finally reaches, in which woman and when its body is conceived, and which body it acquires as per its *karma.* In this context, I thought (during my reflection in 1973) of the following words of

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[1] *Nārada-purāṇa* 1.31.69; *Brahmavaivarta-purāṇa* 2.37.17, etc.
[2] *Mahābhārata* 12.322.16.

the *Nyāyasūtra-bhāṣya* that accord with the scripture: *"sattvasya garbhavāsānubhavanīyaṁ karma pitroś ca putraphalānubhavanīye karmaṇī mātur garbhāśaye śarīrotpattiṁ bhūtebhyaḥ prayojayanti – The karma of a person to experience a stay in a womb along with his father's and mother's karmas to experience parenthood prompt the formation, from the elements, of his body in his mother's womb;"*[1] *"na sarvo dampatyoḥ saṁyogo garbhādhānahetur dṛśyate tatrāsati karmaṇi na bhavati sati ca bhavati – It is seen that not every sexual union between a husband and wife results in a pregnancy; conception takes place following a sexual union when there is the karma for its occurrence and does not occur when such karma is absent."*[2]

His Holiness (continuing): After presenting the two paths, by one of which a *jīva* attains *Brahma-loka* and does not return here and the other by which a *jīva* goes to a heavenly realm from which it has to come back, and describing how a *jīva* returns here and acquires a body, the *Chāndogya-upaniṣad* reveals: *"athaitayoḥ pathor na katareṇacana tānīmāni kṣudrāṇy asakṛd āvartīni bhūtāni bhavanti jāyasva mryasvety etat tṛtīyaṁ sthānam – Then again, there are those who do not go by either of these two paths; such are these small creatures that take birth here again and again. This is the third*

[1] *Nyāyasūtra-bhāṣya on Nyāya-sūtra* 3.2.64 (Anandashrama Edition).
[2] *Nyāyasūtra-bhāṣya on Nyāya-sūtra* 3.2.66.

state; it is referenced by the words (of direction of God), 'Be born and die.'"[1] The number of *jīvas* returning from heaven and being reborn here at any time is a very small fraction of the *jīvas* that directly transmigrate here itself at that time; the latter include all the *jīvas* involved in the non-circuitous rebirth in this world of a human as a human, a human as an animal, a human as a plant, an animal as a human, an animal as an animal, a plant as an animal, and so on. There is no arbitrariness in which *jīva* passes from which body to which incipient body, this being settled even at the time of departure of the *jīva*. It is explained in the *Bṛhadāraṇyaka-upaniṣad* by means of an example how a *jīva* passes from the body that it is dwelling in to what shall become its next abode: *"tad yatha tṛṇajalāyukā tṛṇasyāntaṁ gatvānyam ākramam ākramyātmānam upasaṁharaty evam evāyam ātmedaṁ śarīraṁ nihatyāvidyāṁ gamayitvānyam ākramam ākramyātmānam upasaṁharati – Just as a leech on a blade of grass goes to the end of the grass, takes hold of another blade of grass and then withdraws itself there, so does this jīvātman set aside this body – make this body senseless – take hold of new body and withdraw itself there."*[2] As explained by Bhagavatpāda in His *bhāṣya* on the *Bṛhadāraṇyaka-upaniṣad*, what is indicated when it is stated that the *jīvātman* sets aside, or renders senseless, its current gross body is that it

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[1] *Chāndogya-upaniṣad* 5.10.8.

[2] *Bṛhadāraṇyaka-upaniṣad* 4.4.3.

ceases to identify itself with that body, as it does when it starts to dream; the import of the portion that it takes hold of a new body is that it envisages, through mental impressions, its next body; the import of the portion that it withdraws itself there is that it identifies itself with the envisioned new body, just as it creates a body in a dream and identifies itself, in the dream, with that body. Thus, just prior to leaving a body, a *jīva* obtains, involuntarily, an awareness of its next body, which it gets as per its *karma*; that this is so even in the case of a *jīva* on the verge of quitting a plant has been pointed out by Bhagavatpāda in His *bhāṣya* on the *Chāndogya-upaniṣad*.

His Holiness (continuing): Direct acquisition of new bodies by *jīvas* even without their becoming associated with food or sperm is accepted by the scripture. This is taken up in the *Brahma-sūtra*, "*na tṛtīye tathopalabdheḥ – The specification of the five oblations (semen, food, etc.,) does not apply to the third state (that is mentioned in the Chāndogya-upaniṣad as that of those who do not go by either of the two paths) for this is discernible in the scripture.*"[1] In His *Brahmasūtra-bhāṣya*, Bhagavatpāda has, while commenting on the *Brahma-sūtra*, "*darśanāc ca – And because of observation*,"[2] mentioned plants and organisms emerging from moisture and pointed

[1] *Brahma-sūtra* 3.1.18.

[2] *Brahma-sūtra* 3.1.20.

out, "*evam anyatrāpi bhaviṣyati – It is thus elsewhere also.*"[1] The *Bṛhadāraṇyaka-upaniṣad* speaks, in its *khila-kāṇḍa* (supplementary section), of a *smṛti*-based ritual known as '*mantha'* to be performed by the householder who seeks to obtain that greatness which would enable him to acquire harmlessly the wherewithal to perform Vedic sacrifices; he is required to first observe a vow of subsisting on milk for 12 days, maintaining celibacy and restraint of speech, and sleeping on the bare ground. He should collect in a bowl or cup made of fig wood all the herbs that he is able to obtain and also various grains including the ten grains, such as rice and barley, that are specifically listed, crush them and soak them in curd, honey, and ghee in that fig-wood vessel, and stir them with a rod. Oblations of the resulting paste – the *mantha* – should be offered by him into fire, with the chanting of the prescribed *mantras.* Only a knower of *prāṇa* is qualified to perform this rite. After making the oblations, he should touch the *mantha* thinking of it as the cosmic *prāna* and chant a *mantra.* Finally, he should chant *mantras* and drink the *mantha* in four instalments. Just eulogizing the *mantha* rite, the text says, "*ya enaṁ śuṣke sthaṇau niṣiñcej jāyerañ chākhāḥ praroheyuḥ phalāśāni – If he (who meditates on prāṇa*) *were to sprinkle this sanctified mantha on a dry stump, branches and leaves would start to grow.*"[2] In His *bhāṣya*

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[1] Concluding sentence of the *bhāṣya* on *Brahma-sūtra* 3.1.20.

[2] *Bṛhadāraṇyaka-upaniṣad* 6.3.7.

on this, Bhagavatpāda has explained "*śuṣke sthāṇau*, on a dry stump" as "on a lifeless stump (*gata-prāṇe*)." This then grows branches and leaves; it becomes, explains Bhagavatpāda, "one that has life (*jīvataḥ)*," one having a *jīva*. Direct entry of a *jīva* from without into the stump is implicit in the coming to life of the dead stump spoken of in this passage of the *Bṛhadāraṇyaka-upaniṣad.* The yogic power to leave one's body and enter into another body, living or dead, is mentioned in various texts. For instance, the *Yogaśikhā-upaniṣad* states: "*jitendriyāṇāṁ śāntānāṁ jitaśvāsa-vicetasāṁ…parakāyamanoyogaḥ parakāya-praveśakṛt – For those who have conquered their senses, are tranquil, have controlled breath, and are discerning, … total focus of the mind on another's body gives rise to the power to enter another's body.*"[1] In the *Bhāgavata-puraṇa*, it is said that various yogic powers inclusive of that of being able pass into another body accrued spontaneously to Ṛṣabha but he was not interested in them.[2] The *Mahābhārata* speaks of Vipula entering into his preceptor's wife Ruci's body to protect her and of Sulabhā entering the body of Dharmadhvaja-janaka, having a discussion with him, and returning to her body the next morning.[3] The scripture thus accepts that a *jīva* may pass directly from a body into another.

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[1] *Yogaśikhā-upaniṣad* 5.46 and 5.48. His Holiness cited the second half of first verse and then the second half of the second verse.

[2] *Bhāgavata-purāṇa* 5.5.35.

[3] *Mahābhārata* 13.40.59; 12.320.3-192.

His Holiness (continuing): A virtuous *karma* such as a Vedic sacrifice ends long before the performer attains its fruit, heaven, after his death; moreover, *karma* is inert; being transient and inert, it cannot confer its fruit at the right time on its performer. As per the scripture, it is Īśvara*,* who presides over everything and is all-knowing, who bestows the fruits of *karma* on all. Two of the *Brahma-sūtras* in this regard are: "*śrutatvāc ca* – *Besides, Īśvara is the giver of the fruit of karma for the reason that the Upaniṣads so teach*;" and "*pūrvaṁ tu bādarāyaṇo hetuvyapadeśāt – Refuting the view that karma or karma's unseen potency itself gives rise to the fruit*, *Bādarāyaṇa regards Īśvara as the giver of the fruit of karma on account of His having been characterised in the scripture as the cause of karma*." [1] Which *karma* will give rise to which fruit in a future life is knowable only from the scripture and not through observation or logic or scientific experiments; only the scripture is the means to know, for instance, that the fruit of the Vedic *jyotiṣṭoma*-sacrifice is heaven or that the fruit of the proscribed act of coitus with one's *Guru's* wife includes multiple births as a grass, a shrub, and a creeper;[2] as the fructification of a subset of one's *karmas* of earlier lives accounts for one's present life, the workings of *karma* cannot be fathomed without reliance on the scripture by even a deep scrutiny of just one's present life. When

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[1] *Brahma-sūtra* 3.2.39; *Brahma-sūtra* 3.2.41.
[2] *Manu-smṛti* 12.58.

which *karma* bears fruit and how depends on several unfixed and interactive factors; Bhagavatpāda points out in His *Brahmasūtra-bhāṣya* "*upasthitavipākatvaṁ ca karmaṇo deśakālanimittopanipātād bhavati … śāstram apy asya karmaṇa idaṁ phalaṁ bhavatīty etāvati parya-vasitaṁ na deśakālanimittaviśeṣam api saṅkīrtayati – A karma begins to fructify when the place, time, and causative factors turn out to be apt for this…Even the śāstra stops with specifying that such and such karma has such and such fruit without mentioning the particular place, time, and causative factors for its fructification.*"[1] Īśvara, who impartially bestows the fruits of *karma*, is the one who sustains all the laws of nature. Thus, when the *karma* of a *jīva* responsible, for instance, for its life as a deer ends, the deer dies, not causelessly but due to, say, a disease or being hit on a road by a fast vehicle.

His Holiness (continuing): Not one of the alternatives mentioned in the questions being taken up faces any difficulty because of the large number of *jīvas* required to satisfy it; the reason is that, as seen in the light of the *śāstra*, the number of transmigrating *jīvas* is limitless. Actually, however, there is no need to suppose that a flatworm, plant or human must house numerous latent *jīvas* in sperms, pollen grains or egg-cells or elsewhere to cater to the possibility of any sperm or pollen grain or egg-cell or flatworm-segment or plant-cutting being

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[1] *Bhāṣya* on *Brahma-sūtra* 3.4.51.

the one that leads to another flatworm, plant or human; nor again is it necessary to suppose, alternatively, that many *jīvas* must ever be at hand to ensure that one of them promptly enters into the new life-form when and where it arises. This is because there is no arbitrariness, as per the scripture, in which *jīva* passes, via sperm or directly, into and takes over which particular incipient body; it is only in keeping with its fructifying *karma* that it does so; moreover, even before it quits its previous body, it involuntary gets an awareness of the body that it is to take up next; when and where a *jīva* is reborn and to whom are also not arbitrary. Ipso facto, there would be no need for numerous latent *jīvas* even if, someday[1], fertilization is successfully achieved *in vitro* by putting some sperm from among many into some egg-cell from among several, and, finally, a healthy child is born. Likewise, even if, someday[2], it were feasible to take the nucleus of any intact skin-cell from among the numerous skin cells of even a person who has just died, fuse it with some ovarian egg-cell whose nucleus has been removed and finally obtain a healthy child akin to the person whose skin-cell was used, there would be no need to conjecture that that person housed very many latent *jīvas* in his skin or that numerous *jīvas* were at hand to enter into the fused cell or incipient child. I had

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[1] This was said more than a decade before 'Intracytoplasmic Sperm Injection (ICSI)' culminated in the birth of a child.

[2] Even as of 2023, such cloning of humans has not been done.

asked if multiple *jīvas* should be present in each budding embryo to cater to the possibility of splitting resulting in identical twins or even quintuplets. The scripture-based answer is: If the *karma* of the parents is such that only one child is to be born, only one *jīva* will, as per its own *karma*, inhabit her womb; else, exactly as many as are to be born as per *karma* will do so. I had conceived of a *jīva*-animated human embryo kept frozen in a state of suspended animation for an arbitrarily long period, thawed, and implanted in a womb to become a child, or left frozen; I had then mooted the options of the *jīva* staying on open-endedly or leaving after a fixed time and the implications of the thawing being done after the *jīva* going. The state of the *jīva* in the frozen embryo is similar to that of the *jīva* in an unconscious person and the latter has been clarified in a *Brahma-sūtra*.[1] Just as the entry of a *jīva* into a life-form depends on its *karma*, so does its departure; the exit of the *jīva* in the frozen embryo is no exception. Were it to go before the frozen embryo is thawed, the embryo would, simultaneously, turn out to be unviable; Bhagavatpāda has written in His *bhāṣya* on the said *Brahma-sūtra* that if an unconscious person's *karma* ends, his life ends, without his regaining consciousness. I concluded that every one of the many questions I had posed about *jīvas* in worms, plants, and humans can be easily answered in the light of the *śāstra*.

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[1] *Brahma-sūtra* 3.2.10. His Holiness cited this *sūtra.*

2. Cosmos; Śāstra; Indian Contributions

§2.1 His Holiness sent for me one evening in the first week of June 1975. He was seated in the room in which He usually granted private audience on the ground floor of Saccidananda Vilas, His abode in Sringeri. A person in his forties was seated in front of Him. His Holiness mentioned to me that he was a 'Physics Professor from Bihar.' He introduced me to him as 'My disciple.' In the conversation that followed, while the professor spoke in Hindi, he did use words like 'gravity' rather than their equivalents in Hindi; for His convenience, His Holiness did the same.

1. The professor deemed that the *Bhagavad-gītā* and the *Purāṇas* have made known that the universe undergoes endless, similar cycles of expansion and contraction and that what was taught by them very long ago itself is what modern science is arriving at. The Lord has said in the *Bhagavad-gītā:* "*They, the ones who know the day and the night (of Brahmā, the cosmic progenitor), know that Brahmā's day lasts for 1000 yugas (4.32 billion years) and night for 1000 yugas. At the inception of the day, all manifested entities arise from the Unmanifest (the state of Brahmā's sleep); at the start of the night, they merge in that itself, which is called the Unmanifest.*"[1] Had the professor just wanted to set forth his viewpoint to His Holiness, His Holiness would have given him, as He normally did, a thorough and satisfying hearing, without raising any issues. However, since the professor intended to impart to students his idea of the correlation between

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[1] *Bhagavad-gītā* 8.17-18.

the scripture and science about the universe's start and end, His Holiness gently alerted him to some snags, by posing questions. He first led the professor to admit that his premise that the expanding universe would later begin to contract because of gravity was unsubstantiated by data till then. The hint was that he was seeking to glorify the scripture by correlating its teaching (as conceived by him) with what was till then hypothetical. His Holiness pointed out that for his scripture-science correlation to hold, not only must there be cycles of expansion and contraction, the cycles must be similar. The professor said that if the need to admit dissimilar cycles arose, he would re-examine the scripture and find how they have taught this. His Holiness told him that in that case, he would be reinterpreting the scripture in terms of modern science to claim that the scripture had made known what science was finding! Science relies on data. If years later (after 1975), data were to support accelerated expansion of the cosmos, would he then reinterpret the scripture to claim that it specifies not a cyclical universe but one that expands faster and faster? To drive home His point, He even described an attempt at retrofitting to maintain that our ancient texts had revealed what science is finding.

2. Since the professor's fundamental aim was to tell his students about the greatness of India's past, His Holiness delighted him by giving incontestable examples of Indian achievements in the fields of mathematics, medicine, and engineering; He cited offhand the *Śulba-sūtras*, *Brahma-sphuṭa-siddhānta* and the *Suśruta-saṁhitā* and spoke of the Delhi Iron Pillar and the Kailasa Temple at Ellora.

§2.2 **Professor:** I am interested in showing that what was stated in our ancient books is what modern science is finding about the universe. It is now largely accepted that the universe is expanding. Its origin can be traced back to a time when it was a point[1]. I believe that the universe will start shrinking after reaching some final size. This is because of the pull of gravity associated with the matter in the universe. It will return to the state in which it was when it originated. Thereafter, it will start expanding again. I think that this is exactly what the *Bhagavad-gītā* and the *Purāṇas* had revealed.

His Holiness: You opined that the universe will start shrinking because of the amount of matter in it. Has that much matter been discovered?

Professor: Not yet, but I am confident it will be.

His Holiness: Let us suppose that it will be. Will the next cycle of expansion then be identical to the present one or bigger or smaller? If the next cycle of expansion is larger, more time will be required for the universe to fully shrink than will be needed for it to do so in the present cycle. Hence, the universe will eventually not shrink back no matter how long one waits. Even if the next cycle of expansion is smaller than the previous one, then too the cycles will not continue endlessly. If your position is that the scriptures speak of infinite cycles

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[1] The word the professor used was '*bindu*.'

of expansion and contraction of the universe and that that is exactly what science is arriving at, you must not only have enough matter to cause the universe to shrink, but it must also be that the next expansion matches the present one. Any evidence to the contrary will be detrimental to what you are trying to establish.

Professor: I do not think such a contingency will arise.

{The professor seems to have been unaware of or chose to discount the fact that since the 1930s there had been reports that as per the second law of thermodynamics, even if the universe were to undergo cycles of expansion and contraction, a cycle would be longer and larger than the preceding one.[1]}

Professor (continuing): If it turns out that the cycles will not be identical, I will have to go through our texts again and see how they exactly predict what conforms to the new data.

His Holiness: In that case, you will be modifying your explanation of the scriptural texts to suit the scientific position of the day, whereas your aim is to start with

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[1] R. C. Tolman, *Relativity, Thermodynamics and Cosmology,* The Clarendon Press, Oxford, 1934 (§175, pp. 439-444); H. Zanstra *On the Pulsating or Expanding Universe and its Thermodynamical Aspect*, Circular no. 11, Astronomical Institute of the University of Amsterdam, 1957; I. V. Novikov and Ya. B. Zeldovich *Physical Processes Near Cosmological Singularities*, *Annual Review of Astronomy and Astrophysics*, vol. 11, pp. 387-412, 1973.

texts and establish that that is what modern science has discovered. Let us suppose that nothing fatal to your present view is noticed now or in the near future, and hence no reinterpretation of the texts by you is needed for the present. Even then, what guarantee is there that even after a decade or two, data will not necessitate a major rethink? For instance, what would happen if scientists were to come by data that shows that the universe is expanding faster and faster? In that case, how would even the present expansion be followed by a contraction? Would you then reinterpret the scriptural texts to emphasize that they speak of the universe expanding faster and faster and not of it having infinite cycles of expansion and contraction?

Professor: I do not think that there is any reasonable possibility of data for an increasingly fast expansion of the universe turning up, but I see the point that Your Holiness is making.

{As it turned out, the professor was wrong. Accelerated expansion of the universe was discovered in 1998 by two independent research teams, and three scientists – Saul Perlmutter, Brian Schmidt, and Adam Riess – were awarded the Nobel Prize for this discovery in 2011.}

His Holiness: I value your interest in viewing scientific findings in the light of our ancient texts. The point I sought to make is that if you equate an interpretation of the scripture with even a leading scientific view, as scientific positions are subject to change with new data or interpretations, you may, in time, have to reinterpret the scripture to conform to the new scientific position. When I was at Kalady for some months in 1956, an aged devotee told me, "When I was young, I read a write-up that the *ākāśa* spoken of in our ancient texts as an all-pervasive substance is what scientists had accepted as aether[1], a substance that fills the universe and through which light travels from the sun to the earth. When I told a friend this a few years ago, he said, 'Wrong! The *ākāśa* of our texts is not the aether that was assumed by scientists in the last century but, rightly, dismissed in due course. Aether was taken to be dragged along by moving objects. This is contrary to our description of *ākāśa*. It corresponds to space, not aether. Scientists have now realized that particles[2] appear and disappear in space. This was revealed by our scriptures ages ago; they said that the element *vāyu* originates from *ākāsa* and later dissolves into *ākāśa*.' Another friend objected that scientists accept that space curves near the sun; *ākāśa* does not. They then tried jointly to find how our texts had revealed what scientists accept about space." I related this just to exemplify the point I made earlier.

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[1] Pausing before saying *aether*, His Holiness asked me, "What is used like chloroform in surgeries?" I said, "Ether." The Professor enjoyed how His Holiness seemingly recalled the word *aether.*

[2] Presumably, he was referring to 'virtual particles' and regarded them as entities, and not as computationally helpful visualizations.

§2.3 **Professor:** I esteem the culture and achievements of ancient India. That is why I wanted to tell my students that modern science's universe with infinite cycles of expansion and contraction was made known long ago itself, in the *Bhagavad-gītā* and the *Purāṇas*.

His Holiness: There is much that can make us proud of ancient India in the scientific realm. If you see the *Śulba-sūtras*, which deal with the construction of sacrificial altars, you can confirm that millennia ago itself, India had a notable knowledge of mathematics. For example, a *Śulba-sūtra* of Bodhāyana is, "*dīrgha-caturaśrasya akṣṇayā-rajjuḥ pārśva-mānī tiryaṅ-mānī ca yat pṛthag-bhūte kurutas tad ubhayaṁ karoti – A cord that marks out the diagonal of a rectangle produces [in terms of a square whose sides have that cord's length] an area that is the sum of the two areas that are independently produced by the cords that mark out the rectangle's longer and shorter sides*." [1]

{His Holiness elucidated the *sūtra*. He first spoke of the aim and approach of the *Śulba-sūtras* and about the use of cords to mark lengths and specify areas. He pointed out that the word '*śulba*' means 'cord.' Then, moving His right index finger a little above a book on the desk in front of Him and sequentially indicating a rectangle, its diagonal, a square having that diagonal as a side, the rectangle's length and width and squares with these as

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[1] *Bodhāyana-śulbasūtra* 1.48.

sides, He gave the word-for-word meaning of the *sūtra*[1]. After throwing light on the nomenclature and on the relevance of each word, He concluded His exposition by spelling out the overall import. It was evident from the *sūtra* that the square of the hypotenuse of a right-angled triangle is equal to the sum of the squares of its other two sides.}

Professor: Amazing! This is the Pythagoras theorem. This is evidence that we knew it before Pythagoras, who lived in the sixth-century B.C.

His Holiness: By how much should the side of a square be lengthened to form a square that has double the area of the given square? Bodhāyana has specified this.

Professor: Oh, a rule to compute the square root of 2.

{If l is the length of a square's side, the square's area is l^2; if a square has to have double this area – that is, it is to have an area $2l^2$ – the length of each of its sides must be $\sqrt{2}\, l$. This is the basis of the Professor's remark that what is prescribed is a rule to compute the square root of 2. He said, "square root of 2" in English and not its equivalent in Hindi.}

His Holiness: He says, "*pramāṇaṁ tṛtīyena vardhayet tac caturthenātmacatustriṁśonena / saviśeṣaḥ.*"[2] Begin

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[1] The Hindi words used by His Holiness for *rectangle*, *diagonal,* and *area* were *āyat*, *vikarṇ* and *kṣetra-phal* respectively.
[2] *Bodhāyana-śulba-sūtra* 1.61-62.

with the length of a square's side. To this length, add one third of it. Next, add one fourth of that one third. Finally, subtract one thirty-fourth of that one fourth.

{If the initial length is l, the extended length is $l + l/3 + (l/3)/4 - \{(l/3)/4\}/34$. The professor took out a writing pad and pen from his bag and sought permission to note down the terms and to compute speedily the implied square root of 2. His Holiness nodded. At the professor's request, He repeated what He had said about the terms to be added and subtracted. He then waited. In around a minute itself, the Professor finished what he intended to do, which was to compute the value of $1 + 1/3 + (1/3)/4 - [(1/3)/4]/34$.}

Professor: This ancient rule is quite impressive. I can recall offhand the square root of 2 to four digits. I find that this rule yields those digits.

{The square root of 2 is 1.4142135… The *sūtra* yields: 1.4142156… It is correct to five decimal places; what the professor noted was that it is correct to three decimals. The mismatch with the actual square root of 2 is less than 0.00015 %.}

His Holiness: Immediately after specifying how the new length is to be obtained, Bodhāyana says, "*saviśeṣaḥ*." The new length that is arrived at from the given length is assigned an appellation – *saviśeṣa* – so that it may be expediently referred to in later *sūtras. Saviśeṣa* is not just some appellation for conveniently referring to the length; it is etymologically quite significant here. An etymological meaning of '*saviśeṣa*' is 'with an excess.' It is apt since the length is actually 'with an excess.' How? The area of a square that has this length for its sides is not precisely double the area of the square with the given length; it is actually a little greater; it is 'with an excess.' In an earlier *sūtra*[1], Bodhayana had pointed out that a square's diagonal produces a square with an area that is double – exactly double – the area of the given square. The length that is named *saviśeṣa* is a little greater than the diagonal of the given square; it is truly 'with an excess.' Thus, the appellation '*saviśeṣa*' is apt for this length, regardless of whether double the area of the given square is considered or the diagonal of the given square. Here is an example. I saw it in two commentaries and verified the figures. Beginning with an initial length of 408 *tilas*, the *saviśeṣa* is computed.

Professor: (unasked) It is 408 + 136 + 34 - 1 = 577 *tilas*.

His Holiness: The area of the square produced by the *saviśeṣa* of 577 *tilas* is a little more than twice the area of the square whose sides are all 408 *tilas* long.

Professor: May I quickly calculate the difference?

His Holiness: That is not necessary. The *saviśeṣa*-based area is exactly one square *tila* more than two times the initial area. The name *saviśeṣa* is thus apt here.

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[1] *Bodhāyana-śulbasūtra* 1.45.

Professor: It is striking that the ancient *śulba-sūtras* not only prescribe a rule that yields a fine approximation of the square root of 2, they even point out that this value is slightly greater than the square root. I did not know all this. I shall put together such information and present it to my students. I know Sanskrit and shall study the *Śulba-sūtras*.

{He asked about the two commentaries mentioned by His Holiness as he wished to refer to them. His Holiness told him that they were elucidations of the *Śulba-sūtras* of Āpastamba by Kapardin and Karavinda and that the *sūtras* of Bodhāyana that He had taken up occur nearly identically in the *Āpastamba-śulba-sūtras*. He added that He had presented the *sūtras* of Bodhāyana as he is regarded as preceding Āpastamba.}

His Holiness: The concept of zero as a number is another instance of what we can be proud of. India was the first to comprehend and explicate it. A mathematician told me this when I was at Ujjain in 1966 and pointed to the pioneering contribution of Brahmagupta. He lived about 1300 years ago. *Brahma-spuṭa-siddhānta* is his opus. Taking into account positive numbers[1] such as 1, 2, and 3 and negative numbers[2] such as -1, -2, and -3, he says: *"dhanayor dhanam – The sum of two positive numbers*

[1] His Holiness said, '*dhanātmak aṅk*'; while saying '*dhanātmak*,' He traced the plus sign, '+', with His right index finger.

[2] His Holiness's words were '*ṛṇātmak aṅk*'; He made the minus sign, '–', sign with His finger while saying '*rṇātmak.*'

is a positive number;" "ṛṇam ṛṇayoḥ – The sum of two negative numbers is a negative number;" "dhanarṇayor antaram – The sum of a positive number and a negative number is the difference between them." Immediately after this, he points out: *"samaikyaṁ kham – When the positive and negative numbers added are equal, their sum is zero*." Thus, zero is presented as a number. There is no ambiguity here as he proceeds to take up addition involving zero. He states that the sum of a negative number and zero is negative, while that of a positive number and zero is positive; *"śūnyayoḥ śūnyam – The sum of zero and zero is zero*." Considering subtraction, he says: *"śūnya-vihīnam ṛṇam ṛṇam dhanaṁ dhanaṁ bhavati śūnyam ākāśam – A negative number minus zero is a negative number; a positive number minus zero is a positive number; zero minus zero is zero.*" With respect to multiplication, he first says that the product of a positive and a negative number is negative; that of two negative numbers is positive; and that of two positive numbers is positive. Then, about multiplication by zero, he specifies: *"śūnyarṇayoḥ kha-dhanayoḥ kha-śūnyayor vā vadhaḥ śūnyam – A positive number or a negative number or zero multiplied by zero is zero*."

{The following are citations from six good books on the history of mathematics and zero, and from an article.

1. *Brahmasphuṭasiddhānta* was a landmark achievement, as it is the oldest-known mathematical work in which zero and negative numbers appeared in mathematical

calculations. [M. J. Bradley *The Birth of Mathematics – Ancient Times to 1300*, Chelsea House Publishers, 2006, pp. 82-83.]

2. The systematized arithmetic of negative numbers and zero is, in fact, first found in his work…Moreover, although the Greeks had a concept of nothingness, they never interpreted it as a number, as did the Indians. [Uta C. Merzbach and Carl B. Boyer, *A History of Mathematics* (third edition), 2011, John Wiley and Sons, p.198.]

3. In 628, in *Brahmasphuṭasiddhānta,* Brahmagupta defined zero as the result of the subtraction of a number by itself (a – a = 0), and described its properties… Brahmagupta gives the following rules…Modern algebra was born…It is clear how much we owe to this brilliant civilization… [Georges Ifrah, *The Universal History of Numbers – From Prehistory to the Invention of the Computer* (Translated from the French by D. Bellos et al.), John Wiley and Sons, 2000, p. 439.]

4. Brahmagupta...gave rules…Just as 2 - 3 was now a number, so was 2 - 2. It was zero…It had a specific value, a fixed place on the number line…it had to be placed between one (2 - 1) and negative one (2 - 3)… Zero had finally arrived. [Charles Seife, *Zero – The Biography of a Dangerous Idea*, Penguin Books, 2000, chapter 3.]

5. For zero to be a power of equal status with what it empowered, we must understand how to add, subtract, multiply and divide with it, for a start; and this was just what the Indian mathematicians did. By doing so, they

helped bring about a momentous shift… [Robert Kaplan, *The Nothing That Is – A Natural History of Zero*, Oxford University Press, 2000, pp. 70-71.]

6. …the Hindus…made a conceptual leap that ranks as one of the most important mathematical events of all time…The Hindu recognition of 0 as a number was a key for unlocking the door of algebra. Zero, as a symbol and as a concept, found its way to the West largely through the writings of the 9th-century Arab scholar Muhammad Ibn Mūsa Al-Khwārizmī…the Hindu idea …took a long time to get established in Europe. [W. P. Berlinghoff and F. Q. Gouvêa, *Math Through the Ages – A Gentle History for Teachers and Others* (expanded edition), Oxton House Publishers and The Mathematical Association of America, 2004, pp 80-81.]

7. …the Indian zero was a multi-faceted object: a symbol, a number, a magnitude, a direction, and a place-holder, all in one operating within a fully established positional numeration system…the Indian zero…is now the universal zero…[G. G. Joseph, *A Brief History of Zero*, *Iranian Journal for the History of Science,* vol. 6, pp. 37-48, 2008.]}

His Holiness (continuing): With respect to division, he first points out: *"dhana-bhaktaṁ dhanam ṛṇa-hṛtam ṛṇaṁ dhanaṁ bhavati – A positive number divided by a positive number as also a negative number divided by a negative number results in a positive number*." After this, Brahmagupta makes a mistake for the first time when he says: *"khaṁ kha-bhaktaṁ kham – zero divided by zero is zero."*[1]

{In arithmetic, the division of any non-zero number by zero and the division of zero by zero are undefined. The presumption that the division of zero by zero is valid and the claim here that the result of such a division is zero are, thus, incorrect. It would have been an error even if the result of dividing zero by zero were to have been given here not as zero but as some other number or even as infinity.}

His Holiness (continuing): I deliberately pointed out a flaw even while presenting an instance of an estimable Indian accomplishment of the past. My view is that it is best to stick to facts, not evade inconvenient data, and be wary of fanciful claims and interpretations.

Professor: I shall study Brahmagupta's *Brahma-sphuṭa-siddhānta.* Would Your Holiness please recommend a couple of other books that I may study in order to learn about India's contribution to mathematics in the past?

His Holiness: India had a distinguished mathematical tradition that continued for centuries from the time of Āryabhaṭa. You could study, with the help of a scholar, his pioneering work, *Āryabhaṭīya*; he was, as per a verse in it, 23 when 3600 years of the *kaliyuga* had passed

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[1] In the course of His exposition of Brahmagupta's verses about positive and negative numbers and zero, His Holiness cited, fully or partially, *Brahma-spuṭa-siddhānta* 18.30, 32, 33, 34.

(that is, in 499 A.D.). You will find noteworthy material in it, including that about the number system and zero. To know how mathematics had progressed with the passing of about 650 years, you could study Bhāskara's *Līlāvatī*, which is composed in an engaging style. There flourished in Kerala, a weighty mathematical tradition headed by Mādhava, who was born in the 14th century. I felt that I should not omit to mention this to you.

{The following are brief excerpts from six good books:

1. …the Indian mathematical sciences flourished as one of the richest and most fascinating scientific traditions ever known. [K. Plofker, *Mathematics in India*, Princeton University Press, 2009, p. viii.]

2. …the Indians developed a system of mathematics superior, in everything except geometry, to that of the Greeks. [D. Burton, *The History of Mathematics* (sixth edition), McGraw-Hill, 2006, p. 227.]

3. … showed remarkable ability in indeterminate analysis and were perhaps the first to devise general methods in this branch of mathematics. [H. Eves, *An Introduction to the History of Mathematics* (third edition), Holt, Reinhart and Winston, 1969, p.187.]

4. From Āryabhaṭa…to Bhāskara in the 12th century and onward, one finds more and more sophisticated methods for approximate calculations. Many of these methods anticipate ideas that were later discovered by European mathematicians. [W. P. Berlinghoff and F. Q. Gouvêa, *Math through the Ages – A Gentle History for Teachers*

and Others (expanded edition), Oxton House Publishers and The Mathematical Association of America, 2004, p.186.]

5. …around the beginning of the fifteenth century Madhava of Kerala derived infinite series for pi and for certain trigonometric functions…about 250 years before European mathematicians…[G. G. Joseph, *Crest of the Peacock: Non-European Roots of Mathematics*, Princeton University Press, 2011, p. 21.]

6. Newton…independently discovered the series for $\tan^{-1}x$, sin x and cos x in his *Analysis* without knowing that all the three series had already been discovered by Indian mathematicians. [J. Stillwell, *Mathematics and Its History*, Springer, 2009, p. 108.]}

His Holiness (continuing): We had a great past in other fields too. For instance, over 2000 years ago, Suśruta performed surgery on the eye to remove cataracts[1]. The *Suśruta-saṁhitā* details the surgical treatment of cataract, including information about the cataract to be surgically treated, the preparation of the eye, the position of the patient, the instrument to be used, how it should be held, and where and how the eye should be pierced with it. For instance, it says that the patient is *"yantritasya upaviṣṭasya – secured and seated"*; the eye is pierced "*śalākayā …yava-vaktrayā – by means of a thin rod with a tip like a barley kernel*." After wetting the

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[1] His Holiness used the word '*netra-paṭala'* to refer to cataract.

eye with milk and applying leaves externally: *"śālāgreṇa tato nirlikhed dṛṣṭimaṇḍalam – The circular area of the eye (the pupillary region, where the cataract is located) should then be scraped with the tip of the rod*." In order to cleanse the eye, the patient is made to snort, with the nostril on the opposite side closed. The scraping is assessed to have been accomplished well when the scraped region is clear "*nirabhra iva gharmāṁśuḥ – like the sun in the cloudless sky*." Then: "*tato dṛṣṭeṣu rūpeṣu śalākām āharec chanaiḥ – When forms can be seen, the rod should be slowly removed*." After applying ghee, the eye is bandaged. Thirty-three years ago (in 1942), a learned *vaidya* came to Sringeri for the *darśana* of my *Guru*; he was about 80 years old and belonged to a line of *vaidyas*; having wound up his long practice at his native place, he had moved to Bombay to live with his eldest son; none of his sons had chosen to be a *vaidya*. When conversing with me, he referred to the *Suśruta-saṁhitā* and, to illustrate its worthiness, spelt out all these steps to me. He also explicated a procedure for the reconstruction of a cut nose. It was only after this that I read for the first time the pertinent two portions of the *Suśruta-saṁhitā*, together with a commentary thereon. This *vaidya* was the one who enthused me to do so; he asserted that the surgical treatment of cataract and the surgical reconstruction of cut noses are two of our ancients' ground-breaking achievements in the field of surgery. According to the *Suśruta-saṁhitā*, the cut nose is reconstructed by using skin from the cheek. The *vaidya* said that nowhere else in the world was such reconstruction done till much later and that the *Suśruta-saṁhitā's* influence was great. To arrive at the dimension of the tissue needed from the cheek for fashioning the nose, the surgeon starts with a leaf: "*nāsāpramāṇaṁ pr̥thivī-ruhāṇāṁ patraṁ gr̥hītvā – He takes a tree's leaf that correctly covers the cut portion of the nose*." Next: "*tv avalambi tasya tena hi pramāṇena gaṇḍapārśvād utkr̥tya baddhaṁ – He cuts out from the patient's cheek a patch of skin and flesh of the size of that leaf; the cut is made in the upward direction; also, a bit of the patch is left attached to the cheek*." The *vaidya* told me that the purpose of keeping a bit attached to the cheek is to maintain some supply of blood to the patch till it fully becomes an integral part of the nose. Next: "*nāsikāgraṁ vilikhya – He scrapes the front part of the nose with a knife*." The *vaidya* said that the upper front part of the stump is scraped and that the scarifying is done to prepare the cut end of the nose to bond with the patch. Then: *"cāśu pratisandadhīta sādhubandhair bhiṣag apramattaḥ – The doctor should, being heedful, quickly turn the patch of skin and flesh towards the nose and attach it to the nose by means of fine sutures"*; *"susaṁhitaṁ samyag atho yathāvan nāḍī-dvayena abhisamīkṣya baddhvā pronnamya cenām – Having made sure that that the parts are joined well, he should put two tubes in the nostrils and, thereby, raise* *the attached skin*." The *vaidya* said that till full healing occurs, the tubes, which are hollow stalks, prevent any sagging of the attached skin and facilitate breathing. The text goes on to prescribe that the nose should be medicated and bandaged. After the healing is complete, the piece of skin that was left connected to the cheek should be cut out.[1] The *vaidya* mentioned that with the procedure of the *Suśruta-saṁhitā* as its fount, there arose in India a variant in which a patch of skin is taken from the forehead for nasal reconstruction.

{The following are excerpts from eight medical journals and a book on the history of medicine.

1. …the birthplace of the ancient operation for cataract …the great ancient civilizations, Mesopotamia, Egypt and Persia can be…excluded. In ancient Babylon, the Code of Hammurabi (before 2000 B.C.) is...quoted as mentioning payments for the "needling of cataract"… This…is founded solely on an erroneous interpretation of the word *nagapti* or *nagaptu*, which most probably means a lacrimal fistula…in Semitic languages, the root *naqab* denotes "hole." In ancient Egypt, no indication can be found in the medical papyri of the knowledge of cataract or cataract operation…Old Persian…medicine as presented in Zend-Avesta…is…unprofitable. On

[1] Reconstruction of cut noses is presented in *Suśruta-saṁhitā, sūtra-sthāna* 16.27-31. Cataract surgery is presented in *Suśruta-saṁhitā, uttara-tantra*, 17.55-85. His Holiness directly cited eight verses and took into consideration several more.

the other hand, there are weighty proofs that ancient India was most probably the birth place of the method …Sushruta…was the first Ayurvedic surgeon to deal systematically…[Aryeh Fiegenbaum, *Early History of Cataract and Ancient Operation for Cataract, American Journal of Ophthalmology*, vol. 49, no. 2, pp. 305-326, 1960.]

2. …cataract surgery…Indian tradition and the Persian author Zarrin-Dast attributed the procedure to the Indians, while pseudo-Galen suggested an Egyptian origin…In Egypt, copper needles or probes were found…in the tomb of King Khasekhemwy…(ca. 2700 BCE). Likewise, near the Saqqara pyramids…the tomb of Skar, one of the chief physicians of the fifth dynasty (ca. 2200 BCE) was found…to include bronze surgical needles. Because rods or probes can be used for the application of kohl or ointment, removal of foreign bodies, scraping the eye, nonophthalmic uses…the significance of these rods is unknown…The Eber Papyrus, the Edwin-Smith papyrus and other medical papyri speak of medical recipes for ophthalmic conditions but none refers to cataract surgery …The earliest Indian text that describes cataract surgery is the *Suśruta-saṁhitā*…[C. T. Leffler et al., *The History of Cataract Surgery: From Couching to Phacoemulsification, Annals of Translational Medicine*, vol. 8, no.22, 1551, November 2020.]

3. …dated circa 3000 BC…the *Edwin Smith Surgical Papyrus*…contains the first descriptions of the surgical management of facial trauma, including the treatment

of…nasal fractures. Treatments at that time were simple: nasal manipulation followed by lint, swabs and plugs of linen…Splints were formed of thin wood…The Indian science and art of total nasal reconstruction constitutes the first chapter in the history of plastic surgery… Sushruta …described a method of transferring skin from the…cheek; these were the first operative procedures for reconstructing noses. [I. S. Whitaker et al., *The Birth of Plastic Surgery: The Story of Nasal Reconstruction From the Edwin Smith Papyrus to the Twenty-First Century*, *Plastic and Reconstructive Surgery*, vol. 120, no. 1, pp. 327-336, July 2007.]

4. Sushruta…described…surgical operations, including those for cataracts…and…rhinoplasty…It was from him that the surgical reconstruction of the nose descended into modern medicine [I. Eisenberg, *History of Medicine: A History of Rhinoplasty*, *South African Medical Journal*, vol. 62, pp. 286-292, 21 August 1982.]

5. …rhinoplasty…development…has occurred in three great spurts…1. The Indian period – about 600 B.C. 2. The Italian period 1400-1600 A.D. 3. The Modern Period …Sushruta…the originator of plastic surgery…described the use of flaps from the cheek to reconstruct a lost nose. Later, Indian surgeons started using flaps from the… forehead… [D. J. Brian, *The Indian Contribution to Rhinoplasty*, *Journal of Laryngology and Otology*, vol. 102, pp. 689-693, August 1988.]

6. There is little doubt that plastic surgery in Europe which flourished in medieval Italy is a direct descendant

of classical Indian surgery. [E. H. Ackernecht, *A Short History of Medicine*, John Hopkins University Press, 1982, p. 41.]

7. …plastic surgery diminished in Europe until the late 1700s due to the church's prohibition of plastic surgery. …It was rediscovered in Britain circuitously...in…1793. …Thomas Causo and James Tridaley, surgeons at the British residency in Poona, observed a forehead flap reconstruction on a patient named Cowasjee, a cart-driver for the British whose nose was amputated during the Mysore War of 1792…The 'Indian method' was studied extensively by John Carpue, an English surgeon…Carpue successfully performed the first English rhinoplasty operation…followed by a second successful operation as described in his publication…in 1816. Subsequently …the forehead flap gained popularity among British and European surgeons. [M. C. Champaneria et al., *Sushruta: Father of Plastic Surgery*, *Annals of Plastic Surgery*, vol. 73, no. 1, pp. 2-7, July 2014.]

8. Remarkably, centuries after their first use, the original Indian methods utilizing the cheek flap and median forehead flap remain the basis for most reconstructive rhinoplastic procedures. [L. S. Nichter et al., *The Impact of Indian Methods For Total Nasal Reconstruction*, *Clinics in Plastic Surgery*, vol. 10, no. 4, pp. 635-647, October 1983.]}

His Holiness (continuing): For highlighting the glory of India's past, I deliberately chose to present instances based on passages in texts that were composed in India long ago and are available in print for verification; none of these instances is speculative and none requires any propping up by text-torture or textual reinterpretation driven by modern knowledge.

Professor: I recognized this, noting that in each case Your Holiness unfailingly cited the pertinent passages and explained them, even word by word. Your Holiness has already spared much time for me. Nevertheless, as hearing Your Holiness has truly been impactful and absorbing, I would request Your Holiness to spare a little more time for me and touch upon a couple of non-textual examples, which too are undeniable.

His Holiness: There is the Iron Pillar of Delhi that you may have seen. It is over 1500 years old and has stood exposed to the elements. Yet, it has not corroded and the Sanskrit inscription on it is still distinct. It evidences the metallurgical knowledge and skill of ancient India. Consider the Kailasa Temple in Ellora. This Śiva temple, which is accommodated in a single block of rock, is more than a thousand years old. An extraordinary feature of its construction is that well over a lakh tons of rock was cut out from the hill there, proceeding downward from the top; moreover, this mammoth task was done manually. The Kailasa Temple, with its fine carvings, is a great, Indian sculptural accomplishment.[1]

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[1] H.H. said that while He had not been to these two till then (1975), He had heard and read about them and seen their photographs.

{Two of the excerpts given below are about the Delhi Iron Pillar; the first is from a book of 1914 and the second from a publication of 2020; both books are authored by professors. The next three excerpts are about the Kailasa Temple; two of these are from Encyclopaedias and one is from the UNESCO World Heritage Centre's website.

1. Roscoe and Schorlemmer in their…"Treatise on Chemistry" have remarked that "the dexterity exhibited by the Hindus in the manufacture of wrought iron may be estimated from the fact of the existence of…a wrought iron pillar…bearing an inscription…belonging to the fourth century. It is not an easy operation at the present day to forge such a mass with our largest rollers and steam hammers; how this could be effected by the crude hand-labour of the Hindus, we are at a loss to understand."…Fergusson, the great archaeologist, has written, "…It is equally startling to find that after an exposure to wind and rains…it is unrusted, and the capital and inscription are as clear and sharp now as when put up fifteen centuries ago."…engineer's opinion …– "…It is questionable whether the whole of the iron works of Europe and America could have produced a similar column of wrought iron so short a time ago as the exhibition of 1851." [P. Neyogi, *Iron in Ancient India*, Indian Association for the Cultivation of Science, 1914, pp. 19-20.]

2. …the excellent corrosion resistance is because of the formation of a protective passive film on the surface of the pillar…The high phosphorous content in the iron

of the pillar aids the formation of the protective passive film…We now know phosphoric irons must have been produced in India by the use of high P containing ore, and aided by the absence of limestone in the bloomery furnace charge. …relevance of the studies conducted on the Delhi Iron Pillar to modern technology is that phosphoric irons are the materials of choice in… applications where atmospheric exposure conditions are involved. Recent research at IIT Kanpur has shown the excellent corrosion resistance of phosphoric irons in concrete environments…as an old adage informs, "the best of the new is often the long forgotten past." [R. Balasubramaniam, *Marvels of Indian Iron Through the Ages*, Infinity Foundation India, 2020, Chap. 2.]

3. The Ellora complex was designated a UNESCO World Heritage Site in 1983...The most remarkable of the cave temples is Kailasa…Unlike the other temples at the site, which were delved horizontally into the rock face, the Kailasa complex was excavated downward from the basaltic slope…Construction of the temple in the 8th century, beginning in the reign of Krishna I (c. 765-773), involved the removal of 150,000 to 200,000 tons of solid rock. The complex…has four levels or stories. [Editors, *Ellora Caves*, Encyclopaedia Britannica.]

4. Kailasa Temple…is one of the most spectacular monuments in the world and it is the largest rock-cut structure anywhere…The temple was built by digging out from the sloping basalt hill, two trenches, each 90 m long and joined with a connecting trench 53 m in

length. The temple was then carved from the remaining central portion. This resulted in a 32-metre high structure that seems to come out of the ground…This temple, even if they are not structurally required, has all the architectural details of a…block-built temple with bases, beams, columns, brackets and pilasters. [M. Cartwright, *Ellora Caves*, World History Encyclopedia, 08 March 2016.]

5. Criterion (i): The ensemble of Ellora is a unique artistic achievement, a masterpiece of human creative genius. If one considers only the work of excavating the rock, a monument such as the Kailasa Temple is a technological exploit without parallel. However, this temple, which transposes models from "constructed" architecture, offers an extraordinary repertory of sculpted and painted forms … [*Ellora Caves* – UNESCO World Heritage Centre.]}

His Holiness (continuing): What I have spoken about are some of the Indian achievements of the past in the fields of mathematics, medicine, and engineering. There are, decidedly, more of them in these and other fields; you may acquaint yourself with them. You would have noticed that whenever I referred to the Indian origin of something, I also stated the source of my information. Questions such as, "Was this discovered or developed just in India or elsewhere too? What were the inputs, Indian or foreign, that led to this?" call for answers that are based on credible evidence and objective analysis, not on suspect data, biased interpretations or dogmatic assertions; the answers may, of course, change with the uncovering of new evidence. Personally, I would value any such answer. There is much in India's past that we can be proud of while objectively depending on plain facts and reliable evidence, regardless of whether there were inputs from elsewhere or not and whether or not there were similar developments or findings elsewhere.

{The Professor then received *prasāda* from His Holiness and left, expressing his gratitude and joy. After he left, His Holiness told me, "He is sincere. He is, however, mistaken when he takes it that the *Bhagavad-gītā* and the *Purāṇas* specify that the universe keeps on expanding and contracting. What they do reveal is not incompatible with a universe that has infinite cycles, with a universe that can be traced back to a point, as also with one that expands faster and faster." He did not elaborate on this as His attendant entered and said that a group of devotees was awaiting His *darśana*.}

§2.4 In August 1982, when His Holiness was camping at New Delhi, the *Maṭha's* priest, Ganapathy Subrahmanya Avadhani, introduced a person in his 30s to me, saying, in Tamil, "He has come from abroad and is leaving today. His conversation with His Holiness will interest you." He told that person, in Telugu, "Tell him." When he began to speak in Telugu, Avadhani stopped him and asked him to present the details in English as I did not know Telugu. The following is what he told me. Finally, he said that it was getting late for him and left. When I asked Avadhani about him, he said that all he knew was that his name was Dakshinamurthi and that he was a first-time visitor.

One of his three questions was, "Some of what the Vedas say about the earth, the human body, etc., is known, in the light of science and medicine, to be incorrect. Does this not call into question the validity of the *śruti*?"

His Holiness: What is unknowable by other means of valid knowledge such as perception and inference – this includes the areas of science – is the domain of the *śruti*. Bhagavatpāda has stated in His *Bhagavadgītā-bhāṣya: "pratyakṣādipramāṇānupalabdhe hi viṣaye agnihotrādi-sādhyasādhanasambandhe śruteḥ prāmāṇyam, na pratyakṣādiviṣaye…na hi śrutiśatam api śīto 'gnir aprakāśo veti bruvat prāmāṇyam upaiti / yadi brūyāc chīto 'gnir aprakāśo veti tathāpy arthāntaraṁ śruter vivakṣitaṁ kalpyam – It is in matters that are unknowable by means of knowledge such as perception, an instance being that the Agnihotra rite results in the attainment of heaven, that the Veda has authoritativeness, not in what lies in the domain of perception, etc., … Surely, even if hundred Vedic passages were to declare that fire is cold or dark, they would not become valid in this matter. Were there to be a statement in the Veda that fire is cold or dark, something different from the literal meaning must be arrived at as its intended import."*[1] The *Bṛhadāraṇyaka-Upaniṣad* presents *Brahman* as associated with the five elements in the cosmic and individual contexts and with mental tendencies, and then declares unambiguously:

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[1] *Bhāṣya* on *Bhagavad-gītā* 18.66. The visitor recalled only parts of the quotation but spelt out His Holiness's translation of it.

"*athāta ādeśo neti neti na nahy etasmād iti nety anyat param asti – Now, therefore (following the description of what is not the final truth), is the teaching (about Brahman): 'Not this. Not this.' There is no other more fitting description (of Brahman) that this: 'Not this.'*"[1] Thus, the mention of even the five elements is just a stepping stone to teach the transcendental Brahman, which is completely free of all attributes, and these are included in what are then dismissed. *Arthavādas* (corroborative Vedic passages) are taken up in depth in the *Mīmāṁsā-śāstra* that lays down the cannons of interpretation of the Vedas. Sureśvarācārya has stated in the *Bṛhadāraṇyaka-bhāṣya-vārtika: "virodhe guṇa-vādaḥ syād anuvādo 'vadhārite / bhūtārthavādas tad-dhānād arthavādas tridhā smṛtaḥ – Corroborative Vedic statements (arthavādas) are said to be of three kinds; what contradicts a different means of valid knowledge (such as perception) is a figurative statement (guṇa-vāda); what accords with what is known by another means of valid knowledge is a reiterative statement (anuvāda); what neither contradicts nor states what is determined by another means of valid knowledge is a 'bhūtārthavāda'*."[2] Thus, the case of Vedic passages that are discordant with what is ascertained by other means of knowledge is recognized and accounted for.

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[1] *Bṛhadāraṇyaka-upaniṣad* 2.3.6.

[2] *Bṛhadārānyaka-bhāṣya-vārtika* 1.1.537.

3. Evolution

§3.1 In April 1987, His Holiness asked me, in Sringeri, "What book did you read recently and like?" This was the first time He had asked me such a question and there was nothing that had happened earlier that constituted the backdrop for it. I was about to mention a scriptural text when He added, "Anything about how life, animals, and humans came about." I had read just days earlier, Richard Dawkins' *The Blind Watchmaker*[1] and enjoyed it; it dealt with exactly what His Holiness had specified. I mentioned this book to Him. "Summarize it for me," He directed, and I did so over the course of the next ten minutes; I also used a sheet of paper that He gave me to facilitate my doing so.

William Paley wrote in *Natural Theology or Evidences and Attributes of the Deity* (of 1802) that just as the function and complexity of a watch presupposes a watch-maker, the far greater complexity of lifeforms on earth presupposes the existence of their maker (God); he took up, in some detail, the structure and function of the parts of the body beginning with the eye; after pointing out how wonderful the eye's design is, he inferred that it being made for vision like a telescope for assisting it, it must have had, as does a telescope, a designer (God).[2] Dawkins refutes Paley's 'argument from design' for the existence of God. Some quotes from his book: "All appearances to the contrary, the only watchmaker in nature is the blind

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[1] Richard Dawkins, *The Blind Watchmaker,* Norton & co., 1986.

[2] William Paley, *Natural Theology or Evidences and Attributes of the Deity*, R. Faulder, London, 1802.

forces of physics, albeit deployed in a very special way … Natural selection, the blind, unconscious, automatic process which Darwin discovered, and which we now know is the explanation for the existence and apparently purposeful form of all life, has no purpose in mind…"; "living things are too improbable and too beautifully 'designed' to have come into existence by chance. How, then, did they come into existence? The answer, Darwin's answer, is by gradual, step-by-step transformations from simple beginnings…Each successive change in the… evolutionary process was simple enough *relative to its predecessor*, to have arisen by chance. But the whole sequence of steps is anything but a chance process …The cumulative process is directed by nonrandom survival"; "the form of each individual animal is produced by embryonic development. Evolution occurs because, in successive generations, there are slight differences in embryonic development. These differences come about because of changes (…the small random element…) in the genes controlling development"; "Organisms can never be totally unrelated to one another, since it is all but certain that life as we know it originated only once on earth"; "The last common ancestor of humans and chimps lived perhaps as recently as five million years ago, definitely more recently than the common ancestor of chimps and orangutans;" "Chimpanzees and we share more than 99 percent of our genes."

His Holiness attentively heard my summary in silence. When I finished, He acknowledged that Dawkins is an atheist and then appreciatively told me, "He writes well.

I think he will write more such books. Read them." He asked me, "Have you read in full the works of Darwin?" When I answered that I had, He remarked, "I read an account of his life and work years ago in Kannada. He gathered much data by careful observation during his travels. DNA and genes were not known in his time. Had he known that DNA is present in and plays a key role in the cells of not only humans and gorillas but even bees and flowers,[1] perhaps he would have adduced this fact in support of his conclusion that lifeforms are related and have a common origin." I was a bit surprised to hear His Holiness say this. Clearly amused, He said, "You would know this but, anyway, let me tell you. As a child forms in the womb, it develops three kidney systems; the first ('pronephros') is rudimentary and degenerates without even functioning; the second one ('mesonephros') forms as the first one fades and does not last long; the third one (metanephros) is what is our kidney; I asked and learnt this some years ago from a doctor who explained, using a book with many images, child-formation in the womb; in fishes, however, the first one functions for a time and the second one is the final kidney." Laughing, he added, "Maybe someone will claim that the formation of three kinds of kidneys in humans is a case of bad design if done by God or suggestive of humans having, in the course of evolution, passed through fish-like forms long ago." He then said, "Dawkins has written of the irrelevance of God; I shall now say something based on the *Vedānta-śāstra*."

[1] The evolution-related image on the cover page of a flower, bee, gorilla, and the double helix of DNA is based on these words of H.H.

$\boxed{\text{§3.2}}$ **His Holiness:** The scripture makes it clear time and again that the universe and the laws governing it are the manifestation of God. The *Chāndogya-upaniṣad*, for instance, teaches: *"sa evādhastāt sa upariṣṭāt sa paścāt sa purastāt sa dakṣiṇataḥ sa uttarataḥ sa evedaṁ sarvam — He alone is below; He is above; He is behind; He is in front; He is to the south; He is to the north; He alone is all this*."[1] The *Śvetāśvatara-upaniṣad* points out, *"tvaṁ strī tvaṁ pumān asi tvaṁ kumara uta vā kumārī / tvaṁ jīrṇo daṇḍena vañcasi — You are the woman; You are the man; You are the boy; You are the girl; You are the old man tottering with a stick*"[2] and, *"nīlaḥ pataṅgo harito lohitākṣas taḍidgarbha ṛtavaḥ samudrāḥ — You are the black bee; You are the green parrot; You are the cloud; You indeed are the seasons and the oceans*."[3] The *Muṇḍaka-upaniṣad* teaches, *"brahmaivedaṁ viśvam idaṁ variṣṭham — This cosmos is nothing but Brahman, the greatest*."[4] The Lord has said in the *Bhagavad-gītā*, *"ahaṁ…raviḥ…śaśī…manaḥ… cetanā…sāgaraḥ… himālayaḥ…kālaḥ…mṛgendraḥ…pavanaḥ…makaraḥ… jāhnavī…akāraḥ…kusumākaraḥ…dyūtaṁ…vyavasāyaḥ …maunaṁ…jñānaṁ — I am the sun…I am the moon… I am the mind…I am intelligence…I am the ocean…I am the Himalayas…I am time…I am the lion…I am the*

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[1] *Chāndogya-upaniṣad* 7.25.1.
[2] *Śvetāśvatara-upaniṣad* 4.3.
[3] *Śvetāśvatara-upaniṣad* 4.4.
[4] *Muṇḍaka-upaniṣad* 2.1.11.

wind…I am the shark…I am the Ganges…I am the letter 'a'…I am the spring season…I am gambling…I am effort…I am silence…I am knowledge."[1] He has also said, *"aham evājyaṁ aham agnir ahaṁ hutam — I Myself am ghee (the offering); I am fire; I am the act of offering into fire*" and, *"sad asac cāham — I am the effect; I am the cause*."[2]

His Holiness (continuing): A person who came to see me had an objection to Lord Kṛṣṇa's statement, "*ahaṁ vaiśvānaro bhūtvā prāniṇāṁ deham āśritaḥ / prāṇāpāna-samāyuktaḥ pacāmy annaṁ caturvidham — Taking the form of the gastric fire and residing in bodies of all beings, I digest, in association with prāṇa and apāna, the four types of food (the foods that are ingested by masticating, by swallowing, by sucking and by licking)*."[3] He said, "There is no fire in the stomach; there is only acid." I asked him, "How do you specify the energy of an item of food?" He said, "In calories." I told him, "One method of determining the calories in an item of food involves putting the item in a container surrounded by water, burning it, and noting how much hotter than before the water becomes." "I did not know this," he said. I continued, "The stomach serves to digest food, the body receives energy from the food digested, and this energy

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[1] *Bhagavad-gīta* 10.21,22,24,25,30,31,33,35,36,38. H.H. cited just the relevant words of the verses. The translation reflects this.

[2] *Bhagavad-gītā* 15.16; 15.19.

[3] *Bhagavad-gītā* 15.14.

can be associated with the burning of the item of food. Hence, is it wrong to speak, at least figuratively, of a fire in the stomach, the gastric fire?" "No," he conceded. I then told Him, "When you say that the acid in the stomach digests the food and the Lord says that, being in the stomach, He digests the food in the form of fire, is it not understandable from the Lord's words that He digests food by taking the form of gastric acid and the digestive processes? It is worth bearing in mind that our ancients were not such ignoramuses that they thought that some actual fire, like in the kitchen, burns in the stomach. They did know what the stomach contains." What is relevant now is that from the Lord's words, we can discern that it is He who is even the acid in the stomach and the process of digestion.

His Holiness (continuing): In the *Śrī-rudra*, we have, *"nama āyacchadbhyo visṛjadbhyaś ca vo namaḥ / namo 'syadbhyo vidhyadbhyaś ca vo namaḥ — Salutations to You who stretch the bowstring; Salutations to You who release the arrow; Salutations to You who are the cause of the arrow moving towards the target; Salutations to You who are the cause of the arrow piercing the target*."[1] A bowman's role ends with pulling the bow-string, taking aim, and then releasing the arrow. The movement of the arrow to its target is dependent on

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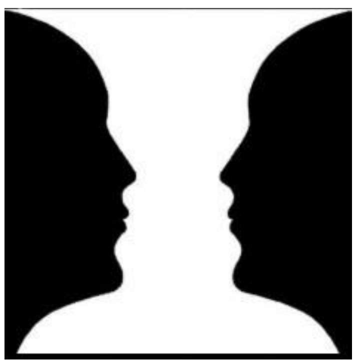
[1] *Taittirīya-saṁhitā* 4.5.3.2. His Holiness gave a brief explanation, in Sanskrit of each of the words. His elaboration was in line with Abhinava-śaṅkara's commentary on the *Śrī-rudra*.

its velocity[1], the laws of motion,[2] the wind, the pull of the earth,[3] etc.; all these are the Lord. To penetrate the target, the sharpness of the tip of the arrow, the density of the target and such other factors play a role; all these are the Lord. The crux of all that I have been saying is that as per the scripture, God is everything in the universe and is every law governing its functioning.

At this point, His Holiness took a sheet of paper and quickly sketched two pictures on it; this was the first time, I saw His Holiness drawing a picture.



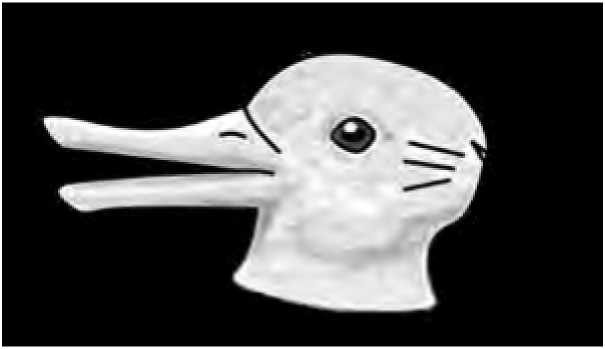
Representation of the first picture drawn by H.H.

He pointed to the first and asked me, "What do you see?" I said, "Two faces close to and facing one another, or a wine glass." "Can you see both together?" He asked. "No," I replied.

[1] His Holiness: '*vega*.'

[2] His Holiness: '*calana-niyama.*'

[3] His Holiness: '*bhūmyākarṣaṇa*.'



Representation of the second picture drawn by H.H.

He then asked me to look at the second picture and tell Him what I could see. I said, "Either a duck with its beak to my left or a rabbit facing right, with its long ears pointing backwards." "Do you see both together," He asked. I answered in the negative.

His Holiness (continuing): Each of these images is apprehended non-simultaneously in two different ways by a person. If two persons were to see either of the images at the same time, one may apprehend the image in one way and the other in the second way. Likewise, what is apprehended by a person as just the material world may be apprehended by him later, after spiritual discipline, as a manifestation of God; simultaneously too, what a materialist perceives as the material world, is seen by a saint as a manifestation of God. He who holds that God is a creator distinct from nature and its laws may have a problem if it be said that the bodies of the animals we see and humans came to their present state through changes over millions of years by the operation of the laws of nature; a true *Vedāntin* would be fine with it. If someone were to say that gradual evolution of animals and humans is wrong, he would be fine with that too. To a *Vedāntin*, a small irregularly shaped stone rolling in the river bed and becoming a round pebble, the formation of the sun and the earth, the development of a human child from a sperm and egg are all equally attributable to God.

His Holiness (continuing): The scripture does not stop with presenting God as just being in the form of the universe and its laws. It goes further and says that the operation of every law of nature depends on God. The *Śvetāśvatara-upaniṣad* teaches, *"yac ca svabhāvaṁ pacati viśvayoniḥ pācyāṁś ca sarvān pariṇāmayed yaḥ / sarvam etad viśvam aditiṣṭhaty ekaḥ — He, the basis of the cosmos, is the one who manifests the nature of things (such as the heat of fire) and transforms all that is mutable*."[1] Thus, He is the universe and its laws; He is the one who gives life to the laws; He is the one who transforms things according to the laws of nature. He is, importantly, not only immanent but also transcendent. The materialist may be unwilling to concede this and argue against it but a true *Vedāntin* is not put off by any of this, for, to him, the materialist is a manifestation of God and his temperament is also manifested by

[1] *Śvetāśvatara-upaniṣad* 5.5. His Holiness gave a brief explanation in Sanskrit; He did not cite the *mantra's* fourth *pāda.*

God. What is primary to the *Vedāntin* is the essential nature of the Supreme, pure consciousness. It is in this that the universe with its laws appears, like a mirage in a desert or as a snake so misapprehended in a rope. There is, thus, no real cause and effect relationship between the Supreme of the nature of consciousness and the world, unlike, say, that between a seed and a tree or between energy and the appearance of an electron. The *Kaṭha-upaniṣad* clearly states, *"na jāyate mriyate vā vipaścin nāyaṁ kutaścin na babhūva kaścit — The Ātman of the nature of consciousness is not born; It does not perish; It did not originate from anything; nothing originated from It*."[1] Hence, there is no way any measurement made on the universe or any understanding of its laws can call into question the scriptural teaching about the true nature of the Supreme Brahman. The Supreme Brahman is decidedly beyond the scope of science. The aim of the *Upaniṣads* is to make one realize one's true nature of being Brahman and become liberated. Therefore, all the descriptions of creation in them are only meant to establish that there is nothing whatsoever that is other than the Supreme; the confirmation or falsification of any such description is immaterial.[2]

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[1] *Kaṭha-upaniṣad* 1.2.18.

[2] Abridged versions of this and the previous chapter were given in the book *The Multifaceted Jīvanmukta*: *His Holiness Jagadguru Śrī Abhinava Vidyātirtha Mahāsvāmin* (free-download link given earlier).

4. Brain, Mind, and Consciousness

§4.1 In the last week of January 1984, I humbly requested His Holiness, "In case Your Holiness kindly permits me, I shall, when convenient to Your Holiness, present Your Holiness, in 30-45 minutes, an overview of information about the brain and its extensive effect on the mind and consciousness and then entreat Your Holiness to throw light on whether the scriptural teaching about the mind and consciousness can accommodate or is incompatible with the data." His Holiness said, "Information about the brain will surely interest me. I shall let you know when to tell me." He went to Sondekoppa (near Bengaluru) on 30th January. On 3rd February, He called me to His room in the afternoon, around 3 p.m. He told me, "Tell me about the brain now" and added, "You have brought pictures of the brain with you to Sondekoppa, have you not? Go and bring them." I promptly fetched three sheets of paper with photocopies of pictures of the brain from books. His Holiness took them from me, looked at the drawings, pointed at the right 'parietal lobe' in one of the pictures, and said, "Start by telling me one consequence of damage to this." I said that following damage to the right parietal lobe because of, say, a stroke, a person may neglect his left side and left visual space. He may shave just the right side of his face, not comb half of his hair, and eat from half his plate; asked to copy a picture, such as of a flower, he may sketch just its right half; told to bisect a line, he may put his mark towards its right half; questioned by an examiner on his left, he may respond without turning or looking to the left; if told to imagine a specific, well-known place and then describe what he perceives from a particular position there, he may refer to the structures that lie in the front and on the right but, unlike one without brain damage, omit those on the left.[1] Such persons are not conscious that they are neglecting anything. An explanation for unilateral neglect is that the parietal lobes are involved in directing spatial attention and that due to damage to the right parietal lobe, there occurs a disability in directing attention to the left space. His Holiness asked whether damage to the area on the left side of the brain results in similar neglect of the right side. I replied that in most cases it does not and that a reason that has been given is that while the left space essentially lies in the purview of just the right side of the brain in right-handers, the right space is processed even by the right side of the brain. His Holiness nodded.

He then looked at another picture of the brain, pointed to the 'hippocampus' that was marked therein, and asked, me, "What does this do? Highlight its role by means of an example. This is if you yourself intended to speak of this structure. Else, move on to something else about the brain as per your choice." I told His Holiness that it is involved in memory and, by way of illustrating this,

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[1] Macdonald Critchley, *The Parietal Lobes,* Edward Arnold and Co., London, 1953. Juhani Hyvärinen, *The Parietal Cortex of Monkey and Man*, Springer-Verlag, New York, 1982. E. Bisiach and C. Luzzatti, *Unilateral Neglect of Representational Space*, *Cortex,* vol. 14, issue 1, pp. 129-133, 1978 (Two patients were asked to describe the Pizza del Duomo in Milan, Italy, imagining that they were looking at the front of the Cathedral from the opposite side of the square and then from the reverse perspective).

mentioned the case of a person, referred to as 'H.M.' He had, I said, a long history of fits and, in 1953, underwent brain-surgery to control them. This structure's important role in memory was not recognized then and the surgeon removed parts of both his 'temporal lobes' (I indicated these using one of the sketches) as also much of this structure bilaterally. While he got some relief from fits and his perception, personality, intellect, and also early memories remained intact, he was, after the surgery, no more able to form new memories. He was, for instance, unable to remember the way to the toilet or recognize any of the hospital staff. Later, his family moved to a new house near and on the same street as the previous one; while he clearly remembered his previous house, he could not learn the address of his new one or find his way to it. He read the same magazines repeatedly, without remembering either their contents or that he had already read them. Half an hour after eating a meal, he could not name a single dish that he had eaten and did not even remember that he had eaten.[1] His Holiness asked whether his memory defect reduced over the years; I told Him that it did not. I paused, waiting for Holiness to point to some portion of the brain in one of the pictures. Noting this, He said, "It was only to set into motion your

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[1] W.M. Scoville and B. Milner, *Loss of Recent Memory after Bilateral Hippocampal Lesions, J. Neurol. Neurosurg. Psychiat.,* vol. 20, issue 11, pp. 11-21, 1957. It was only after H.M.'s death in 2008 that his actual name, Henry Molaison, was revealed. A book on his life: S. Corkin, *Permanent Present Tense: The Man with No Memory and What He Taught the World*, Penguin Books, 2014.

description of the brain that I indicated two parts of the brain. Now continue in any way convenient, whether by specifically referring to some part of the brain or without doing so."

Since His Holiness had pointed to the hippocampus in a picture, I drew His attention to the 'amygdala' seen in the same picture nearby and then stated that it plays a role in mediating emotional responses and fight-flight reactions; that when this is electrically stimulated in animals, aggression is evoked while lesions in it reduce aggression and reduce reactions of fear in threatening situations; and that improvements following its surgical ablation have been reported in persons with behavioural disorders who had uncontrolled rage or were assaultive or broke things or were self-destructive, and non-surgical means such as medicines did not remedy the problematic behaviour.[1] I passed on to the 'septal region' near it and, pointing to it in a picture, said that electrical stimulation of this has been found to produce varying degrees of sexual arousal and a feeling of pleasure.[2]

As His Holiness had said that I could refer or not refer to a specific part of the brain, and as I had specified the

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[1] For example: V. Balasubramaniam and B. Ramamurthi, *Stereotaxic Amygdalotomy in Behavioural Disorders, Confin. Neurol.*, vol. 32, issue 2, pp. 367-373, 1970. This is based on 100 cases operated on in Madras (Chennai) in the period 1964-1968.

[2] R. G. Heath, *Pleasure Response of Human Subjects to Direct Stimulation of the Brain,* In *The Role of Pleasure in Behaviour* (ed. R. G. Heath), Harper & Row, New York, 1964, pp. 219-243. (62 cases.)

amygdala and the septal region, I proceeded to speak of a few brain-related conditions without any recourse to the pictures. I said that Alzheimer's disease is a disorder in which memory and thinking abilities are progressively destroyed, and, eventually, the affected one has virtually no memory left, cannot speak, and cannot perform even the simplest of tasks; many clumps ('amyloid plaques') and tangled fibres ('neurofibrillary tangles') form in the brain. Lesch-Nyhan Syndrome is, I then said, a disorder that is congenital and affects the brain and behaviour; the affected child uncontrollably injures itself, such as by banging its head against a hard surface or biting its fingers and lips forcefully, even to the extent of biting off a portion of them. After this, I mentioned the Tourette Syndrome and said that one of the symptoms is that the affected person compulsively voices a profanity even when and where this is wholly unwarranted and socially inappropriate; the person is aware of what he is doing but feels an increasing urge to utter a swearword like the build up to a sneeze, and feels relieved only on doing so. I then stated that the brain is sensitive to the levels of sodium and glucose in the blood and if the levels of any of these falls below the normal range, adverse mental effects are seen. By way of an example, I said that an aged kidney-impaired person's level of sodium may drop to somewhat below normal ('hyponatremia') due to his drinking too much water in a short interval and he may become confused and blabber[1]; a greater drop in its level

[1] Normal range: 135-145 mEq/L. Even if the level of sodium drops a little to 130 mEq/L, one may become confused and blabber.

can result in seizures and coma.[1] When I stated an effect on the mind and behaviour of glucose in the blood being below the normal range ('hypoglycemia'), His Holiness said, "A diabetic told me three years ago that a fortnight earlier, he had accidentally injected himself twice with insulin and his level of sugar fell. On a couple of times before this when his sugar-level had come down, he had experienced shaking and sweating, and he had restored normalcy by taking something sweet. That day, however, he felt odd and did not remember what happened after that. It was only later that he learnt to his embarrassment from his son that he had blankly taken off his clothes in the hall in the presence of relatives." As His Holiness had mentioned insulin and drop in sugar-level, I indicated, with that as basis, an effect of low glucose by saying that about four decades ago, a form of treatment of mentally deranged patients (schizophrenics) consisted of putting them into coma by giving them injections of insulin and causing their levels of glucose to drop significantly and reviving them after some time by administering glucose.[2] Drug therapy for such persons became available since 1952, with the development of 'chlorpromazine'; a drug for depression, 'imipramine', was also introduced in the 1950s. Chemical messengers ('neurotransmitters') from a brain cell ('neuron') pass through a gap ('synapse') and

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[1] 125 mEq/L or less can result in seizures, coma, and death.

[2] Insulin coma therapy was developed by Manfred Sakel in the 1930s; coma was induced in schizophrenics five to six times a week. This was discredited in the late 1950s (K. Jones, *Insulin Coma Therapy in Schizophrenia*, *J R Soc. Med.,* vol. 93, issue 3, pp. 147-149, Mar. 2000).

link to and act on another cell; these are also retaken from the gap by the cell that released them; imipramine, the drug that treats depression, blocks the reuptake of the chemical messengers 'serotonin' and 'norepinephrine' and, thus, more of these messengers become available to link with the next cell; chlorpromazine, on the other hand, blocks the chemical messenger 'dopamine' from the next cell; this drug, a treatment for insanity, is not effective in depression, and imipramine, a medicine for depression, is ineffective in treating insanity. I wanted to mention the reason for my having conveyed this when His Holiness Himself remarked, "You said this to convey that mental disorders such as insanity and depression are linked to the brain and that drugs that act differently on the brain can treat such different, abnormal mental conditions." Anticipating how I thought of continuing, He said, with a smile, "You want to now tell me a few disease-and-medicine related cases of striking mental changes in persons, is it not? Go ahead."

I said that in the second decade of the (20th) century, a disease ('encephalitis lethargica') that attacks the brain made its appearance in Europe, spread all over the world, and, in around 10 years, resulted in the death of lakhs of people. A survivor referred to in a book[1] as 'Leonard L.' could not speak or move, except for being able to make tiny movements with his right hand. His sharp intellect was unaffected and he spelt out on a small letter-board what he wanted to communicate. After he had been in

[1] Oliver Sacks, *Awakenings*, Paperback edition, Penguin Books, 1976.

this state for 15-20 years, in 1969, a doctor (Oliver Sacks) began to administer a drug, levodopa, to him. This drug passes, via blood, into the brain and yields the chemical messenger, dopamine. His Holiness said, “Oh, the drug that you mentioned as a treatment for insanity blocks this chemical messenger; on the other hand, this drug makes more of it available. I have heard of this drug; a person told me that he was prescribed this to treat his tremors and slowed movement and that he found it beneficial.” I continued that after this patient had taken five grams of levodopa a day for two weeks, an abrupt change in his state occurred; the rigidity of his limbs fully vanished; he was able to get up, walk with a little help, speak, write, and type. Over the next couple of weeks, he was full of happiness and enjoyed good health; he stated that he felt as if he had been born again and that levodopa was a wonderful drug. After this, the situation started to change for the worse with each passing day; he began to feel that he was a messiah; he talked with increasing speed and repeated phrases; he read faster and faster to the extent that he had to shut his book after each sentence or paragraph to understand what he had read; he felt an urge to clap, and when he started to clap, he could not stop; he became hypersexual and sought to have sex with all the nurses. In this period, his daily dosage of levodopa was greatly reduced and, finally, the drug was stopped. Abruptly, one day, he reverted to the state that he had been in for years before he received levodopa. Another such patient in that hospital who has been referred to as ‘Rachel I.’ was completely immobilised; however, she was able to speak. With her consent, she was given levodopa in 1970. Her reaction to the drug was catastrophic. In less than two weeks, she became extremely excited and started to hallucinate; she saw figures and faces on all the sides in her room; she repeated, in a screaming voice, hundreds of times what was said to her. Levodopa was stopped, and she was administered drugs to calm her, but to no avail. Her intellectual status began to decline. One day, her state of excitement abruptly ceased, and she became comatose. She emerged from coma after a month. However, she could no more recognize anybody or anything; she could only make some noises; she seemed to have become a complete mental blank, with no identifiable signs of a mind. She remained in this mindless condition until she died of pneumonia seven weeks later.[1]

Moving on to visual perception, I pointed to the 'occipital lobe' in the back of the brain and said that this processes visual inputs, with the one on the left handling the right half of the visual fields of both eyes and the one on the right, the left half of the visual fields of both eyes. Hence, if the primary visual area in the left lobe is damaged, a person cannot see in the right half of his visual fields; partial loss of this area results in the loss of vision in a portion of the right visual fields, depending on the locus of the damage. I then stated that in an experiment, four persons with areas of blindness due to such damage were asked to gaze at a light and told that when they heard a

[1] Oliver Sacks, *Awakenings*, Paperback edition, Penguin Books, 1976.

sound they should shift their gaze towards where a light was shown in their blind area. They found the task odd and asked how they could turn their eyes towards what they could not see. Nonetheless, it was found that they moved their eyes towards the stimulus more accurately than would have been the case were they doing so just randomly.[1] In a different study, a person ('D.B.') who was blind in the left half of both his visual fields was asked to guess whether the lines that were presented in his blind area were horizontal or vertical and whether what was shown was 'X' or 'O'. He said that he could see nothing. Nevertheless, he was able to choose between the options much better than just by chance.[2] Such seeing without conscious awareness has been termed 'blind-sight.' It is absent if the blindness is due to damage to the eyes, rather than to the primary visual area in the back of the brain. Damage to the brain can result in loss or impairment of colour-perception. For instance, a man referred to as 'C.M.'[3] abruptly lost colour vision in his 40s in the left half of the visual fields of both the eyes; a CT scan showed damage to his right occipital lobe; his colour vision in the right half of his visual fields was intact; he

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[1] E. Pöppel et al., *Residual Vision After Brain Wounds Involving the Central Visual Pathways in Man, Nature,* vol. 243., issue 5405, pp. 295-296, 1 June 1973.

[2] L. Weiskrantz et al., *Visual Capacity in the Hemianopic Field Following a Restricted Occipital Ablation, Brain,* vol. 97, issue 4, pp.709-728, 1974.

[3] A. Damasio et al., *Central Achromatopsia: Behavioural, Anatomic, and Physiologic Aspects, Neurology*, vol. 30, issue 10, October 1980.

could see objects without any distortion of form even in the left half of his visual fields; his distant vision was normal in both his eyes (acuity '20/20'); he could read small letters with either eye and identify small objects, moving and stationary; when he was told to fixate on a spot in front and then coloured objects were presented, one by one, proceeding from the periphery of the left half of his visual fields to the midline, he was unable to identify their colours but on their passing the midline to the right, he readily did so; when a red flashlight was held such that half its beam fell to the left of his visual midline and half to the right, he reported that its right half was red but that its left half looked grey. As in the case of the perception of colours, brain damage can result in a loss or impairment of visual perception of motion. I told Him that an article of the previous year (1983) detailed the case of a woman referred to as 'L.M.' who became motion-blind following damage to her brain due to a blood clot;[1] she had difficulty in pouring coffee or tea into a cup as the falling liquid appeared still and she did not see its level rising in the cup; when people moved in a room, she found them at one place and, suddenly, elsewhere but not in motion; in a test, a black wooden cube was moved from 30 cm in front of her to 130 cm from her at different velocities, but on no occasion did she did perceive it moving even though she could see it; while she was impaired in seeing movement, she could

[1] J. Zihl et al., *Selective Disturbance of Movement Vision after Bilateral Brain Damage, Brain*, vol. 106, issue 2, pp. 313-340, 1983.

detect it in tests involving touch and hearing; in a test, when she was blindfolded and a stick touching her was moved slowly or fast from her wrist to her elbow or vice versa, she was able to sense the motion and its direction; likewise, when she was blindfolded and a source of sound moved, she was readily able to identify this. There can arise, following brain-damage, an inability to visually recognize faces. I said that a few-months-old article (of 1983) presented in detail the case of a man referred to therein as 'Mr. W.'; during hospitalization for a cardiac ailment, he started to experience difficulties in visually identifying familiar faces such as those of the nurses; subsequently, a CT scan showed damage on both sides of the back of his brain; he had no problem in visually identifying, for instance, his dogs and cats, familiar cars, houses, and streets but he could not visually identify any face even though he could perceive its constituents; he identified familiar persons not from their faces but from, mainly, their voices and also from their clothes and gait; when he looked into a mirror, the reflected face seemed to be that of someone else and 'funny' but he did realize that it must be his face only.[1] In a different article[2], it was reported that a man with this problem could recognize pictures of animals and inanimate things but could not

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[1] R. Bruyer et al., *A Case of Prosopagnosia with Some Preserved Covert Remembrance of Familiar Faces, Brain and Cognition,* vol. 2, issue 3, pp. 257-284, 1983.

[2] R. Cohn et al., *Prosopagnosia: A Clinicopathalogical Study, Annals of Neurology,* vol. 1, issue 2, pp. 177-182, February 1977.

clearly recognize his own picture; asked to pick out his wife from among five persons in front of him, he failed but the moment he heard her voice, he was able to do so.

Moving on to sensations from and control of bodily parts such as the fingers, I drew His Holiness's attention to two pictures; one depicted the 'primary somatosensory area' (in the front portion of the parietal lobe); the second portrayed the 'primary motor area' (in the rear end of the frontal lobe); the parts of the body as represented in these areas were also sketched in these pictures. I told Him that both these drawings had been published in a book by a neurosurgeon (Wilder Penfield) who had electrically stimulated the brains of patients while they were fully conscious during brain surgery for treating epilepsy.[1] His Holiness had a close look at the drawings and remarked, "The body is not represented uniformly; the fingers as also the lips have, for instance, greater areas meant for them than the toes." I mentioned that the somatosensory and motor areas on the left side of the brain deal with the right side of the body and vice versa. He asked, "What were some of the effects produced when the surgeon who published the two drawings applied electricity to these areas?" I answered that depending on where the primary sensory area was electrically stimulated, patients reported experiencing tingling or numbness in different portions of the body such as a thumb, a wrist, or one side of a lip.

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[1] W. Penfield and T. Rasmussen, *The Cerebral Cortex of Man: A Clinical Study of Localization of Function,* The Macmillan Company, New York, 1950 (Fig. 17, p.44 and Fig. 22, p. 48).

An effect observed when the motor area of a patient was stimulated while he was, as told, squeezing a doctor's hand was that his hand relaxed instantaneously and he could not press until the stimulation ended; movements produced by such stimulation could not be volitionally prevented by the patients. When a patient's motor area was stimulated, he began to make a long-drawn vowel sound that continued till the end of the stimulation; in spite of his best efforts, he was unable to stop or alter it. I then told His Holiness that an American neuroscientist (Benjamin Libet) had, in one of his studies,[1] electrically stimulated the sensory area of patients (undergoing brain surgery) with a train of pulses that elicited a conscious sensory experience, as reported by the subjects, when the stimulation continued for about half a second. He applied to their skin a single electrical pulse of sufficient intensity to just elicit a sensation in the same area as the brain-stimulation. The subjects were able to distinguish the sensation elicited by the brain-stimulation from that elicited by the skin-stimulus. When the skin-stimulus was applied at any time during the brain-stimulation, it did not elicit any experience and the subjects reported only the sensation due to the brain-stimulation. Significantly, the skin-stimulus was not consciously experienced even when it was applied first and the brain-stimulation begun after a delay of up to 125-200 milliseconds in most of the subjects and up to half a second in one subject; only

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[1] B. Libet, *Electrical Stimulation of Cortex in Human Subjects and Conscious Sensory Aspects*, In *Handbook of Sensory Physiology* Vol. 2 (ed. A. Iggo), Springer-Verlag, New York, 1973, pp. 743-790.

when the start of the brain-stimulation was delayed more, the subjects reported two experiences, first that elicited by the skin-stimulus and thereafter that elicited by the brain-stimulation.

Moving on to language, I mentioned to His Holiness that one hemisphere – mostly the left – is dominant for language. I showed the 'Broca's area' in the left frontal lobe in a drawing and said that following damage to it, people have great difficulty in expressing themselves; they speak slowly and with lengthy pauses; their verbal output is telegraphic and ungrammatical; being aware that they are not able to find the right words to express what they intend to, they feel frustrated. Some persons in whom this area was normal and whose brains were exposed during brain-surgery were shown pictures and told to specify what was shown; when they were about to answer, this area was electrically stimulated; they were unable to find the apt words but when the stimulation stopped, they had no difficulty in doing so.[1] His Holiness asked if persons with damage to this area can understand what is said to them and if, as in the case of speech, they have difficulty in conveying through writing what they have in mind; my answer to both the questions was yes. I then pointed in a picture to the 'Wernicke's area' in the left temporal lobe and said that following damage to it, while persons are able to speak without difficulty at the normal speed, what they say does not make sense; they

[1] W. Penfield and L. Roberts, *Speech and Brain-Mechanisms*, Princeton University Press, Princeton, 1959.

are greatly impaired in comprehending what is spoken to them; while they write without difficulty, their writing is full of misused and misspelt words and, like their speech, is not meaningful; they are, unlike those with damage to the Broca's area, not conscious of their impairment.

After this, I pointed in a picture to the 'corpus callosum,' a set of fibres linking the left and the right hemispheres, and said that it had been sectioned in some to mitigate epilepsy by averting the spread of abnormal electrical discharges from one hemisphere to the other. They did not, subsequent to the bisection of their brains, report feeling mentally different; they were temperamentally and intellectually unchanged; they continued to be as socially aware as before the bisection and interacted with others normally. However, controlled tests revealed some consequences.[1] When, as they held their gaze at a spot on their visual midline, an image was flashed to the left half of their visual fields and, thus, to just their right hemisphere, they said – with such speech generated in their linguistically proficient left hemisphere – that

[1] Some books/chapters on which I based my account: R. W. Sperry, In *Brain and Conscious Experience* (ed. J. C. Eccles), Springer-Verlag, 1966 (pp. 298-313); M. S. Gazzaniga, *The Bisected Brain*, Appleton-Century-Crafts, New York, 1970; M. S. Gazzaniga and J. E. LeDoux, *The Integrated Mind,* Plenum Press, New York, 1978; C. Trevarthen, In *Hemisphere Disconnection and Cerebral Function* (eds. M. Kinsbourne and W. L. Smith), John Wiley & Sons, New York, 1974 (pp. 208-237). The articles in journals (up to 1983) that were relied upon are not listed here. {R. W. Sperry was awarded the Nobel Prize in 1981 for his studies on split-brain patients.}

they did not see anything; yet, when they were shown a set of pictures, they were able to point correctly with the left hand, under the control of the right hemisphere, to the picture that matched that image. On the other hand, when an image was flashed to the right half of their visual fields and, thus, to the left hemisphere, they were able to verbally describe it and to point with the right hand to the matching image from among the pictures shown to them. When the image of an object was flashed to just the right hemisphere and they were allowed to feel objects hidden from their view with the left hand, they were able to pick out the object that matched the image; they were unable to do so with the right hand. If the object that matched that image was not included in the items made available to them, they selected with the left hand that object which corresponded best to the image that had been flashed; for instance, when a wall-clock was flashed and no clock was available, the split-brain subject selected a child's toy-watch with the left hand. When an image was flashed to the left hemisphere, they were able to feel and select the corresponding object with the right hand but not with the left hand. They did not, unlike people with undivided brains, find anything odd if, while they fixated on the visual midline, a composite image with the left half of one picture and the right half of a different picture was flashed. For instance, when a composite image with half a tree on the left and half a boat on the right was flashed, a split-brain subject drew a full tree with the left hand; he verbally reported seeing a boat. A split-brain patient ('P.S.') was, as he fixated on his visual midline, briefly presented the image of a snow-scene – with the ground covered with snow, a car with snow on it, and a cottage – to his right hemisphere and the image of a chicken's claw to his left hemisphere. Then, he was shown eight pictures that he could see freely with his eyes. With his left hand, he pointed to the image of a shovel; this was the picture that related to the snow-scene. The picture of a chicken, which fitted the image of the chicken's claw, was what he chose verbally. He, who had seen the left hand pointing to the picture of a shovel, said that he saw a chicken's claw, chose the picture of a chicken, and pointed to a shovel as one needs to clean a chicken-shed; he had not been shown even a portion of a chicken-shed. Researchers have reported several such left-hemisphere-based, fanciful justifications by split-brain patients. A split-brain patient ('N.G.') was briefly shown in her left visual fields some unmixed pictures, one after the other; on seeing one of them, she began to laugh; asked for the reason, she, who did not report seeing any of the pictures, said that the machine was funny; when this picture was flashed to her right visual fields, she again laughed but this time spoke of the picture. Another split-brain patient ('L.B.') was shown pictures in his left visual fields and required to indicate his approval by a thumbs-up sign or disapproval by a thumbs-down sign; he gave, with his left hand, a thumbs-down sign for Hitler and a thumbs-up sign for Churchill. He was then shown three pictures of strangers and one of himself; required to point to the picture he recognized, he pointed with his left hand to his picture; he showed a thumbs-down sign but did so with a self-conscious grin. It has been contended that this evidences that the right-hemisphere can self-recognize and display a sense of humour. The right hemisphere of ‘P.S.’ whose corpus callosum was sectioned in 1976 when he was 15 years old displayed a good degree of linguistic proficiency. In a test, he was asked questions with a crucial word omitted; this word was flashed to just his right hemisphere; he was required to spell out his answer by selecting and arranging chips marked with the letters of the alphabet. The idea was to investigate the mute right hemisphere’s knowledge and preferences. One question put to him was “Who are you?” with the words “are you” presented to just his right hemisphere. P.S. spelt out, “Paul,” his name. On being asked, “Would you spell the name of your favourite girl?” with the word “girl” shown to his right hemisphere, his answer was “Liz,” his then girlfriend. Asked, “What is tomorrow?” with “tomorrow” presented visually, his right response was, “Monday.” When asked, “In one word, how would you describe your mood?” with the key word “mood” not uttered but flashed, his answer, as expressed by the right hemisphere, was “Good.” When he was asked, “If you had a choice, what job would you pick?” with the word “job” shown to just the right hemisphere, his answer, as given by the right hemisphere, was “automobile race,” that is, a race-car driver; when he was orally asked this question after the test session, his verbal answer, given by the left hemisphere, was “draftsman.”[1]

[1] About two years after his surgery, his right hemisphere, which was mute at the time of these tests, began to verbally name objects.

I then moved on from bisected brains to sleep and told His Holiness that on the basis of recordings of electrical activity with electrodes on the scalp and face (EEG), two forms of sleep, labelled REM ('rapid eye movement') sleep and NREM ('non-rapid eye movement') sleep have been identified, as also four stages of NREM sleep.[1] People awakened from REM sleep reported dreams 80-90 percent of the time; on the other hand, dreams were reported in 5-10 percent of the awakenings from NREM sleep. NREM and REM alternate, with successive REM durations being longer than the preceding ones. During REM sleep, as is clear from the appellation itself, rapid eye movement occurs, in various directions; the skeletal muscles are relaxed ('muscle atonia'), and hence, one is paralysed as it were. People sometimes – many at least once in their life – have the disconcerting experience of awakening and finding that, for durations from seconds up to a few minutes, they are unable to move; the reason is said to be the brief persistence of the brain-induced muscle relaxation of REM sleep after arousal. I pointed, in a picture, to the 'pons' in the brain stem and said that this is regarded as playing a vital role in generating REM sleep; bursts of electrical activity characterized by spikes originating here trigger REM sleep; there are reports[2] of damage to the pons reducing or abolishing REM sleep.

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[1] NREM sleep that was earlier subdivided into four stages is now viewed, with the merger of the final two stages, as having three stages, N1, N2, N3; each successive stage represents a deeper sleep.
[2] O. N. Markand and M. L. Dyken, *Sleep Abnormalities in Patients with Brain Stem Lesions*, *Neurology,* vol. 23, issue 8, pp. 769-76, 1976.

Sleepwalking ('somnambulism') is, I said to Him, a sleep disorder that principally occurs during stages[1] 3 and 4 of NREM sleep. In an investigation,[2] nine persons – seven males and two females – were chosen on the basis of their having a high frequency of sleepwalking and electrical signals recorded for several nights via electrodes placed on their heads and faces; the apparatus was such that the recordings continued uninterrupted even when a subject moved around. Several incidents of sleepwalking and of just sitting up in bed were recorded; every one of them occurred during periods of stage 3 and stage 4 of NREM sleep, characterized by recordings of slow waves. The activities ranged from sitting up, walking, tugging at the electrical cables, and, uncommonly, jumping, running or appearing to search for something; their eyes were open and expressions blank; their movements were somewhat rigid; when spoken to, they answered monosyllabically and as if displeased; they returned to bed themselves and lay down or could be led back easily; on no occasion did they recall anything of their sleepwalking when they got up in the morning; even when they happened to awaken spontaneously during an episode of sleepwalking, they had no recollection of what had happened earlier. Rather uncommonly, a sleepwalker may cause injury or death. For instance, a 50-year-old man with a history of sleep-walking felt tired while driving, stopped at the side of the road to rest, started his car subsequently, and kept

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[1] Third stage, N3, as per the present three-stage classification.
[2] A. Jacobson et al., *Somnambulism: All-night Electroencephalographic Studies, Science,* vol. 148, issue 3672, pp. 975-77, 1965.

on driving on the wrong side of the road, with a fixed, blank expression; a car coming in the opposite direction unavoidably crashed into his car and its occupants died; he had no recollection of what happened after he had parked his car earlier to sleep.[1] Another instance: During an episode of sleepwalking, a 28-year-old man (Simon Fraser) picked up his infant and banged its head against a wall, causing the child's skull to split. His wife was awakened by the sound of her husband roaring and saw him rush out of bed. When she went after him, she found him smashing something against a wall. She then saw her child lying motionless on the floor. Her cries awakened him. When he came to know what he had done, he became extremely distressed and sorrowful and rushed to fetch a doctor. The child died. After hearing his account and the views of medical experts, the jury and judge concluded that he had killed his child when he was not conscious of what he was doing because of a condition arising from somnambulism and set him free.[2]

I then mentioned to His Holiness that severe damage to the brain due to, say, head-injury or oxygen-deprivation, may result in what has been termed a 'vegetative state.' A person in this state cannot speak, act volitionally or think and has no awareness of anything; however, he has

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[1] E. Hartman, *Two Case Reports: Night-terrors with Sleep-Walking – A Potentially Lethal Disorder, J.Nerv. Ment. Dis.,* vol. 171, issue 8, pp. 503-505, 1983.

[2] D. Yellowless, *Homicide by a Somnambulist, J. Ment. Sci.,* vol. 24, issue 107, pp. 451-458, October 1878.

regular cycles of sleep and wakefulness; his eyes open and move; he may make some sounds, reflexively grasp, like an infant, an object put in contact with his hand, gag, suck, swallow, and appear to smile, frown or be startled by sudden loud sounds; in this state, the upper portion of the brain ('cerebellum') that is associated with mental activity is non-functional but the brain-stem that controls wakefulness-sleep is active. A small percentage of those in a vegetative state slowly improve and become able to understand and communicate. With almost 45 minutes having passed, I ended my account here.

I was about to request His Holiness for scriptural light on the data when He Himself commenced His response and spelt out how the data about the brain is not antithetical to what has been said in the *śāstra* about the mind and consciousness. Having clarified for around 15 minutes, He said that He would continue later. He did so that night after he had performed *pūjā* and blessed the assembled devotees. He completed His explanation in His room in roughly 15 minutes. Then, gesturing to me to not get up, He sat fully upright with His right hand on his left with the palms facing upwards, promptly became absorbed in *nirvikalpa-samādhi,* and remained in that exalted state for over half an hour. He then retired for the night.

Except for His use of Tamil in His prelude, which forms Section 4.2, and in the concluding portion, which is given in Section 4.8, He spoke entirely in Sanskrit. Section 4.3 has His Holiness's establishment, through citations from the scripture and Bhagavatpāda's *bhāṣyas* that, as per the *śāstra*, a body is required for the functioning of the subtle mind, which accompanies the *jīva* from birth to birth; the functioning of the mind is influenced by what is ingested; physical factors are involved in the onset of dreams and dreamless sleep; bodily factors can lead to even the derangement of the mind and medicines given to the body can positively impact an affected mind; the expression of mental impressions of experiences does depend on the body and its state. Having illustrated in five ways that the *śāstra* does accept that the mind can be and is extensively influenced by somatic factors, His Holiness expounded in depth the scriptural account of the mind, *Ātman* of the nature of pure consciousness, *jīva*, misidentification, due to *avidyā*, of consciousness with the mind, and consciousness in deep sleep and set out the framework and laid the foundation for establishing that nothing in the data about the brain is antithetical to the scriptural teaching about the mind and consciousness; this constitutes Section 4.4. In continuation of this, His Holiness took up scriptural statements on waking, dream, deep sleep, their subdivisions, and unconsciousness with and without convulsions, and then pointed out how the scriptural classification of states is wide enough to cover sleepwalking, etc. This forms Section 4.5. His Holiness presented three scriptural accounts and drawing upon them pointed out that adverse impacts on the mind on account of physical causes as also abnormal behaviour without subsequent recollection are not antithetical to the scriptural teaching; this forms Section 4.6. After this, His Holiness considered the role of *prāṇa* in some detail and brought out, in the light of scriptural statements, that activities without conscious awareness are recognized. This forms Section 4.7. His Holiness then showed that the data about perception, hemi-neglect and brain-bisection is not dissonant with the scripture; this forms Section 4.8.

§4.2 **His Holiness:** Even if it were to be established that every kind of thought, emotion, perception, conscious experience, and conscious and unconscious behaviour may be elicited, modified or blocked by manipulation of brain-states, the teaching of the *śāstra* about the mind and consciousness would not be undermined.[1] This is because the *śāstra* never states or even hints that corporeal factors cannot affect the mind; on the contrary, it highlights that the mind can be extensively influenced by physical factors such as what is ingested. Were the scripture to have ruled out the influence of corporeal factors on, for example, memory, this would have been contradicted by the fact that brain-damage can adversely impact memory, with 'H.M.' being a case in point. However, the scripture neither does anything such as this nor does it mention any limit to the extent to which any mental act can be impacted. The scriptural teaching that there does exist a *jīva* that is distinct from the body and is eternal; that, on account of ignorance, it transmigrates as associated with the mind, senses, and *prāṇa* in accordance with its *karma*; and that it is

[1] This a literal translation of the categorical, tightly-worded, opening sentence of His Holiness in Tamil.

intrinsically of the very nature of changeless, limitless consciousness pertains to what transcends the domains of perception and inference[1] and, therefore, brain-data can neither rule this out nor establish it. To specify the scriptural view of the mind and consciousness, I shall, almost wholly, limit myself to what is taught about them in the *prasthāna-traya* (the *Upaniṣads*, *Bhagavad-gītā*, and the *Brahma-sūtras*) as explained by Bhagavatpāda in His *bhāṣyas*. In view of the categorical statement in the *Mahābhārata* that, *"itihāsa-purāṇābhyāṁ vedaṁ samupabṛṁhayet — The Vedas should be clarified with the aid of the Itihāsas* and the *Purāṇas*"[2] and since these texts have been relied upon in the *Brahma-sūtras* and in Bhagavatpāda's *bhāṣyas*, I shall draw upon them also but only as supportive evidence and occasionally. There is no mention of the 'brain' in the *prasthāna-traya*, in Bhagavatpāda's *bhāṣyas* thereon and in the *Itihāsas* and the *Purāṇas*; as I have no intention of overstepping the traditional interpretation of the *Vedānta-śāstra*, I shall not conceive references to the brain and its functions in these texts in the light of what is known now; there is, anyway, no word denoting the brain in the *Amarakośa* (traditional, metrical Sanskrit lexicon that is memorized). Since what you wanted me to consider in the light of the *śāstra* is the data about the brain's effect on the mind, how the mind acts on the body is not pertinent here.

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[1] Bhagavatpāda shows this in His *Bṛhadāraṇyaka-upaniṣad-bhāṣya.*
[2] *Mahābhārata* 1.1.267 (Gita Press Edition).

§4.3 **His Holiness (continuing):** The scriptural position is that in the absence of a body, the *jīva* has no knowledge of anything and has no willed activity. Bhagavatpāda states in His *bhāṣya* on the *Bṛhadāraṇyaka-upaniṣad* in the context of bliss being the very nature of *Brahman: kāryakaraṇābhāve 'nupapatter vijñānasya…śarīrābhāve ca karaṇānupapattir āśrayābhāvāt…dehādyabhāve ca vijñānotpattau sarveṣāṁ kāryakaraṇopādānānarthakya-prasaṅgaḥ — In the absence of a body as also the subtle sense-organs and mind, no knowledge is possible…In the absence of a body, there would be no functioning of the sense-organs and the mind, for they would have no base. If knowledge could arise even without the body, organs, and mind, it would be meaningless for anyone to possess these."*[1] Not only the *jīva* that is bodiless in the interval between discarding a human body and passing, due to its sinful *karma*, into a lower form, such as that of an animal or plant, but even the *jīva* that is on the way to *Brahma-loka* is like one in coma; explaining the *Brahma-sūtra, "ubhayavyāmohāt tatsiddheḥ — That (guiding deities are referred to) is settled because both (the person travelling and the path) are not conscious,"*[2] Bhagavatpāda has written, "*ye tāvad arcirādimārgagās te dehaviyogāt sampiṇḍitakaraṇagrāmā ity asvatantrāḥ — Because of their separation from their bodies, all their*

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[1] *Bhāṣya* on *Bṛhadāraṇyaka-upaniṣad* 3.9.28.7. His Holiness began to paraphrase, closed His eyes for a few seconds, and then cited this.
[2] *Brahma-sūtra* 4.3.5.

organs and mind become lumped and, therefore, those who proceed by the path of flame, etc., are not capable of independent activity."[1] Whether it be in the higher realms from those of the manes (*pitr̥loka*) onwards or on earth or in the lower realms down to *pātāla* (the lowest hell), the *jīva*, accompanied by the mind, the organs, and *prāṇa*, is functional only when in a body suitable to that realm, not otherwise. That *jīvas* need bodies in order to experience delights in higher realms is inferable from the teaching of the *Br̥hadāraṇyaka-upaniṣad* about rebirth that: *"tad yathā peśaskārī peśaso mātrām āpādāyānyan navataraṁ kalyāṇataraṁ rūpaṁ tanuta evam evāyam ātmedaṁ śarīraṁ nihatyāvidyāṁ gamayitvānyan navataraṁ kalyāṇataraṁ rūpaṁ kurute pitryaṁ vā gāndharvaṁ vā daivaṁ vā prājāpatyaṁ vā brāhmaṁ vānyeṣāṁ vā bhūtānām — Just as a goldsmith separates and takes up some gold and makes another form that is newer and better, likewise, this Ātman (jīva) sets aside the present body (stops identifying with it as when starting to dream) – renders it senseless – and makes another newer and better body that is suitable for the manes (suitable for experiences in the world of the manes) or gandharvas or devas or Prajāpati or Hiraṇyagarbha or other beings*."[2] When the *jīva's puṇya* responsible for its stay in, say, the world of the manes is exhausted, it returns to this world without knowledge of anything, like one in coma, till it

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[1] *Bhāṣya* on *Brahma-sūtra* 4.3.5.
[2] *Br̥hadāraṇyaka-upaniṣad* 4.4.2.

gets another body. Thus, as per the scripture, any activity of the mind or of the senses — and, so, any experience by the *jīva* of the fruits of its *karma* — takes place only in association with a body.

His Holiness (continuing): While in a body, the mind's functions are influenced by physical factors. In order to teach that just like the external world, the mind, *prāṇa*, and the organs are composed of the elements (such as earth) and that these have no existence apart from the non-dual Reality, it is said in the *Chāndogya-upaniṣad: "annam aśitaṁ tredhā vidhīyate tasya yaḥ sthaviṣṭho dhātus tat purīṣaṁ bhavati yo madhyamas tan māṁsaṁ yo 'ṇiṣṭhas tan manaḥ — Food that is eaten is (following digestion) divided in three ways. Its grossest constituent becomes faeces, its middling ingredient becomes flesh and its subtlest part becomes the mind*."[1] The mind is already present in the body, having accompanied the *jīva* and, hence, what is meant by the statement that the subtlest part of the ingested food becomes the mind is that it nourishes the mind; Bhagavatpāda has clarified in His *bhāṣya* on the *Chāndogya-upaniṣad* that following digestion, the subtlest part eventually passes into the *naḍīs* (nerves) known as '*hitā'* (in the *Upaniṣads*) and nourishes the mind; He has then pointed out, "*annopacitatvān manaso bhautikatvam eva – Because the mind is nourished by food, it is certainly elemental"*[2]; as per

[1] *Chāndogya-upaniṣad* 6.5.1.
[2] *Bhāṣya* on *Chāndogya-upaniṣad* 6.5.1.

the scripture, the mind is subtle, material, and, per se, inert; any conception of the mind as something that is non-material and characterized by consciousness finds no favour at all in the scripture. In this portion of the *Upaniṣad* (that has the form of a dialogue between Sage Uddālaka Āruṇi and his son Śvetaketu), the relationship between food and the mind is then pressed home as follows. After conceptualizing that a person consists of sixteen parts, Uddālaka Āruṇi instructs Śvetaketu to fast for 15 days, drinking as much water as he wishes to sustain life. Having fasted, as told, for 15 days, the son presents himself to his father. The father asks him to chant the passages of the Ṛg, Yajur and Sāma Vedas. Though having studied the Vedas, together with their six auxiliaries, for 12 years, Śvetaketu finds, as per the story, that he is unable to recall any of the passages; his memory fails. Uddālaka Āruṇi then tells him, "*yathā somya mahato 'bhyāhitasyaiko 'ṅgāraḥ khadyotamātraḥ pariśiṣṭaḥ syāt tena tato 'pi na bahu dahed evaṁ somya te ṣoḍaśānāṁ kalānām ekā kalātiśiṣṭā syāt tayaitarhi vedān nānubhavasi — Amiable boy, just as one ember of a firefly's size left as the residue of a large blazing fire cannot burn anything bigger than that, likewise, amiable boy, (after your fast,) only one of your 16 parts remains as residue and with just that little, you cannot remember the Vedas now.*"[1] He directs him to eat and states that he would then correctly understand him. The

[1] *Chāndogya-upaniṣad* 6.7.3.

boy takes food and thereafter approaches his father. This time, Śvetaketu correctly answers every question that Uddālaka Āruṇi asks him regarding the Vedas and the meanings of the passages. Uddālaka Āruṇi then tells him, "*yathā somya mahato 'bhyāhitasyaikam aṅgāraṁ khadyotamātraṁ pariśiṣṭaṁ taṁ tṛṇair upasamādhāya prājvalayet tena tato 'pi bahu dahet / evaṁ somya te ṣoḍaśānāṁ kalānāṁ ekā kalātiśiṣṭābhūt sānnenopasamāhitā prājvālī tayaitarhi vedān anubhavasy annamayaṁ hi somya manaḥ — Amiable boy, just as when the one ember of a firefly's size that is left as the residue of a large blazing fire is made to blaze up by adding straws, it burns up much more than before, likewise, amiable boy, of your 16 parts only one part remained and it has blazed up by being nourished by food, and, with that, you now apprehend the Vedas. Amiable boy, the mind is decidedly constituted by food.*"[1] The *Upaniṣad* later points out that, "*āhāraśuddhau sattvaśuddhiḥ — When food is pure, the mind becomes pure.*"[2] The well-known meaning of the word '*āhāra*' is food; Bhagavatpāda has quoted this passage in the *Brahmasūtra-bhāṣya* in the context of food.[3] Pure food is *sāttvika* food such as that described by the Lord in the *Bhagavad-gītā: "āyuḥsattvabalārogyasukhaprītivivardhanāḥ / rasyāḥ snigdhāḥ sthirā hṛdyā āhārāḥ śāttvikapriyāḥ — Foods that enhance life,*

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[1] *Chāndogya-upaniṣad* 6.7.5-6.
[2] *Chāndogya-upaniṣad* 7.26.2.
[3] *Bhaṣya* on *Brahma-sūtra* 3.4.29. (A wider interpretation of the word is given in the *bhāṣya* on *Chāndogya-upaniṣad* 7.26.2.)

steadiness of the mind, heath, joy, and cheerfulness, and are succulent, oleaginous, substantial, and appetizing are dear to those in whom sattva-guṇa preponderates."[1] Just as some foods are conducive to the mind becoming pure, some others act negatively on the mind, such as by fostering irritability or dullness; this is recognized in the scripture.

His Holiness (continuing): That physical factors play a causal role in the mind's passing from the state of waking to that of dream is implicit in the following passage of the *Bṛhadāraṇyaka-upaniṣad: tā vā asyaitā hitā nāma nāḍyo yathā keśaḥ sahasradhā bhinnas tāvatāṇimnā tiṣṭhanti śuklasya nīlasya piṅgalasya haritasya lohitasya pūrṇā atha yatrainaṁ ghnantīva jinantīva hastīva vicchāyayati gartam iva patati yad eva jāgradbhayaṁ paśyati tad atrāvidyayā manyate — There are in him the nāḍīs (nerves) termed 'hitā', which are fine like a hair split into a thousand parts and are filled with white, blue, brown, green and red serums. Such being the case, (there is his state of dream) when he feels as though somebody is killing him or is overpowering him or an elephant is chasing him or he is falling into a pit, that is, when he fancies through ignorance what fears he had experienced in the waking state.*"[2] Bhagavatpāda has explained in His *bhāṣya* on this passage that the said colours of the serums in the *nāḍīs*, which are spread

[1] *Bhagavad-gītā* 17.8.

[2] *Bṛhadāraṇyaka-upaniṣad* 4.3.20.

all over the body, are on account of the intermixture, in different proportions, of *'vāta', 'pitta' and 'kapha'* (the three '*doṣas'* described in texts on *Āyurveda*); that the mind with all its impressions, the ten organs (five sense-organs and five organs of action) and the five-fold *prāṇa* have as their habitat these *nāḍīs;* and that on account of contact with these serums therein, the colourless-crystal-like mind undergoes, as per *karma,* transformations and manifests with impressions in the form of what all is seen in the dream.[1] In the following passage of the *Praśna-upaniṣad,* there is a mention of the causal role of a physical factor in the onset of deep (dreamless) sleep: "*sa yadā tejasābhibhūto bhavati / atraiṣa devaḥ svapnān na paśyati — When that deva is overcome by light, he does not see dreams.*"[2] In his *bhāṣya* on this passage, Bhagavatpāda has clarified that by the word '*devaḥ* (the bright one)', it is the mind that is referred to; the word '*tejas* (light)' here refers to the '*pitta'* in the *nāḍīs*; when the mind is overwhelmed by the '*pitta'* in the *nāḍīs*, the doorway for its impressions to manifest in dreams becomes shut and it does not dream; in the state of deep sleep, the mind in the body is like non-manifest fire in wood.[3]

His Holiness (continuing): It is stated in the *Atharva-veda:* "*kṛṇomi vidvān bheṣajaṁ yathānunmadito 'sasi*

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[1] *Bhāṣya* on *Bṛhadāraṇyaka-upaniṣad* 4.3.20.
[2] *Praśna-upaniṣad* 4.6.
[3] *Bhāṣya* on *Praśna-upaniṣad* 4.6.

— Knowing the remedy, I prepare the medicine such that you will be free from insanity."[1] The *Garuḍa-purāṇa* describes a herbal medicine for insanity: "*brāhmīrasa-vacā-kuṣṭha-śaṅkhapuṣpībhir eva ca / purāṇaṁ sevyam unmāda-grahāpasmāranud ghr̥tam — Juice of brāhmī (Bacopa monnieri), vacā (Acorus calamus Linn.), kuṣṭha (Sausseurea Lappa), and śaṅkhapuṣpī (Convolvulus pluricaulis Choisy) with ghee is a treatment for insanity, possession, and epilepsy*."[2] The *Agni-purāṇa* mentions this preparation as a first-rate memory booster and as a remedy for insanity and epilepsy.[3] The scripture thus recognizes that a medicine given to the body can act beneficially on even a deranged mind, with reasoning, thinking, and emotions affected. It also recognizes that physical factors may be involved in a mind becoming deranged. For instance, in a set of verses beginning with, "*hr̥droganidānaṁ vakṣye — I shall speak of the aetiology of mental ailments,"* it is said in the *Garuḍa-purāṇa,* in line with what is spelt out in *Āyurveda* texts such as the *Suśruta-saṁhitā* and *Caraka-saṁhitā*, that insanity may be triggered by *vāta* or *pitta* or *kapha* or all the three.[4]

His Holiness (continuing): The *Br̥hadāraṇyaka-upaniṣad* teaches that when the *jīva* leaves a body: "*taṁ vidyā-karmaṇī samanvārabhete pūrvaprajñā ca — The jīva is*

[1] *Atharvaveda-saṁhitā* 6.111.2.

[2] *Garuḍa-purāṇa* 1.170.36. H.H. said that He read this a month earlier.

[3] *Agni-purāṇa* 284.19. (Both *Purāṇas* – Nag Publishers Edition.)

[4] *Garuḍa-purāṇa* 1.154.1-9.

followed by its knowledge (of all forms) and karma (virtuous, sinful and neither), and impressions of past experience."[1] The word '*pūrvaprajñā* (past experience)' refers to all the mental impressions of past experiences of the results of actions. These play a role in the next life in initiating unperformed activity in that life, such as a new-born infant suckling, and in the fruition of *karma.* In the present context, it is pertinent that the operation of mental impressions in any life depends on the body and its state. Thus, while one's mind has impressions of experiences had in past lives as a human, a peacock, a monkey, etc., during rebirth as a monkey, only those mental impressions that are compatible with that body manifest, such as to hold on, even upside down, to the mother-monkey's abdomen when quite young.[2] Bodily factors do influence which impressions emerge when. It is well-known, for instance, that inclinations differ with age; the *Viṣṇu-purāṇa* says, *"bālye krīḍanakāsaktā yauvane viṣayonmukhāḥ / ajñā nayanty aśaktyā ca vārdhakaṁ samupasthitam— Engrossed in play in childhood, drawn to objects of pleasure as youths and with powerlessness in old age is how the unenlightened lead their lives."*[3]

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[1] *Bṛhadāraṇyaka-upaniṣad* 4.4.2.

[2] In His *bhāṣya* on *Chāndogya-upaniṣad* 5.10.5, Bhagavatpāda has mentioned impressions of lives as a human, a peacock, a monkey, etc., and to a young monkey holding on to its mother's abdomen.

[3] *Viṣṇu-purāṇa* 1.17.75.

§4.4 His Holiness (continuing): The *Bṛhadāraṇyaka-upaniṣad* confirms the existence of a mind apart from the senses and presents the mind's nature thus: "*anyatra-manā abhūvaṁ nādarśam anyatramanā abhūvaṁ nāśrauṣam iti manasā hy eva paśyati manasā śṛṇoti / kāmaḥ saṅkalpo vicikitsā śraddhāśraddhā dhṛtir adhṛtir hrīr dhīr bhīr ity etat sarvaṁ mana eva tasmād api pṛṣ-ṭhata upaspṛṣṭo manasā vijānāti — (People say,) 'My mind was elsewhere (I was absentminded); I did not see it. My mind was elsewhere; I did not hear it.' It is through the mind that one sees, and it is through the mind that one hears. Sexual desire, judgment about sense-inputs, doubt, faith, disbelief, firmness, irresoluteness, shame, understanding, and fear; all these are but (forms of) the mind. Even when one is touched from behind, one knows it (discerns what touch that is) through the mind; therefore (there exists a mind apart from the sense-organs).*"[1] A boy in fine fettle having sharp eyesight is seated in the front portion of his house and is facing the road. It is midday, and the road is brightly lit by the sun. An old bull goes by. Moments later, a person comes there from a path on the side of the house, draws his attention, and asks him, "Did you see my old bull pass this way?" The boy truthfully answers, "No, I did not see it; because I was mentally preoccupied, I could have failed to perceive it." The bull went in front of him, the place was bright, there was nothing between him and

[1] *Bṛhadāraṇyaka-upaniṣad* 1.5.3. The translation is *bhāṣya*-based.

the bull, his physical eyes were unimpaired, his subtle sense-organ of sight continued to be functional, with no reason for it to lose its functionality just when the bull passed, and, being changeless and of the very nature of consciousness, there was no possibility of his *Ātman* losing its capacity to illumine even for an instant. Yet, because of the non-involvement of the mind, the boy had no conscious perception of the bull. Suppose that his mind was not preoccupied. He would, decidedly, have then consciously perceived the bull and answered, "Yes, an old bull did pass by; I saw it." The example of the non-perception of an old bull is not one thought up by me. Sureśvarācārya gave it in his *Bṛhadāraṇyaka-upaniṣad-bhāṣya-vārtika*[1] to elucidate the words, *"My mind was elsewhere; I did not see it"* of the *Upaniṣad,* and all I did now was to build on that, keeping in mind the *Brahma-sūtra, "nityopalabdhyanupalabdhiprasaṅgo 'nyataraniyamo vānyathā — Otherwise (that is, if the existence of the mind is not admitted), there would arise the contingency of perpetual perception (of objects on account of the contiguous presence of objects, sense-organs and the Ātman) or of perpetual non-perception (due to the triad's insufficiency), or else, it will have to be admitted that the power of either the sense-organs or of the Ātman becomes (discontinuously) debarred*."[2]

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[1] *Bṛhadāraṇyaka-upaniṣad-bhāṣya-vārtika* 1.5.102-105.

[2] *Brahma-sūtra* 2.3.32. The translation, with elaboration, is based on Bhagavatpāda's *bhāṣya* on this *Brahma-sūtra.*

Buttressing the point made, the *Upaniṣad* refers to the experience of people failing to hear something due to their being mentally preoccupied. A boy is engrossedly watching a calf frolicking on the road or is engrossed in some thought and his brother calls him from inside the house. He fails to respond. On his brother asking him afterwards, he says truthfully, "My mind was elsewhere; I did not hear your call." In the *Mahābhārata* in the *Śānti-parvan* and in the *Bhāgavata-purāṇa* in the *Uddhava-gītā*, an example is given of a maker of arrows being so engrossed in the task of making an arrow that he was completely unaware of the king passing nearby;[1] in the *Śrīdharī* (the authoritative gloss, *Bhāvārthadīpikā*, of Śrīdhara on the *Bhāgavata-purāṇa*), it is explicated that the arrow-maker did not hear even the sound of kettledrums playing as the king advanced. By mentioning people's failure to see and, without stopping with this, also referring to people's failure to hear because of their minds being elsewhere, the *Upaniṣad* tacitly includes as similar, cases of people failing to consciously apprehend some touch, taste or smell (the objects of the remaining three sense-organs) when their minds are occupied with something else. Suppose a person becomes distracted just when he takes a little milk into his mouth. He would then not consciously apprehend its taste and may even swallow it reflexively. The *Upaniṣad* points out here, via people's experience, that there exists something —

[1] *Mahābhārata* 12.178.12; *Bhāgavata-purāṇa* 11.13.36.

the mind — other than the five sense-organs without whose involvement none of the sense-organs can bring about conscious perception of its object in a person and in the congruous presence of which, each of them does so. That the mind is the common means by which one is able to consciously perceive an object is specified in the portion, "*It is through the mind that one sees, and it is through the mind that one hears*."

His Holiness (continuing): The *Upaniṣad* speaks of the nature of the mind in the portion, "*Desire, resolution, doubt, faith, disbelief, firmness, irresoluteness, shame, understanding, and fear; all these are but (forms of) the mind.*" All these that are mentioned, from desire to fear, are forms of (*rūpāṇi*)[1], are transformations of, the mind, just as a golden bracelet, diadem and armlet[2] are of gold and, hence, are said here to be the mind (*mana eva*), just as the bracelet, diadem and, armlet of gold are spoken of as gold, other than as which they have no separate existence. One of the examples of the '*vṛttis*' of the mind given here is '*śraddhā* (faith)'; this includes faith that rites, such as *jyotiṣṭoma*, prescribed in the scripture are efficacious means to attain heaven after death; while the sense-organs can grasp only what is perceptible and present now, the mind can think of even what pertains to the future and what is unseen.

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[1] H.H. used this word of the *bhāṣya* on the *Bṛhadāraṇyaka-upaniṣad.*
[2] The *bhāṣya* on *Chāndogya-upaniṣad* 6.1.4 mentions these three as examples of products of gold having existence only as gold.

His Holiness (continuing): The *Upaniṣad* once again draws on human experience to point out that there does exist a mind apart from the five sense-organs and says: "*Even when one is touched from behind, one knows it (discerns what touch that is)*; *hence (there does exist a mind apart from the sense-organs)*." A person touches another on the back with his hand or with his knee.[1] The latter's sense-organ of touch can detect whether the touch is soft or hard but cannot identify the touch as that of a hand or a knee. However, people are able to recognize what touched them on the back. This calls for something over and above the organ of touch; this is the mind. Likewise, if a person is seated with his eyes closed and the fragrance of jasmine flowers wafts into his nose and he thereafter hears his name being called, he is able to recognize that the smell is that of jasmine and that the sound is his mother's voice even though his sense-organs of smell and of hearing can only detect the smell's and sound's characteristics; for such recognition that is a matter of experience, something apart from the sense-organs of smell and hearing is needed; this is the mind. In some places, the scripture categorises the inner means of knowing (*antaḥkaraṇa*) as *manas* (mind) with reference to its function of thinking and as *buddhi* (intellect) in view of its function of deciding; this division is not done by it in some other places, inclusive of here.

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[1] Bhagavatpāda has mentioned touch with a hand and touch with a knee in His *bhāṣya* on *Bṛhadāraṇyaka-upaniṣad* 1.5.3.

His Holiness (continuing): The mind is thus a material entity that undergoes various transformations in the form of *vṛttis* such as those illustratively mentioned by the *Bṛhadāraṇyaka-upaniṣad*; being but inert, it cannot, by itself, perceive or make known any sense-object, just as clay plastered on a pot[1] cannot make it known nor can a mirror turned towards it in the dark. It is only on account of being lit up by the *Ātman* of the nature of pure consciousness that it is able to do so, like a mirror bearing the reflection of the sun illumining, by the sun's light, a pot in a room or like an iron rod, which cannot scorch on its own, being said to burn when associated with fire. Some contextually relevant passages of the scripture about the *Ātman*, the *jīva*, and the mind are as follows. It is said in the *Bṛhadāraṇyaka-upaniṣad: "sa eṣa iha praviṣṭaḥ — The Supreme entered (in the form of the jīva) into these bodies, from that of Hiraṇya-garbha to a blade of grass."*[2] Likewise, it is conveyed in the *Taittirīya-upaniṣad: "tat sṛṣṭvā tad evānuprāviśat — Having manifested the universe, Brahman entered into that itself (in the form of the jīva)."*[3] As *Brahman* is all-pervasive, eternal, changeless, and without parts, there is just no question of the Supreme literally entering anything from elsewhere at any time. What these texts

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[1] The example is from the *Vedānta*-text, *Pañcadaśī* (Verse 8.9).

[2] *Bṛhadāraṇyaka-upaniṣad* 1.4.7. The translations of the texts cited here by His Holiness incorporate some *bhāṣya*-based clarifications.

[3] *Taittirīya-upaniṣad* 2.6.1.

reveal is that the non-manifest Supreme is perceived in the body in the intellect as the *jīva*; as the one who sees, hears, thinks, knows, etc.[1] Thus, the *Praśṇa-upaniṣad* says, *"eṣa hi draṣṭā spraṣṭā śrotā ghrātā rasayitā mantā boddhā kartā vijñānātmā puruṣaḥ — This one who fully pervades the body and is of the nature of knowledge is the seer, toucher, hearer, smeller, taster, thinker, knower, and doer"*[2] and the *Kaṭha-upaniṣad* states that, *"ātmendriya-mano-yuktaṁ bhoktety āhur manīṣiṇaḥ — The discerning ones term the Ātman when associated with the body, organs, and the mind as the experiencer (the jīva)*."[3] A limited parallel for the appearance of the Supreme *Ātman* in the body in the form of the *jīva* is the appearance of the sun in a body of water; a *Brahma-sūtra* is, *"ābhāsa eva ca — The jīva is surely a reflection of the Supreme (like that of the sun in water)*."[4] Though the sun remains as it is, in the form of its reflection in water, it conforms to the condition of the water, such as being still or shaking when the water is still or unstill. The *Bṛhadaraṇya-upaniṣad* brings out the distinctness of the *Ātman* from the intellect, mind, organs, and the body and that, as manifesting in and being identified, because of *avidyā*, with the intellect, it conforms to the intellect: *"ātmanaivāyaṁ jyotiṣāste palyayate karma*

[1] His Holiness explanation follows the *bhāṣyas* on these passages.
[2] *Praśna-upaniṣad* 4.9.
[3] *Kaṭha-upaniṣad* 1.3.4.
[4] *Brahma-sūtra* 2.3.50.

kurute vipalyetīti / katama ātmeti yo 'yam vijñāna-mayaḥ prāṇeṣu hṛdy antarjyotiḥ puruṣaḥ sa samānaḥ sann ubhau lokāv anusañcarati dhyāyatīva lelāyatīva — It is by the light of the Ātman that a person sits, goes out, works, and returns. Which one (among the body, organs, prāṇa, and the mind-intellect) is the Ātman? The infinite being who is identified (on account of avidyā) with the intellect, is amidst the organs, and is the light of consciousness within the intellect. Seeming to be the intellect (because of one's failure to distinguish between the Ātman, which illumines, and its limiting adjunct, the intellect, which is illumined), it travels between the present life and the next life (since the intellect does so). It meditates as it were (when the intellect meditates) and shakes as it were (when the intellect and the rest are unstill)."[1] That the *jīva*, which is seen conforming to the activities of the intellect, etc., is intrinsically non-different from the Supreme is taken up in the following *Brahma-sūtra* (His Holiness's explanation in line with the *bhāṣya* is reflected in the translation): "*prakāśādivac cāvaiśeṣyaṁ prakāśaś ca karmaṇy abhyāsāt — The effulgent one (the Ātman of the nature of consciousness) appears differently during activities (like meditation of the intellect-mind) as in the case of light etc., appearing differently (that is, as in the case of the effulgent sun appearing different in the form of a sunbeam that looks straight or crooked when a finger is held straight or*

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[1] *Bṛhadāraṇyaka-upaniṣad* 4.3.6-7.

bent in the sunbeam, and as space in a pot seems to shift when the pot is moved though space is actually all-pervasive, and as the sun, in the form of its reflection, appears to be still or unstill when the water in which it is reflected is still or unstill); yet, intrinsically, there is non-difference (of the jīva and the Supreme Brahman), for this is repeated in the scripture (with the teaching, 'tat tvam asi - You are that' being repeated nine times in the Chāndogya-upaniṣad)."[1] While the *jīva* is intrinsically *Brahman* and, even as reflected in the intellect like the sun in water, consciousness is distinct from the body, organs, mind, and intellect, nevertheless, on account of *avidyā*, it identifies itself with the intellect. It is this *jīva* as misidentified with the intellect that is object of the notion "I," not the changeless *Ātman*. Thus, it is said in the *Bṛhadāraṇyaka-upaniṣad*, *"na dṛṣṭer draṣṭāraṁ paśyer na śruteḥ śrotāraṁ śṛṇuyā na mater mantāraṁ manvīthā na vijñāter vijñātāraṁ vijānīyāḥ — You cannot see the 'seer of sight' (the eternal consciousness, which pervades the mental act of seeing and is, figuratively, the witness of vision). You cannot hear the 'hearer of hearing' (the perpetual consciousness, which pervades the mental function of hearing and is, metaphorically, the witness of hearing). You cannot think of the 'thinker of thought' (the eternal consciousness, which pervades the mental act of thinking and is, figuratively, the witness of thought). You cannot know the 'knower of knowledge'*

[1] *Brahma-sūtra* 3.2.25.

(the eternal consciousness, which pervades intellect's act of knowing and is, metaphorically, the witness of knowledge)."[1] Here, the text differentiates two kinds of vision. One is the ordinary, familiar vision; this is an act of the mind-intellect (with reflected consciousness) as connected with the sense-organ of sight and the object seen; it is characterized by a mental cognition of the object such as, "This is a pot." This vision has a start and end; it can be lost if the eyes are damaged; it is absent in one who is congenitally, fully blind. The *Ātman* of the nature of consciousness is, with respect to such cognitions, the unfailing witness; its 'vision' is eternal; never does any visual, mental *vṛtti* arise unwitnessed by the *Ātman* and never can any mental, visual cognition take place without the consciousness that is the very nature of the changeless *Ātman;* highlighting this, the text speaks of the *Ātman* as the seer of sight. Likewise, it refers to it as the hearer of hearing, thinker of thought and knower of knowledge. The *Ātman* — the seer of sight, the hearer of hearing, the thinker of thought, and the knower of knowledge — cannot, at any time, be known objectively.

His Holiness (continuing): In the state of deep sleep, the intellect-mind is, points out the scripture, latent; with its limiting adjunct, the intellect, latent, the *jīva* abides as the *Ātman.* Considering the objection that if

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[1] *Bṛhadāraṇyaka-upaniṣad* 3.4.2.

consciousness is the nature of the *Ātman,* how does it cease to know anything during deep sleep, the scripture teaches that the *Ātman* being eternal, its consciousness is never lost but there is nothing apart from it then for it to witness. The words of the *Bṛhadaraṇyaka-upaniṣad* are (the clarifications based on the *bhāṣya* given by His Holiness are included in the translation): *"yad vai tan na vijānāti vijānan vai tan na vijānāti na hi vijñātur vijñāter viparilopo vidyate 'vināśitvān na tu tad dvitīyam asti tato 'nyad vibhaktaṁ yad vijānīyāt — (Do not think that it does not know in the state of deep sleep.) That it does not know in the state of deep sleep is because even though knowing since the power of knowing of the Ātman can never be lost as it is Imperishable, it does not know since there is then no second thing besides it (no subject of knowledge, 'I', as this is dissolved), there is nothing other than it (no means of knowing such as the sense-organ of sight as this is dissolved) and there is nothing apart from it (no object of knowledge appearing as distinct), which It can know then*."[1]

§4.5 **His Holiness (continuing):** After describing, with stress on the experiencer, the three states of waking, dream, and dreamless sleep, the *Māṇḍūkya-upaniṣad* teaches the non-dual *Ātman* through negations thus: *"nāntaḥprajñaṁ na bahiṣprajñaṁ nobhayataḥprajñaṁ na prajñānaghanaṁ na prajñaṁ nāprajñam — It is not*

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[1] *Bṛhadāraṇyaka-upaniṣad* 4.3.30.

conscious of what is within (as in the dream state), nor conscious of what is without (as in the waking state), nor conscious of both the internal and the external (in an intermediate state), nor a mass of consciousness (as in the state of deep sleep), nor conscious of everything simultaneously, nor insentient."[1] Bhagavatpāda has said that the term '*nobhayataḥprajñam*, not conscious of the internal and the external' effects '*jāgrat-svapnayor antarālāvasthā-pratiṣedhaḥ*, negation of a state between waking and dream,' and the term '*na prajñānaghanam*, not a mass of consciousness' effects '*suṣuptyavasthā-pratiṣedhah,* negation of the state of deep sleep.'[2] In the *Nr̥siṁha-uttaratāpanī-upaniṣad*, waking, dream, and deep sleep are each sub-divided into four;[3] this text (which has no *bhāṣya* on it by Bhagavatpāda) has a gloss ('*dīpikā')* by Vidyāranya[4], who has also explained it in verses in the *Anubhūti-prakāśa*; as per Vidyāraṇya, one of the subdivisions of the waking state is characterized by the perception of objects through the senses, one by thinking, and the third by being quiet while awake. In the *Br̥hadāraṇyaka-bhāṣya-vārtika*, Sureśvarācāya has, while giving an alternative explanation of the passage "*sa vā esa etasmin samprasāde ratvā ...*"[5] apart from

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[1] *Māṇḍukya-upaniṣad* 7.

[2] Both H.H.'s explanations are quotes from Bhagavatpāda's *bhāṣya*.

[3] *Nr̥siṁha-uttaratāpanī-upaniṣad* 2.5-7.

[4] Authority on *Vedānta*; celebrated disciple of the great saint and *yogin*, Vidyātīrtha, the 10th pontiff of the Sringeri Sharada Peetham.

[5] *Br̥hadāraṇyaka-upaniṣad* 4.3.15.

that given in the *bhāṣya*, said that the states of waking, dream, and deep sleep are each subdivided into three; the second of the three subdivisions of the dream state is, for instance, marked by a dream within a dream.[1] Thus, the states of waking, dream, and deep sleep have been taught in detail in the scripture and subdivided also, explicitly in the *Nṛsiṁha-uttaratāpanī-upaniṣad* and implicitly in the *Bṛhadāraṇyaka-upaniṣad* as per an interpretation of Sureśvarācāya. Unconsciousness (*mūrcchā*) is mentioned in the *Rāmāyaṇa*, *Mahābhārata,* and the *Purāṇas*; for instance, it is said in the *Rāmāyaṇa* that when Rāvaṇa tried to lift Lakṣmaṇa but could not, Hanumān struck him forcefully on the chest with his fist and Rāvaṇa become unconscious;[2] Sage Nārada, as per the *Bhāgavata-purāṇā*, told Prācīnabarhis while making known the Truth that the sense of 'I' does not manifest in deep sleep and unconsciousness (*mūrcchā*).[3] Epilepsy (*apasmāra*) is explicitly mentioned in the *Mahābhārata* a few times; an instance from the *Śānti-parvan* that first comes to mind is of Sage Vasiṣṭha telling Karāla-janaka in the course of his elaborate exposition of the means to liberation that though the *jīva* is intrinsically beyond pleasure and pain, due to false identification with the body, it experiences pleasure and pain, and, though transcendent of all ailments, it regards itself as

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[1] *Bṛhadāraṇyaka-bhāṣya-vārtika* 4.3.1054-62.

[2] *Rāmāyaṇa* 6.59.113-117 (Gita Press Edition).

[3] *Bhāgavata-purāṇa* 4.29.71.

having ailments such as headache, toothache, fever, burns, leprosy (*kuṣṭha*), and epilepsy (*apasmāra*).[1] In the *Brahma-sūtras,* it is concluded that unconsciousness must be regarded as a state apart from waking, dream, deep sleep, and death, which are the conditions that are distinctly detailed in the scripture, and should not be included under any one of these four heads: "*mugdher ardhasampattiḥ pariśeṣāt — In the case of swoon, there is only partial attainment of the state of deep sleep, as this is the only alternative that is left*."[2] How this pithy aphorism distinguishes swoon from the states of waking, dream, deep sleep, and death has been spelt out in the *Brahmasūtra-bhāṣya* by Bhagavatpāda; for instance, it results from causes such as a blow by a club unlike deep sleep; a person in deep sleep breathes rhythmically, has his eyes closed, and looks calm, while a person who has swooned because of, say, a blow, may have convulsions with his eyes open, an unrelaxed visage, and interrupted breathing; a person in deep sleep can be awakened by pushing him with the hand while he who is convulsing without consciousness cannot be made conscious even by striking him; it is partially a form of sleep in as much as in both there is lack of awareness of anything and is different too from sleep; it is also partially like death as it is a door to death since a person may well pass away without regaining consciousness unless he has residual

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[1] *Mahābhārata* 12.303.5-7. H.H. named six of the 14 ailments listed.

[2] *Brahma-sūtra* 3.2.10.

karma to experience in this life. In both deep sleep and in swoon, the *jīva* abides as *Brahman*; the term '*ardha-sampattiḥ*, partial attainment' of the aphorism does not refer to any difference between swoon and deep sleep with regard to the *jīva's* abidance as *Brahman*. To sum up, the *śāstra* describes the states of waking, dream, and deep sleep, subdivides them too and even considers the existence of a state between waking and dream, refers to unconsciousness, accompanied by and without convulsions, and classifies it as a distinct state that is partially like sleep and partially a doorway to death. This scriptural coverage of states is comprehensive enough to at least indirectly accommodate the condition of one adversely affected mentally due to liquor or low sugar in the blood, one walking in sleep, etc.

§4.6 His Holiness (continuing): The *Chāndogya-upaniṣad* brings out the greatness of *prāṇa* through a fictional[1] story of the organs – organs presided over by deities[2] – arguing as to who among them is the greatest.[3] They approach Prajāpati; he tells them that the one on whose going from the body, it would become a corpse is the greatest. The organ of speech leaves the body, comes back after a year, and asks the others how they were able to survive till then without it. They respond that they lived like the dumb; while without speech, they

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[1] H.H.: "*kalpita.*" This is a word used in the *bhāṣya* about the story.
[2] This is clarified in the *bhāṣya* on *Chāndogya-upaniṣad* 5.1.15.
[3] *Chāndogya-upaniṣad* 5.1.1-15.

lived by means of *prāṇa,* seeing with the eye, hearing with the ear, and thinking with the mind. The organ of speech re-enters the body. The organ of sight goes out and returns after a year and learns that the others had lived as do the blind; next, the organ of hearing goes out for a year and returns and is told that the rest had lived as do the deaf. The mind leaves for a year, comes back, and asks how they survived without it. They say, "*yathā bālā amanasaḥ prāṇantaḥ prāṇena vadanto vācā paśyantaś cakṣuṣā śr̥ṇvantaḥ śrotreṇaivam iti — Like infants, whose minds are undeveloped, living by means of prāṇa, speaking by means of the organ of speech, seeing with the eye, and hearing with the ear.*"[1] The mind re-enters the body. *Prāṇa* starts to leave. The organs are pulled up, like a spirited horse uprooting the pegs to which it is tethered. Unable to continue in the body, they admit to *prāṇa* that *prāṇa* is the greatest among them, ask *prāṇa* to be their master, and request it to not depart from the body. This story finds a place in the *Br̥hadāraṇyaka-upaniṣad* also;[2] here, on the mind returning after a year and asking the others how they survived without it, they answer that they lived as do "*mugdhā avidvāṁsaḥ,* ignorant idiots."[3] Bhagavatpāda has clarified that the body in which the organs operated was animated by a distinct *jīva*, not by the deities such

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[1] *Chāndogya-upaniṣad* 5.1.11.

[2] *Br̥hadāraṇyaka-upaniṣad* 6.1.7-14.

[3] *Br̥hadāraṇyaka-upaniṣad* 6.1.11.

as Agni who graced the organs such as that of speech.[1] I communicated all this to point out that in two major *Upaniṣads* wherein much is spelt out about the mind, *jīva*, and the *Ātman*, this story too is presented in which a person, the one with the organs, abruptly becomes (with the supposed exit of the mind) mentally disabled, mentally equivalent to just an infant or unlearned idiot. In the *Mahābhārata,* wherein too the scriptural position about the mind, *jīva* and the *Ātman* is enunciated, there is a story in which Sage Jamadagni pronounces a curse on four of his sons named Rumaṇvān, Suṣeṇa, Vasu, and Viśvāvasu and they become greatly stunted mentally.[2] Ipso facto, these texts find no contradiction between their teaching about the mind, *jīva,* and the *Ātman* and the occurrence, for some reason, of even an abrupt, great drop in a person's mental level. When such is the case and loss of consciousness due to injury is spoken of, one need not look upon adverse impacts on the mind due to physical causes as antithetical to the scriptural teaching. The *Rāmāyaṇa*, *Mahābhārata,* and *Purāṇas* narrate that Saudāsa, a righteous king and an ancestor of Rāma, became, due to a curse, unable to resist killing and eating humans for a period; at the end of his time as a cannibal, he did not remember it.[3] The scripture is not contradicted by such changes due to physical causes.

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[1] *Bhāṣya* on *Chāndogya-upaniṣad* 5.1.15.

[2] *Mahābhārata* 3.116.10-12.

[3] *Rāmāyaṇa* 7.65.36. (*na smariṣyasi* – You will not remember.)

§4.7 **His Holiness (continuing):** Like the mind, *prāṇa* is subtle but its functional manifestations in the body in the form of, for instance, inhalation and exhalation can be observed and investigated. The scripture holds that the mind and *prāṇa* are interrelated. For instance, it is taught in the *Śāṇḍilya-upaniṣad* that*: "pūrakādy anil-āyāmād … manaḥspando nirudhyate — By the restraint of inhalation and exhalation, the fluctuation of the mind becomes restrained."*[1] Likewise, it is said in the *Skanda-purāṇa* that, "*cale vāyau calaṁ cittaṁ sthire tasmin sthiraṁ tataḥ — When the breath (prāṇa) fluctuates, the mind is unsteady. When the breath (prāṇa) is still, the mind is still*"[2] and in the *Yoga-vāsiṣṭha* that, "*yaḥ prāṇapavanaspandaś cittaspandaḥ sa eva hi — Prāṇa's fluctuation is indeed the same as the fluctuation of the mind.*"[3] The correlation between the mind and *prāṇa* is when the mind is not dormant. As per the scripture, while the mind becomes fully dormant in deep sleep and during unconsciousness, *prāṇa* is uninterruptedly active, right until death; life begins with the entry and ends with the exit of *prāṇa.* It is because of *prāṇa*, in its five aspects, that inhalation, exhalation, and digestion, which are functions of *prāṇa*, continue normally during deep sleep; as evacuation falls under the purview of *prāṇa*, a child may pass stools and urine even while it is

[1] *Śāṇḍilya-upaniṣad* 1.28-29. H.H cited just 1.28c and then 1.29d.
[2] *Skanda-purāṇa* 4.41.72.
[3] *Bṛhad-yogavāsiṣṭha* 5.92.31. *Laghu-yogavāsiṣṭha* 28.125.

fast asleep. Every physiological function and movement during a period of unconsciousness depends on *prāṇa* and none on the mind, which is then latent. Even when the mind is active, many a bodily function is handled by *prāṇa* without involving the mind and without one being conscious of it; for instance, the body remains erect even when one is fully unaware of the body and one's mind is fully focussed, in the state of *samādhi,* on, say, some form of Kr̥ṣṇa. A person may continue walking, swinging his arms, even when, for a time, he is conscious of just what he is very absorbedly thinking about. It is stated in the *Chāndogya-upaniṣad* about a person who has realized the *Ātman*, "*sa tatra paryeti… nopajanaṁ smarann idam śarīraṁ sa yathā prayogya ācaraṇe yukta evam evāyam asmiñ charīre prāṇo yuktaḥ — He moves there…without remembering the body born of the contact of a man and woman. Just as a prayogya (a horse or bullock) is yoked to a vehicle, likewise, prāṇa is yoked (by Īśvara) to this body*."[1] Interpreting the word '*prāṇa*' here in its literal sense and not as referring to the *jīva* (as done in the *bhāṣya* on the *Chāndogya-upaniṣad*), the word '*prayogya*' as referring to a well-trained horse, and the example as meant to clarify how the body of an enlightened sage is able to function aptly even as he has no sense of identity with it and does not remember it, Vidyāraṇya (author of noted works on *Vedānta* and 12th pontiff of the Sringeri Sharada Peetham) has explained

[1] *Chāndogya-upaniṣad* 8.12.3.

this passage as follows in his *Anubhūti-prakāśa*: "*rathe prayogayogyo 'śvaḥ śikṣitaḥ sārathiṁ vinā /svayam eva sadābhyāsād gantavyaṁ prāpayet khalu // īśvareṇāsya dehasya preraṇāya niyojitaḥ / prāṇas tat tad bhoga-deśe dehaṁ nayati karmaṇā — A well-trained horse that is fit to be yoked to a chariot surely takes, because of much practice, the chariot to the destination by itself, without any charioteer. Likewise, prāṇa, which has been assigned by Īśvara to impel the body, takes the body (of the enlightened person) to each place of experience in accordance with karma*."[1] In the *Bhāgavata-purāṇa,* in the *Uddhava-gītā*, a verse speaks, as brought out in the *Śrīdharī* (Śrīdhara's gloss, *Bhāvārthadīpikā)*, of an enlightened person whose mind is so inward-turned that he is not aware of even whether his body is seated or is getting up or is going somewhere or is returning: "*dehaṁ naśvaram avasthitam utthitaṁ vā siddho na paśyati yato 'dhyagamat svarūpam / daivād apetaṁ daivāvaśād upetaṁ vāso yathā parikṛtaṁ madirāma-dāndhaḥ — He, who has attained perfection, does not realize whether his perishable body that enabled him to realize his own true nature is seated or has got up or whether, as per karma, it has gone out or come back, just as a person deadened by drink is not conscious of whether the cloth on his waist remains or drops off.* [2]

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[1] *Anubhūtiprakāśa* 5.84-85. His Holiness began to give the overall meaning, stopped, thought for a moment, and cited the verses.
[2] *Bhāgavata-purāṇa* 11.13.36. The translation is *Śrīdharī*-based.

His Holiness (continuing): Whereas every single mental *vṛtti* is unfailingly witnessed by the *Ātman* and is never unknown, one does not have conscious awareness of mental impressions (*saṁskāra*, *vāsanā*). It is said in the *Muktika-upaniṣad* that fluctuation of *prāṇa* and mental impressions (*vāsanā*) constitute the seeds of the tree of the mind: "*dve bīje cittavṛkṣasya prānaspandana-vāsane — The tree of the mind has two seeds, these being the fluctuation of prāṇa and mental impressions.*"[1] It is also said therein that *prāṇa* and mental impressions interact: "*vāsanāvaśataḥ prāṇaspandas tena ca vāsanā — There is fluctuation of prāṇa due to mental impressions, and mental impressions (are triggered) by the fluctuation of prāṇa*."[2] Thus, *prāṇa* can carry out some bodily activities even in the absence of conscious awareness of them and it can be triggered by mental impressions, of which one is not conscious. In short, the *śāstra* accepts that actions can occur without one being conscious of them.

§4.8 **His Holiness (continuing):** Regardless of which *vṛtti* arises in the mind and no matter when it does so, one is necessarily conscious of it without any delay at all; this is discernible from the scriptural teaching that the *Ātman* is of the nature of consciousness and is eternal, that it is the 'seer of sight', etc. It does not, however, follow that the scripture would be contradicted if, for instance, an object comes into contact with one's hand

[1] *Muktika-upaniṣad* 2.27.
[2] *Muktika-upaniṣad* 2.26.

at some time and one does not consciously apprehend it then itself. One will have no conscious experience of it if the mind does not become linked, via the organ of touch, with it or one will sense it after it has been there for some time in case one's mind becomes associated with it through the organ of touch only after that time; this is discernible from scriptural statements such as, "My mind was elsewhere; I did not see it." You spoke of an experiment in which the conscious experience of a stimulus applied to the hand was prevented by a brain-stimulus whose application began up to a fraction of a second later. While, no doubt, the scripture does not speak of what was experimentally ascertained, it can, on the basis of the scriptural teaching, be said that a mental *vṛtti* related to that hand-stimulus did not, for whatever reason, arise and, hence, the stimulus was not consciously sensed; whether or when a *vṛtti* arises in the subtle mind that is associated with the *jīva* in all lives was neither determined nor findable by this study. Next, whatever be the *vṛtti* that arises, one's conscious cognition accurately corresponds to that; the *śāstra* has referred to the *Ātman*, to consciousness, by words such as "*sākṣī*, witness." Therefore, depending upon the *vṛtti*, one is aware of a pot, a pungent taste, anger, fear, etc.; from the standpoint of the *śāstra*, such were the *vṛttis* that arose in the minds of 'L.M.', 'C.M.', and 'Mr. W.', whose cases you described, that 'L.M.' saw a person in motion in just distinct positions, 'C.M.' saw not a circle of red light but half a circle of grey light and half a circle of red light, and 'Mr. W.' saw each of his dogs identifiably but not a human face. While the scripture mentions the association of the mind, sense-organs, and objects in the perception of objects, it does not detail perception's modus operandi and impairments, and nothing said in the *Upaniṣads*, *Bhagavad-gītā*, and the *Brahma-sūtras* about perception is called into question by these cases.

His Holiness (continuing): The *Bṛhadāraṇyaka-upaniṣad* teaches that though one is changeless consciousness, one erroneously identifies oneself with the body and that while dreaming, one sets aside the body as it were, and identifies oneself with a dream-body. Ipso facto, if one's identification with a part of the body were to become inhibited for any reason, one may not direct attention to or treat that part as before; the data about persons neglecting one side of the body following brain-injury is not incompatible with the scriptural teaching.

His Holiness (continuing): The presence of two *jivās*, each with a mind, must be admitted in conjoined twins and I had told you how the *śāstra* has room for this (vide chap. 1, pp. 77-80); hence, even if it were supposed that two *jivās* are there in one with a split-brain, that would be unproblematic for the *śāstra*; such being the case, it is not necessary for me to detail now why there is no need for two *jīvas* here and only thereby show that the split-brain data is unopposed to the scriptural teaching.

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5. Exposure to Physics

§5.1 This chapter contains the details that His Holiness blessed me with of His exposure, in 1941, to scientific studies of light, aspects of relativity, and elements of quantum mechanics. He vouchsafed this information (in Tamil) in the second half of July 1984 in ten sessions of about 15 minutes each; he was then camping at Kalady. He had told me on 4th February that year at Sondekoppa (near Bengaluru) that He would do so some time; at that time, while clarifying an issue, He had given the example of an electron not having any specific position prior to being detected somewhere, and I had silently wondered when He first heard or read of this. Some of the points of note about His Holiness in this chapter are:

1. His systematically guiding and spiritually uplifting in days a physicist named Murthi who approached him (in 1941) on learning that he had only a few months to live.

2. His dispelling Murthi's discomfiture at being unable to offer Him anything worthy as a mark of deep gratitude and delighting him by providing him the opportunity to expound physics to Him for an hour a day for a week.

3. His innovatively setting up, in private, and fruitfully performing the double-slit experiment with the unrelated materials at hand to observe for himself the interference pattern that Murthi told him about.

4. His imagining experimental situations and reflecting deeply on persons in uniform motion and their measuring the same speed of light; surmising, in his own way, time dilation and length contraction; and forming a diagram to estimate time dilation. (When Murthi concluded his second day's account by stating Einstein's two postulates

and that their implications were amazing, He felt inclined to think privately about what the implications might be.)
5. His posing apt questions and surmising points rightly about the topics that He was hearing of for the first time.

§5.2 **His Holiness:** Over 40 years ago, in 1941, a bachelor named Murthi came to Sringeri to request my *Guru* for initiation into a *Kṛṣṇa-mantra*, seek advice on how to meditate, and to pray for blessings that his mind may remain centred on Kṛṣṇa. Just some weeks earlier, it had been found and then confirmed that he was suffering from an incurable disease. Doctors told him that he could expect to live for only some months. He promptly quit his job and came to Sringeri. He wished to stay for ten days, then proceed to Brindavan, and live there centred on Kṛṣṇa till the end of his life. My *Guru* told him that I would initiate him into a *mantra* and teach him meditation, and wholeheartedly blessed him that by God's grace his desire to remain dedicated to God would be fulfilled. Before he came to meet me, my *Guru* told me about him and directed me to initiate and guide him. As it happened, that very evening, my *Guru* became withdrawn and remained so for weeks.

His Holiness (continuing): While conversing with me, Murthi told me that this was the second time he was receiving the blessings of my *Guru* in person. He said, "After my college studies in physics, I became a teacher of science. A few years later, in 1938, I learnt that the senior *Jagadguru* was then in Bangalore (Bengaluru).

I travelled to Bangalore and had His *darśana* there. The reason for my proceeding to His presence was purely worldly. To upgrade my knowledge of physics, I wanted to spend a fortnight in Dhaka and another fortnight in Calcutta (Kolkata); the great physicists Satyendra Nath Bose[1], whom I was in awe of, and Megnad Saha[2], who too I admired greatly, were at Dhaka University and Calcutta University respectively. I knew that there was practically no chance that I, who was just an ordinary teacher of science in South India, did not have a single research paper to my credit, had no recommendation, and knew no one in Dhaka or Calcutta, would be able to spend time with them. I thought that my chances of interacting with them would brighten greatly if I had the *darśana* of the senior *Jagadguru*, about whose true greatness I had heard. As I felt too ashamed to state my purpose to Him, I just prostrated before Him and mentally prayed to Him for His blessings for my trip.

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[1] Satyendra Nath Bose (1894-1974) after whom particles with integer spin are termed 'bosons' and who, with Albert Einstein, developed what is referred to as 'Bose-Einstein Statistics' and theorised what is called 'Bose-Einstein Condensate,' a state of matter at very low temperatures, close to absolute zero. He and his close associate, Meghnad Saha, translated into English from German the original articles of Einstein on the special theory of relativity and the general theory of relativity.

[2] Meghnad Saha (1893-1956) who contributed to astrophysics through his work on thermal ionization and formulated what is known as the Saha equation.

He kindly smiled at me and nodded. Shortly thereafter, I went to Dhaka and Calcutta. I was greatly surprised that at Dhaka, Bose, notwithstanding his stature and tight schedule, spared much time for me and treated me as if I had been his old student. I was able to freely interact with the scholars there and devote much time to reading. At Calcutta, again to my surprise, Saha gave me time. I was also able to have discussions with his students and engage extensively in study. All this was definitely nothing but a miracle wrought by the senior *Jagadguru*. Because of the powerful impact that His very presence had made on me in Bangalore and my experience of the power of His grace, when I learnt that I had only some months left, I strongly felt that I must have His *darśana* and seek His blessings, this time not for anything material but for firm devotion to God."

The next morning, I initiated Murthi into a *mantra.* I then taught him *prāṇāyāma* and instructed him about meditation. I found him to be devoted and unworried. During his stay, he dedicatedly performed much *japa* every day and put forth his best to meditate for hours, while seated at the Janardana Temple. He made a point of updating me daily, and I duly guided him. In response to his fervent request, I spoke to him every afternoon about Kṛṣṇa's glories and select teachings.

His Holiness (continuing): He was eager to offer me something prized to tangibly express his gratitude but felt ill at ease that he had nothing worthwhile to offer me. Assuaging him, I told him, “As you are versed in physics, you could tell me something about it daily.” He happily expounded it every afternoon for an hour. I can vividly recall his expositions. They were riveting.

§5.3 **His Holiness (continuing):** He started with light. He said that for some centuries, it was deemed to be a wave[1]. Newton (Isaac Newton, 1643-1727) advanced the view that it consists of particles[2]. Using sketches, Murthi described reflection[3] and refraction[4] and how Newton elucidated, in terms of his position, these two as also the separation of sunlight into seven colours. Murthi then said that a senior contemporary of Newton (Christiaan Huygens, 1629-1695) maintained that light is a wave and explicated this scientist’s idea about how light spreads by the formation of further waves and how reflection from a surface can be accounted for. Newton’s view prevailed over the other one for years. Having pointed this out, Murthi detailed an experiment performed at the start of the 19th century using a source of light, two slits[5], and a screen. He highlighted how its

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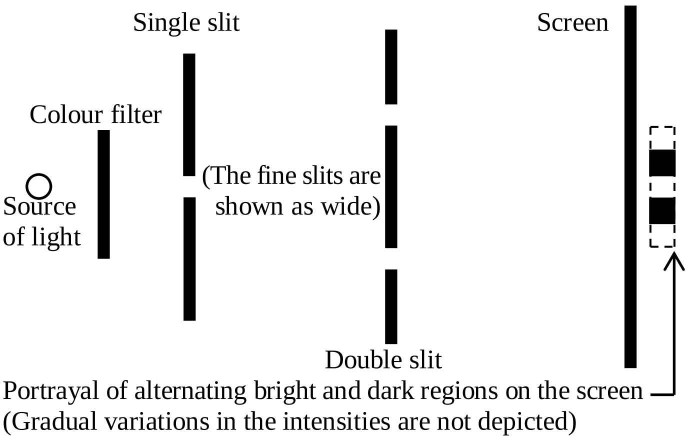
[1] What His Holiness said was ‘*taraṅga.*’ This and most of the other such Sanskrit words made use of by Him are in line with the terms seen in books on physics in Hindi.
[2] His Holiness: ‘*kaṇa.*’
[3] His Holiness referred to ‘reflection’ by the word ‘*pratiphalanam.’*
[4] With regard to ‘refraction,’ His Holiness said, in Tamil, ‘how light changes direction when it passes from one material to another, such as from air into water or from water into air.’
[5] His Holiness: ‘*rekhācchidra.*’

result was incompatible with the position that light is made up of particles and how it demonstrated that light comprises waves.[1]



Setup of the Double-slit Experiment (Not to Scale)

His Holiness (continuing): The portion of the screen that is midway between the pair of slits and, hence, equidistant from them is the brightest. On either side of the bright central band, there is a dark band followed by alternating bright and dark bands. All this disfavours the view that light consists of particles. On the other hand, it accords well with the position that light is in the

[1] Thomas Young's double-slit experiment described in his *A Course of Lectures on Natural Philosophy and the Mechanical Arts* (first published in 1807 by Joseph Johnson), facsimile reprint, vol. 1, Thoemmes, Bristol (UK), 2002, pp. 464-465.

form of waves. When Murthi spoke of light waves from two narrow slits adding up at a spot on the screen to form a bright band and neutralizing each other at an adjacent place to form a dark band, I was reminded of the reinforcement and the balancing out that I had once witnessed, well before my *saṁnyāsa*, of a pair of waves in water. My father had taken me with him to the lake (the Dharmambudhi Lake where the Kempegowda Bus Station in Bengaluru now stands) and was conversing there for long with some people. I sat down on the bank. Perhaps because it was noon and hot, there was no one using the lake nearby and the water appeared still. I playfully tapped the water rhythmically with my right hand. I beheld waves form and spread away from me, looking like parts of bigger and bigger circles. There were several dry leaves floating on the water. I noticed, with some surprise, that the leaves did not move away with the spreading waves; they simply moved up and down wherever they were. I then tapped the water with my left hand also, at the same rate. I saw another set of waves form and spread. Where the waves set off by my left hand crossed those started by my right hand, I saw something new. While some leaves moved up and down far more than earlier, some others between these did not appear to move at all. Recalling this, I asked Murthi if the formation of dark bands due to the light rays from the two slits counteracting one another was somewhat like two water waves offsetting one another at some places. He said this was so. He added that the scientist who described the double-slit experiment had himself spoken of the result of water waves meeting and of the effect of light waves meeting being like this.[1]

His Holiness (continuing): Murthi described one more experiment that favoured light's being a wave. In it, light passed through a tiny hole was shone on a small, circular object. A spot[2] of light was seen in the centre of the object's circular shadow on a screen. If light consists of particles that go straight, it could not have illumined that spot. Waves from the object's surface can add up there.

His Holiness (continuing): That a spot lit by a beam of light could become dark when a second beam of light was also directed to that spot intrigued me and I wished to observe this. Hence, that night, in the privacy of my room, I performed the experiment with two slits in a rudimentary way with the materials available with me. In those days, torchlights powered by batteries were not available in Sringeri. I, however, had one that had been submitted to the Math weeks earlier by a devotee and passed on to me by my *Guru.* I decided to use it as the source of light for the experiment. Murthi had explained why the light of the sun or a candle needed to be passed through a tiny hole or a narrow slit before

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[1] G. Peacock (ed.), *Miscellaneous Works of the Late Thomas Young*, vol. 1, John Murray, London, 1855, pp. 202-203.
[2] Arago spot or Poisson spot.

being made to fall on the double slits and why it was desirable to use light of one colour rather than white light, which is made up of seven colours. I had four (razor) blades that had been given to me by a devotee along with a tool kit some months after my *saṁnyāsa* (in 1931). He had told me that such (razor) blades were then produced only in America and by one company. I took the precautions suggested by him to prevent them rusting and checked them occasionally[1] but did not know what they were meant for. I decided to use them to form slits with very small width. I thought of forming a fine slit by positioning the straight, sharp edge of one blade very close to the straight, sharp edge of another blade. Six glass panes were lying unused in Sacchidananda Vilas for years. I had no idea when or why they had been procured, possibly by Srikantha Sastri. I carried them to my room that evening. They were all one foot by one foot in dimension and of the same thickness. Two were wholly red, two green and two colourless. I passed light from the torch through the red glass and what emerged from the glass and fell on a white paper held by me appeared to me to be just red light. I then placed the green glass after the red glass. When I did so, virtually no light fell on the paper. On observing this, I recognized that the red glass that I had was effectively allowing just red light to pass

[1] The razor blades of that time were produced only by the US-based Gillette and were not made of stainless steel.

through, while my green glass was, for its part, duly disallowing the red light to pass. I decided to keep the red glass in front of the torch to obtain red light. Making measurements and using a magnifying glass, I carefully positioned two blades in the middle of the other face of the glass so as to form a fine slit. I then covered the rest of the surface with carbon paper. I confirmed that the light from the torch passed through the red glass and emerged from just the slit as a very thin ray of red light. I then took up a colourless glass pane and determined where I should position the two slits on it so that the thin red beam would be centred between them. To form the two slits with very small separation between them, I took a fine (gold) thread from the *zari* border of my clothing, fixed it tautly on the glass and placed the sharp edges of two blades very close to it, one on either side. I used carbon paper to cover up the colourless glass except for the portion where the two slits were. The glass panes were such that it was not difficult to ensure, with supports, that they remained vertical on a wooden plank on the floor, with the torch positioned next to the red glass at the right height. White paper fixed on the other colourless pane served as my screen. Setting up all this took me about half an hour.[1]

[1] His Holiness did not tell Murthi about this experiment or about His reflection (the next day) on relativity. He clarified that He wished to make the most of Murthi's hour and not eat into it by sharing all this.

His Holiness (continuing): I was doubtful if this crude setup would result in my seeing alternating bright and dark bands as described by Murthi. However, when I darkened the room, turned on the torch and adjusted the distance of the screen from the slits, I could make out a vertical red band of light on the paper screen; on either side of it, there was a dark band followed by a red band.[1] I then carefully blocked one of the pair of slits with a blade. When I did so, I was able to discern dim red illumination in a portion that had been dark when both the slits were open. I reopened the closed slit and noticed that the said portion appeared dark again. Having seen for myself a spot lit by a beam of light become dark when another beam of light also fell on that spot, I dismantled the entire setup and went to sleep.

§5.4 **His Holiness (continuing):** On the second day of his exposition, Murthi started with the measurement of the speed of light. He said that for many centuries it was supposed that the speed of light was infinite and that it reached anywhere instantaneously. Thereafter, in the 17th century, an experiment was performed to

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[1] At a portion of the screen where the light waves arriving from the two slits are in phase, there is 'constructive interference' and the illumination there is greater than if only one slit were open. However, at a portion of the screen where the light waves from the slits are out of phase, there is 'destructive interference' and that portion appears dark.

determine the speed of light. A person stood on a hill with a covered lamp and a second person on another hill about a mile away. The first person uncovered his lamp. As soon as the other person perceived the light, he exposed his lamp and the first person noted when he saw it. The time interval between the first person opening his lamp and seeing the light from the other lamp was presumed to be the time taken by light to travel from the first hill to the second and then from the second hill to the first.[1] As soon as Murthi told me about the procedure, I voiced my misgiving. I told him that people cannot react instantaneously, and so, there would be a temporal gap between the second person perceiving the light from the first lamp and uncovering his lamp. In view of our unavoidable reaction time, the experiment cannot be reliable even if light were to take as much as a tenth of a second to travel the mile from one hill to the other, and there is no question of light being expected to require even a tenth of a second to cover the mile. After all, at sunrise, we are able to see light all over the sky without our being able to discern any time for the light to spread. Murthi agreed and communicated that this experiment did not result in the ascertainment of any finite speed of light.

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[1] Such an experiment was described by Galileo Galilei in 1638 but whether he actually performed it is uncertain. The Academia del Cimento of Florence conducted this experiment and reported the details in 1667.

His Holiness (continuing): Murthi then described an interesting astronomical study that showed that the speed of light is finite. He said that in the 17th century, several moons of Jupiter[1] were identified, and it was ascertained that the moon closest to Jupiter goes around it once in about 42 hours. This moon is called 'Io'[2]. Murthi said that it becomes hidden from the earth each time it goes behind Jupiter in the course of its orbit[3] around the planet. Therefore, as seen from the earth, an eclipse of Io occurs repeatedly. A scientist (Ole Rømer) recorded the timings of the eclipses over a period of several years. He found that the interval between eclipses decreases as the earth moves nearer Jupiter and increases as the earth moves away from Jupiter.[4] He understood that this is because the speed of light is finite and light takes less and less time to reach the earth as the earth moves closer and closer to Jupiter and more and more time to reach the earth as the earth moves farther and farther from Jupiter. On the basis of his data and the then accepted size of the earth's orbit[5], another scientist (Christiaan Huygens)

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[1] His Holiness referred to Jupiter by its Sanskrit name '*guru.*'

[2] His Holiness first laughingly pronounced the name as '*aiyō*', a word of exclamation in Tamil, and then, seriously, as '*io.*'

[3] His Holiness: '*pradakṣiṇa.*'

[4] Ole Rømer (1644-1710) reported his findings and reasoning to the French Academy of Sciences in 1676.

[5] There was an error of a few percent in Rømer's estimate of the diameter of the earth's orbit. Huygens approximated this.

computed the speed of light to be around 132,000 miles per second. Murthi pointed out that the correct speed is about 186,300 miles per second.[1]

His Holiness (continuing): He then conveyed that the first earth-based scientific experiment that yielded a finite speed of light was conducted only over 150 years later, in the middle of the 19th century.[2] Describing this experiment, Murthi said that the setup comprised a source of light, a rotating wheel with many teeth and a mirror that was located five miles away. A bright flash of light passed through the gap between two successive teeth of the wheel, went to the distant mirror, and returned. If, by the time the light returned, the rotating wheel turned to the extent that the next gap between the teeth took the place of the previous gap, the returning light encountered no obstruction and passed through. On the other hand, if the wheel did not turn this much, the returning light encountered a tooth and was obstructed. The speed of the wheel was increased till the returning light was able to pass through. The time taken for the light to go outwards for five miles and return was then equal to that taken for one gap of the turning wheel to take the place of the earlier one. As the size of the teeth, the number

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[1] The speed of light in vacuum is 299,792,458 metres per second (186282.3971 miles per second).

[2] Armand Fizeau (1819-1896) performed this experiment and reported its result in 1849.

of teeth, speed of rotation, and the distance travelled by the light were known, the speed of light could be computed. Murthi said that the speed of light reported (in 1849) on the basis of this experiment is only about five percent more than its actual speed.

His Holiness (continuing): He then described another earth-based experiment that, he said, had been done 15 years earlier (that is, in 1926) and gave an accurate value for light's speed.[1] First, the distance between two mountains, which was about 22 miles, was carefully measured such that any inaccuracy was less than one inch. A very powerful flash of light was produced in the research centre on the first mountain by the use of several generators. The flash was so bright that it was capable of even lighting up the sky between the mountains. The light was precisely directed to one face of an eight-faced mirror. Reflected from that face of the mirror, it travelled to a mirror on the second mountain 22 miles away and returned from there. The returning light fell on another face of the octagonal mirror and entered a viewing device. This experiment was then performed with the octagonal mirror rotating. If, by the time the light went outwards and returned, the

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[1] Albert Michelson (1852-1931) performed this experiment in the USA, with light being directed from Mount Wilson to Lookout Mountain. It was completed in 1926. The speed of light arrived at was 299,796 kilometres per second (186284.6 miles per second).

mirror turned such that a face was in the right position to direct the light to the viewing device, the flash was seen through that device. On the other hand, if the rotating octagonal mirror was in any other position when the light returned, the light did not pass into the viewing device. Much data was gathered by doing the experiment again and again, for two years, with the mirror being rotated in a controlled manner, at various speeds. The speed of light was worked out based on the to and fro distance travelled by the light and the speed of rotation of the octagonal mirror that resulted in the returning light passing into the viewing unit.

His Holiness (continuing): I asked him how long light takes to come to the earth from the moon, from the sun, from the brightest star that we see, *Mṛga-vyāḍha* (Sirius or Dog Star), and from the *Dhruva-nakṣatra* (Pole Star). He stated that the moon is about 240,000 miles from us, and light takes about one and a quarter seconds to cover this distance.[1] The sun is about 93 million miles away, and light takes about eight and a quarter minutes to arrive from there.[2] He said that in

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[1] The distance of the moon from the earth varies between 225, 623 miles and 252,088 miles. The average distance is 238,855 miles and the time taken by light to traverse this is 1.28 seconds.

[2] His Holiness said 'about 930 lakh miles.' The distance of the earth from the sun varies between 91.4 million miles and 94.5 million miles. The average distance is 92.9 million miles and light takes 8 minutes and 19 seconds to cover this.

a year, light covers about six trillion miles[1]. It takes about eight years to come here from *Mṛga-vyādha* (Sirius)[2] and a few hundred years to reach us from the *Dhruva-nakṣatra* (Pole Star).[3] He added that on a clear night, we can see stars from which light arrives after well over a thousand years. Recapitulating the times mentioned by him, I asked him whether, in view of the finite speed of light and the great distances involved, scientists hold that we see the moon only as it was one and a quarter seconds earlier, the sun as it was eight and quarter minutes earlier, *Mṛga-vyādha* (Sirius) as it was about eight years earlier, the *Dhruva-nakṣatra* (Pole Star) as it was a few hundred years earlier, and several stars as they were well over a thousand years earlier. His answer was that such is the case and that scientists maintain that when we look up at the sky at night, we see what was there at various times in the past, with what is more and more distant seen here now as it was further and further in the past.

His Holiness (continuing): He then pointed out that the light that we get from the sun, the moon, the stars and terrestrial sources like oil lamps; the heat that we obtain from the sun and from fire here; radio signals;

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[1] His Holiness said, in Tamil, 'six lakh crore miles.'

[2] 8.1 years.

[3] The European Space Agency's *Gaia Data Release 2*, released on 25 April 2018, shows that light from the Pole Star takes 445.5 years to reach us.

and X-rays are all waves of the same kind, with just different wavelengths[1]. Electricity and magnetism[2] were, he said, once thought of as distinct phenomena. The discovery that a current in a wire can make an iron piece a magnet and that a moving magnet can give rise to current in a wire led to the realisation that the two are not disparate. Years earlier, soon after I first went to Bangalore by car from Sringeri (in 1936), I asked an engineer how a car's engine functions. In the course of his explanation, he touched upon how electricity is produced and used in a car. This led me to ask him and learn how electricity is generated at Shivasamudram[3]. I thus knew that electricity and magnetism are related. Murthi said that light, heat, X-rays, etc. are waves with two constituents: An oscillating electric field[4] and an associated, oscillating magnetic field. These stimulate one another. Like water moving up and down and a wave spreading sideways, the light wave travels in a direction that is perpendicular to these[5].

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[1] His Holiness: '*taraṅga-dairghya.*'

[2] His Holiness referred to electricity and magnetism by means of the words '*vidyucchakti'* and *'cumbaka-śakti'* respectively.

[3] The first hydro-electric power station of the then Princely State of Mysore was commissioned in 1902 at Shivasamudram. The Shivasamudram Water Falls are on the Cauvery (Kaveri) River.

[4] The Sanskrit expression '*spandamāna-vaidyuta-prabhāva*' used by His Holiness denotes 'an oscillating electrical influence.'

[5] His Holiness gestured to show the two fields and light's advance.

§5.5 **His Holiness (continuing):** Murthi said that about 300 years before, an Italian scientist (Galileo) had, while making the case that the earth rotates and also goes around the sun, pointed out through an example that a person moving at a constant velocity does not sense that he is in motion. A person is in the lower part of a big ship. Regardless of whether the ship is motionless or moving straight at any constant speed without any shake, he does not find any difference in how water falls drop by drop from a container into a bowl. He does not notice any change in how the smoke of burning incense rises up. He does not find changes in how an object tossed by him in different directions moves.[1]

His Holiness (continuing): Having described the Italian scientist's ship-related example, Murthi mentioned that in keeping with this, Einstein posited that the laws of physics are the same for every observer[2] in uniform motion. He further posited that the velocity[3] of light in empty space is the same for all observers. Saying just that the implications of these two postulates[4] are astonishing, he concluded his second day's account.

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[1] Galileo Galilei, *Dialogue Concerning the Two Chief World Systems* (first brought out in Italian in 1630), Translated by S. Drake, Second Edition, University of California Press, Berkley and Los Angeles, 1967, pp. 186-187.
[2] His Holiness: '*avekṣaka.*'
[3] His Holiness: '*vega.*'
[4] His Holiness: '*abhyupagama.*'

His Holiness (continuing): Since Murthi had said that the implications were astounding, I decided to spend some time thinking about them. I first considered the example of the person in the ship. Prior to travelling straight at some constant speed, the ship would have started from rest and gradually picked up speed till that uniform speed was reached. During this time, he would have sensed a little tug and discerned that he was moving. However, the states to be considered are only those of the ship being stationary with respect to the shore and being in uniform motion with respect to it. Hence, I imagined that the man enters the lower part of the ship when it is near the shore, does not, obviously, sense any motion, does some experiments, and falls asleep. By the time he gets up, the ship is moving straight, at a uniform speed. After getting up too, he does not sense any motion. He continues with his experiments. He observes, for instance, that the water drops look like before, fall vertically as before, and also take the same time as before to fall the one foot from the container above to the bowl below[1]. This means that the laws of nature, or at least those that are relevant to the results of his studies, operate in the same way after he gets up (that is, when the ship is moving straight at a uniform speed with respect to the shore) as they did before he fell asleep (when the

[1] The time taken for the water drops to fall the one foot from the container to the bowl would be 0.3 second.

ship was not moving with respect to the shore). Hence, after getting up, he discerns that he is not in motion not merely because he feels no jerks but also since his studies show that everything is as it had been before he fell asleep (when the ship remained stationary near the shore).

His Holiness (continuing): At this point, I happened to recall Bhagavatpāda's illustration in the *Bhagavadgītā-bhāṣya*, "To a man in a moving boat, the stationary trees on the bank appear to move in the opposite direction." With this in mind, I imagined that the man in the ship looks out through a tightly closable opening at a height and sees another ship nearby. That second ship is stationary (with respect to the shore). However, this person, who discerns that his ship is stationary, perceives the second ship as moving past him in the opposite direction. The speed at which he finds the second ship moving is the constant speed at which his own ship is moving (with respect to the shore). I then imagined that in the second ship there is a closable opening at the same level as in the first ship. Inside that ship, a person is watching water fall drop by drop, straight down from a vessel into a bowl kept a foot below. The person in the first ship is able to see what is happening inside the second ship when the openings of the ships pass one another. One watering plants from a pot while walking sees the water falling straight down, but the persons standing nearby see the water falling to the front in a curved path (His Holiness showed with His hand, a semi-parabolic path). Likewise, the person in the first ship sees the water drops in the second ship falling in a curved path into the bowl. On the basis of this observation, he confirms that the second ship is indeed moving. On the other hand, the person in the second ship sees the water drops fall vertically. He finds the first ship moving past his ship and observes that water drops are falling in a curved path in that ship. He confirms thereby that the first ship is indeed moving. I then conceived that the second ship is not stationary with respect to the shore. It is travelling without jerks at a uniform speed but in a direction opposite to that of the first ship. In this situation too, the person in the first ship discerns that his ship is stationary and that the second ship is the one that is moving. However, he sees the second ship as moving faster than he would have done had that ship been stationary. Further, he sees the falling water drops in the second ship taking a longer path than he would have observed had that ship been still. Similar to this is what the person in the second ship makes out with respect to the first ship.

His Holiness (continuing): As far as a person standing on the shore is concerned, he is not moving and these two ships are the ones that are moving. I imagined a person stationed on the sun, observing the earth and the man on the shore. While he finds himself to be stationary, he sees that the man on the shore is not at rest and that he is moving along with the earth. I thereafter imagined a person observing the sun and the earth from afar in space. I reasoned that he would see himself as stationary and would see the man on the sun not as stationary but as rotating with the sun. Furthermore, he would see the man on the shore as rotating with the earth and also moving with the earth, around the sun. My conception of a person on the sun observing the earth and another observing the sun and the earth from somewhere in space was fanciful. However, it helped me to extrapolate the example of the ship of the Italian scientist (Galileo) and appreciate that steady motion is something relative[1]. After all, tacitly accepting the earth as our reference, all of us find ourselves to be stationary when we are standing. Though rotating with the earth, we do not sense this and, instead, see the sun rising in the east and setting in the west every day. Though hurtling through space, going around the sun in a year, we do not discern that we are moving and, on the contrary, note that the sun moves northwards for six months and southwards for six months.

His Holiness (continuing): I imagined that the moon has air and an ocean, as on the earth. There is a ship in the lunar ocean. A person in it is observing water drops falling from a vessel into a bowl kept a foot below. I

[1] His Holiness: '*sāpekṣa.*'

reasoned that as the gravity[1] on the moon would be different from that on the earth, the falling of the water drops there would not be identical to that on the earth[2]. Nonetheless, just like on the earth, there would be no difference between how the water falls when the ship proceeds straight at a uniform speed, without any shaking, and how it falls when the ship is stationary with respect to the shore there. Hence, just as on the earth, the person in the ship would, not only on account of not feeling any jerks but also on the basis of studies such as this, conclude that he is not in motion. A person on the shore there would discern that he is stationary and that the ship is moving. On the other hand, a person standing on the earth would see that person as moving with the moon. The person on the shore on the moon would, for his part, see the person on the earth not as stationary but as moving with the earth. Thinking in this fashion about the ship on the moon helped me to grasp further how steady motion can be indiscernible and how it is relative.

His Holiness (continuing): I then turned to Murthi's statement that Einstein deemed that the speed of light in space is the same for all observers. I thought of a

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[1] His Holiness said '*adhaḥ-karṣaṇa*', which means, 'downward pull.' On subsequent occasions, He used the Hindi term for 'gravity.'

[2] The time for a water-drop to fall the one foot from the container to the bowl would be 0.75 second on the moon, unlike 0.3 second on the earth.

ship and a person within it conducting studies on the speed of light. The ship faces east and is stationary, near the shore. The person shines a light towards the front of the ship (that is, to the east) and, somehow, measures its speed accurately. Murthi had said that the speed of light is about 186,300 miles per second. Rather than recollect this again and again, I decided to think of the value as *c* in view of Murthi having stated that the true speed of light in space is denoted by *c*. The person finds the speed of his beam to be exactly *c*. For convenience, I deliberately chose to overlook the point that this beam is moving through air, while *c* is the speed of light moving in airless space. As light passed through air in some of the elegant experiments conducted to measure the speed of light, I presumed that the discrepancy between *c* and the speed of light in air is small[1]. The person in the ship then shines light in the opposite direction (the west) and, once more, finds that its speed is *c*. He continues by directing light northwards, southwards, upwards, and downwards. Each time, he finds that its speed is *c* only. After this, he sleeps for some time. While he is asleep, the ship starts and picks up speed. By the time he wakes up, it is moving eastwards at a uniform speed, without any shake. Resuming his study, he directs a beam of light towards what he knows is the front of the ship (that is,

[1] The velocity of light in air is about 99.97 % of that in space.

towards the east) and measures its speed. He finds it to be exactly *c*. As he had done previously, he then directs a beam westwards, northwards, southwards, upwards, and downwards. Each time, he determines that its speed is exactly *c*. Thus, even by measuring the speed of light in different directions, he cannot identify that his ship is not stationary near the shore but is travelling at a uniform speed.

His Holiness (continuing): I then considered a man on the shore facing this ship that is steadily moving away from him at night. He points a light in the direction of the ship and measures its speed. He finds it to be exactly *c*. As this beam of light goes past the ship, the person in the ship observes it through his opening and measures its speed. He also finds its speed to be *c*, not *c* minus the uniform speed at which the ship is moving in the direction of the beam. I then thought of a second ship moving at some other uniform speed in a direction opposite to that of the first ship. A person in the interior of the second ship also notices the beam from the shore passing nearby and measures its speed. He finds this beam's speed to be exactly *c*, not *c* plus the unchanging speed of the second ship, which is moving in a direction opposite to that of the beam. I acknowledged that every one of these measurements of the speed of the beam of light from the shore yields the same result because the speed of light is posited to be the same for all observers.

His Holiness (continuing): Since the person in the first ship measures the speed of the light from the shore to be exactly *c* even though the ship is moving away from the shore at some constant speed, I inferred that no matter how fast anyone may manage to travel at a uniform speed, one cannot overtake a beam of light. After all, regardless of whether the ship moves steadily at just one mile an hour or unrealistically fast at 100,000 miles per second, the person in it will find the ray of light from the shore going past the ship at a speed that is exactly *c*.

His Holiness (continuing): Earlier, I had conceived that a person in a steadily moving ship is studying the fall of water in drops from a container into a bowl below. I had noted that while he finds the water drops falling straight down into the bowl, a person in a stationary second ship sees these drops falling in a curved path. In keeping with this, I conceived that the person in the steadily moving first ship is directing light downward and the person in the stationary second ship is seeing this. I noted that while the light is travelling straight down as observed by the person in the first ship, the person in the second ship sees it taking a straight, but slanting, path downward (His Holiness indicated the path by a movement of His hand). I understood that the second person would not find the light taking a curved path like a falling drop of water. This is because the speed of light is constant, while a drop of water falls with rising speed. I had visualized water drops falling a distance of one foot from the container above into the bowl below and recognized that the time taken for them to drop that one foot is the same regardless of whether the ship is stationary or moving at a uniform speed. In line with this, I imagined that the person in the first ship keeps a foot rule vertical, directs a beam downward from its initial mark, and records, using a watch, the time the ray takes to reach the final mark on the foot rule. I did realize that the speed of light is so great that even a second is many crore times greater than the time required by light to travel one foot.[1] Yet, I simply supposed that he is able to measure this time. As per his assessment, light travels straight down along the foot rule and therefore moves exactly one foot to reach the final mark from the initial mark. The time taken by the ray to reach the final mark and measured by him is, thus, that taken by it to travel one foot. He determines that the speed of that beam is exactly *c*. The person in the second ship also measures the time taken by this very beam to travel from the initial to the final mark of that very foot rule. However, as discerned by him, while the light journeys from the initial mark, the foot rule moves sideways, along with the first ship. Even if the ship were to move as fast as a bullet, its speed would be negligible compared to the tremendous

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[1] One second is about 100 crore times (one billion times) the time taken by light to travel one foot.

speed of light. Consequently, by the time light reaches the final mark, the foot rule would have practically not moved sideways. I imagined, therefore, that the ship is moving unrealistically fast, at half the speed of light. Due to the very swift sideways movement of the foot rule, the person in the second ship sees the beam of light travelling in a slanting path and, hence, covering more than a foot to reach the final mark. Still, like the man in the first ship, he also finds that the speed of that beam is *c*, for light's speed is the same for all observers.

His Holiness (continuing): A point that struck me as significant was that though both the persons measure the time taken by the same beam to travel from the initial mark to the final mark of the same foot rule, they record different values. The time recorded by the person in the first ship (who sees the light as having travelled one foot) is less than that recorded by the one in the second ship (who sees that beam as having travelled more than one foot). Else, the two persons could not have arrived at the same value *c* for the speed of that beam. I conceived that on finishing his measurement, the person in the first ship writes it on a board and records that this is the time taken by light to go from the initial to the final mark of the foot rule. The writing on the board is seen by the person in the second ship. From it, he first comes to know that, like himself, the person on the first ship has measured the time taken by the beam to reach the final mark on the foot rule from the initial mark. He also notes that that person has recorded a shorter time than what he has determined. There being no reason for him to doubt that person’s meticulousness, he concludes that the watch used by that person is running slow.

His Holiness (continuing): If the first ship is stationary, he does not observe any sideways movement of the foot rule, finds the beam of light moving straight down from the initial to the final mark, and measures the same time for the light’s travel as that recorded on the board in the first ship. He does not conclude that the watch in the first ship is running slow. It is only when the first ship is moving relative to his that he decides that that watch is running slow. I proceeded to reason that, as found by him, the more the steady speed of the first ship, the more would be the sideways movement of the foot rule and, as a result, the more extended would be the path of light to reach the final mark from the initial mark. As a consequence of light having to travel further to reach the final mark and because the speed of light is the same for all observers, the more the first ship's steady speed, the more would be the time measured by him as compared to that measured and recorded on the board by the person in the first ship. His ascertainment, in the light of the measurements, of how slowly the watch in the first ship is running compared to his watch depends, thus, on the speed of the first ship with respect to his ship.

His Holiness (continuing): The movement of the first ship relative to the second ship and the constancy of the speed of light are responsible for the person in the second ship construing that the watch in the first ship is running slow and not any defect in that watch. Therefore, even if the person in the second ship were to directly observe the running of the watch in the first ship and compare it with the running of his watch, he would still conclude that the former watch is running slowly. It was only at this point in my thinking that I realized that he would see not just the watch but also everything else in the interior of the first ship, with light the sole exception, functioning slowly. He would, for example, find that the person in that ship moves slothfully, closes and opens his eyes slowly, and even breathes sluggishly. He would find water drops falling slowly from the vessel above into the container below. Thus, as ascertained by him, the very course of time[1] would be slow there; the extent of slowing would depend upon the speed at which the first ship moves with respect to his ship.

His Holiness (continuing): I had earlier inferred that no matter what steady speed one manages to achieve, one cannot overtake a beam of light since, regardless of whether one travels steadily at one mile per hour or at 100,000 miles a second, a beam of light goes past

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[1] His Holiness: '*kāla-gati.*'

one at the speed *c*. I presumed that only light and, maybe, what is akin to light can travel at exactly *c* and that none can reach this speed. I, nevertheless, thought of what might happen if the steady speed of the first ship were to be *c*. I readily concluded that from the perspective of the person in the second ship, the watch in the first ship would not be running at all. The person there would be completely motionless, without any sign of eye-movement, breath, or even a heartbeat. A water drop that is midway between the upper vessel and the container below would remain just suspended in space. In short, time would appear to have stopped there. I arrived at this conclusion by considering, from his perspective, the movement of the beam of light from the initial mark of the foot rule in the first ship. The foot rule moves with the ship and, accordingly, its final mark moves eastwards in a horizontal straight line at the speed *c*. At the start, the beam is one foot directly above the final mark. Hence, if the beam is to reach the moving final mark at some time, the beam has to cover a longer distance than that covered by the final mark in that time. However, the speed of the beam and that of the final mark are both exactly *c*. Hence, the beam can never reach the final mark. This would be the case even if it were initially one inch or one-thousandth of an inch above the final mark. Thus, as seen by him, the beam does not travel downwards at all and all it does is to travel eastwards at a speed of exactly *c*, keeping pace with the initial mark, which is also moving at the speed *c*. I then easily figured out that he, who finds light itself maintaining its position at the initial mark of the foot rule, would see the person and the water drop as motionless.

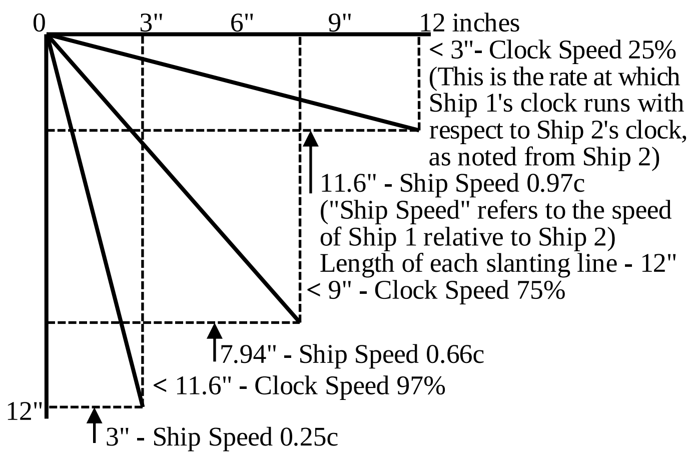
His Holiness (continuing): I surmised that though an object cannot, even in principle, reach the speed *c*, it could, conceivably, reach a uniform speed of almost *c*. If the speed of the first ship is almost *c*, he sees the beam moving not thoroughly horizontally but in a very slightly inclined path towards the final mark. He finds the watch, the person, and the drop of water there to be well-nigh but not completely motionless. There is no slowing of time when the first ship is stationary and only trifling slowing even when it travels at 100,000 miles per hour as even this very great speed is much less than a thousandth part of the speed of light. There is great slowing as the speed approaches that of light, with time almost stopping when the speed is almost that of light. I did not lose sight of the fact that while there is such slowing of time in the first ship as found by the person in the second ship, for the person in the first ship, everything there is normal only.

His Holiness (continuing): I proceeded to think about the relation between the speed of the first ship (with reference to the second ship) and the slowing of time there as found by the person in the second ship. I noted that as both the persons find the beam moving from the initial mark of the foot rule at the same speed *c*, therefore when the person in the first ship finds that it has moved one foot, the person in the second ship must, regardless of whatever the speed of the first ship is, also find that it has traversed one foot. The only difference is that if the first ship is stationary, both find that the beam has travelled one foot straight down from the initial mark, while if the first ship is moving at a uniform speed, the person in the second ship finds that the beam has moved one foot from the initial mark in a slanting, downward path. At this point, I realized that I could use a simple sketch to compute, for any speed of the first ship, the extent to which the flow of time is slowed down there, as assessed from the second ship.

His Holiness (continuing): *{What His Holiness conveyed partly through words and partly through gestures is put fully in words in this paragraph.}* I took two sheets of paper[1] and pasted them together so as to form a large sheet. In it, I marked a point to represent the initial mark of the foot rule in the first ship. With the aid of my foot rule, I drew a line one foot long, straight down from that point. This line represented the foot rule in the ship, with the bottom of that line corresponding

[1] These sheets were, presumably, of foolscap size (thirteen and a half inches height and eight and a half inches width).

to the final mark. I then drew a horizontal line one foot long from the initial point. Next, from the point, I drew a slanting line one foot long, between the vertical line and the horizontal line. I bore in mind that when the person in the first ship finds the beam at the bottom of the vertical line, the person in the second ship finds it at the end of the slanting line. I took my foot rule and measured the distance of the end of the slanting line from the vertical line. I did so as I recognized that this distance depended on the speed of the first ship. If the speed were one quarter that of light, the distance would be three inches; if the speed were half that of light, it would be six inches; if the speed were three fourths that of light, it would be nine inches, and so on. Then, I measured how far the end of the slanting line was from the horizontal line. I understood that this distance shows how slow the person in the second ship finds time flowing in the first ship. After all, this is the distance that the person in the second ship finds light to have travelled down the foot rule when the person in the first ship finds it at the final mark of the foot rule. If the distance is three inches, then, as discerned by the person in the second ship, the time in the first ship moves at one fourth that in his ship; if the distance is six inches, then he finds time in the first ship flowing at half that in his ship; if the distance is nine inches, he finds time passing at three fourths the rate in his ship, and so on. Accordingly, with one slanting line and two measurements, I found the extent of slowing for one speed. To relate other degrees of slowing with speeds, I systematically drew more slanting lines, with different slopes. From my two measurements on each of them, I ascertained that the extent of slowing does not vary uniformly with speed. It grows mildly at speeds that are much less than that of light and rises rapidly as the speed of the first ship comes closer and closer to that of light.



Representation of Diagram Conceived By His Holiness

His Holiness (continuing): Recalling that as determined by the person in the first ship, his ship is stationary and the second ship is moving westward at a steady speed, I reasoned that he finds time to be running slow in the second ship to the very same extent that the person in that ship finds time to be running slow in the first ship. Each of the persons finds everything to be normal in his own ship. I recognized that if the speed of light is to be the same for both of them, the flow of time in a ship needs to be measured differently by them and so it is not as though one of them is right and the other wrong. I thought of the following analogy. A person is standing on the North Pole and another on the South Pole.[1] There is a mirror situated midway between them in space, and this moves with the earth, such that it appears stationary to both of them. Each of them is able to see, through a telescope, the reflection of the other in this mirror. As determined by the first person, while he is standing upright on the ground, the other is hanging upside down like a bat. The second person finds himself upright and the first one upside down. Because the earth is round, which direction is up is not the same for both of them, and so, it is not that one of them is right about what is up and the other wrong. Because the earth is rotating, at the very instant when it is noon in India, it is night in the United States, and neither the statement of one in India that it is day nor that of one in the United States that it is night is erroneous. As the speed of light is *c* for all observers, persons who are moving at a constant speed relative

[1] His Holiness referred to the poles as the 'northernmost' and the 'southernmost' spots on the earth.

to one another ascertain the flow of time at even the same place dissimilarly with respect to their own clocks and, though distinct, their findings are valid.

His Holiness (continuing): I then thought of what would happen if the person in the first ship (who finds that the watch of the person in the second ship is running slowly) and the person in the second ship (who finds that the watch of the person in the first ship is running slowly) were to meet and compare the times shown by their watches. It was obvious that they can never meet as long as the first ship is moving at a uniform speed with respect to the second ship. For them to meet, the first ship that is moving eastwards at a steady speed would have to slow down, stop, start travelling westwards, and then slow down and stop next to the second ship. Murthi had mentioned only steady speed and the constancy of the speed of light and, in view of that, I had all along taken into account only uniform speed. I had no idea about what effects the slowing or speeding up of the first ship would have on the flow of time in it as ascertained by the one in the second ship. Nonetheless, I figured that any effect of the first ship starting and accelerating[1] to reach a steady speed cannot depend on how long the ship travels thereafter at the uniform speed. Likewise, any effect of the ship slowing down to a stop from its uniform speed cannot

[1] His Holiness said, in Tamil, 'steadily increasing speed.'

depend on how long the ship had been moving earlier at the uniform speed. I presumed, therefore, that if the acceleration and the deceleration[1] were to last for a very much shorter time than the journey at a constant speed, then, as ascertained from the stationary second ship, the travel of the first ship would be essentially at the uniform speed. I initially thought of proceeding further by assuming that the first ship accelerates from rest to the uniform speed instantaneously and also that it later decelerates from the uniform speed to a stop instantaneously. However, I then pictured what looked to me to be an equivalent scenario, but one that did not require instantaneous attainment of the uniform speed and instantaneous halting.

His Holiness (continuing): I supposed that a person on the shore enters the first ship and that it accelerates to the uniform speed in some time. While moving at the uniform speed, it comes alongside the still second ship. When the first ship does so, the person in it starts a stopwatch[2]. As the stopwatch starts, the person in the second ship notes the time in his watch. He also compares the running of the stopwatch and his watch. The time noted by him is 1 p.m., and the first ship's uniform speed is such that he finds that the

[1] His Holiness: '*vegāpacaya.*'

[2] What His Holiness said, in Tamil, was 'a watch that, I had heard, can be started as well as stopped by pressing its top.'

stopwatch is running at half the rate of his watch.[1] The person in the first ship determines, for his part, that the watch in the second ship is running at half the rate of his stopwatch. The first ship continues its journey at the uniform speed and passes another stationary ship. The watch in this third ship runs at the same rate as and shows the same time as the watch in the second ship. After all, this third ship is not moving with respect to the second ship. When the first ship is alongside the third ship, the person in it stops his stopwatch. The person in the third ship observes this and notes the time in his watch. It is 3 p.m. He then ascertains that another watch in the first ship is running at half the rate of his watch. Meanwhile, the person in the first ship finds that the watch in the third ship is running at half the speed of his watch. The first ship starts slowing down and comes to a stop.

Ship 1 (Next to Ship 2) (Next to Ship 3) (Stops)
❶>accelerates>❶>uniform speed>❶>decelerates>❶
Stopwatch started Stopwatch stopped
❷ ❸
Ship 2 (stationary) **Ship 3** (stationary)
Ship 1 next to Ship 2 at 1 p.m. Ship 1 next to Ship 3 at 3 p.m.

Representation of the First Ship's Outward Journey

His Holiness (continuing): Immediately after that, it starts moving in the opposite direction and accelerates

[1] For this, the uniform speed of the first ship must be 86.6% of *c*.

till it reaches the uniform speed. While moving at the uniform speed, it comes to the side of the third ship. As the first ship does so, the person in it restarts his stopwatch. The person within the stationary third ship observes this and notes the time shown by his watch when the stopwatch restarts. It is 3:30 p.m. He finds that the stopwatch and the other watch in the first ship are running at half the rate of his watch. On the other hand, the person in the first ship finds that the watch in the third ship is running at half the rate of his watch. The first ship advances smoothly at just its uniform speed. When it comes alongside the second ship, the person in the first ship stops his stopwatch. The person in the second ship notes the time shown by his watch when the stopwatch stops. It is 5:30 p.m. He then finds that the other watch in the first ship is running at half the speed of his watch. As for the person in the first ship, he finds the watch in the second ship running at half the rate of his watch. The first ship then begins to decelerate and stops at the place near the shore where it started its journey.

(Stops) (Next to Ship 2) (Next to Ship 3) **Ship 1**
❶<decelerates<❶<uniform speed<❶<accelerates<❶
Stopwatch stopped Stopwatch restarted
❷ ❸
Ship 2 (stationary) **Ship 3** (stationary)
Ship 1 alongside at 5:30 p.m. Ship 1 alongside at 3:30 p.m.

Representation of the First Ship's Return Journey

His Holiness (continuing): Afterwards, the person of the third ship comes to the second ship and reports his measurements to the person there. From the initial time of 1 p.m. noted by the person of the second ship (when the first ship was passing it for the first time) and the time of 3 p.m. noted by the person of the third ship (when the first ship was passing it for the first time), they ascertain that the duration of the first ship's forward journey at the uniform speed from alongside the second ship to the side of the third ship was two hours. Next, from the time of 3:30 p.m. noted by the person of the third ship (when the first ship was going past it on the way back) and the final time of 5:30 p.m. recorded by the person of the second ship (when the first ship was alongside it on the way back), they note that the duration of the first ship's return journey at the steady speed was also two hours. They, therefore, conclude that the total time of the first ship's travel at the uniform speed from alongside the second ship to the third ship and back was four hours, as per their watches. They recognize that the duration of travel at the uniform speed as measured from the first ship is that recorded by the stopwatch there. During the first ship's forward as well as return journeys, they found the stopwatch and the other watch in the first ship running at half the rate of their watches. Thus, they expect the stopwatch to show the passage of just two hours, as against the four hours as per their watches.

His Holiness (continuing): The person on the first ship subsequently comes to the second ship bringing his stopwatch with him. He started his stopwatch when his ship was passing the second ship at the uniform speed and stopped it when his ship was beside the third ship. The times recorded by him for the start and end of his forward journey thus exclude the periods of acceleration and deceleration. It is as though the first ship instantaneously attained the uniform speed when next to the second ship, travelled to the third ship at just the uniform speed, and stopped suddenly. On the return journey, he restarted the stopwatch when the first ship was next to the third ship and finally stopped it when the ship was back next to the second ship. The periods of acceleration and deceleration were excluded in this case also. Consequently, the total time recorded by his stopwatch is that of his forward and return journeys at just the uniform speed between the second and third ships. For him, what his stopwatch finally shows is the actual duration of the full journey at the uniform speed. However, on his outward as well as return journeys, he found the watches of the second and third ships to be running at half the rate of his stopwatch and other watch. He thus expects the time of travel arrived at on the basis of the watches of these ships to be just half that registered by his stopwatch.

His Holiness (continuing): I came to the conclusion that they must find that while the duration of the first ship's travel at the uniform speed from alongside the second ship to the side of the third ship and back is four hours as ascertained from the second and third ships, the duration as determined from the first ship and recorded by the stopwatch is only two hours. The reasoning that led me to this conclusion was as follows. If the first ship had just continued to travel eastwards at the uniform speed, the person in it would have been on the same footing as the person in the second ship. This is because, even in the light of experiments, he would have concluded that he is stationary, exactly like the person in the second ship. Also, he would have found the second ship to be travelling to the west at the uniform speed just like the person in the second ship would have found the first ship to be moving to the east at the uniform speed. His assessment of the flow of time in the second ship would then have been truly equivalent to the assessment of the flow of time in the first ship by the person in the second ship. However, the present situation is different. It is his ship that reverses the direction of travel and comes back to the side of the second ship. Regardless of whether, in order to change direction, his ship decelerates to a stop slowly or swiftly or, quite unrealistically, does so instantaneously, he cannot but experience being pushed eastwards and know that his ship has not been stationary. Similarly, when his ship accelerates in the opposite direction to reach the uniform speed, he cannot but know from the experience of being pushed eastwards that his ship is moving. Apart from his experience, an accelerometer[1] on the ship shows the slowing down and speeding up. None of this occurs on the second ship. Thus, in the present case, as the first ship does not just travel at the uniform speed in one direction, but changes direction and returns to the side of the second ship, the person in it is not on the same footing as the person on the second ship. Hence, while his stopwatch correctly records the duration of his ship's journey at the uniform speed, his assumption that the duration determined by the persons of the second and third ships on the basis of their watches must be half that shown by his stopwatch is incorrect. As regards the persons on the second and third ships, not only is their determination of the duration of the first ship's travel on the basis of their watches correct, so is their assessment that the stopwatch in the first ship must show half this time.

His Holiness (continuing): Till this point, I had just used the example of the ship of the Italian scientist (Galileo) as the basis for all my analysis. I had not seen a big ship till then. Further, though I knew that even if one were to travel at only a thousandth of the speed of light, one would still go completely round the earth in a few minutes itself, I had, for facilitating my analysis, fancied

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[1] His Holiness said, in Tamil, 'device to measure a change in speed.'

that a ship travels for two hours at a speed near that of light. Hence, I continued my reflection about the implication of the constancy of the speed of light by considering not a big ship but what I was quite familiar with. Further, I decided to assume, for convenience, that the speed of light is just a few miles an hour. In keeping with this, I considered entities moving at less than this speed.

His Holiness (continuing): When young, on many days, after a swim in the river (Tunga), I placed my legs in the *padmāsana*, lay down on my back in the water, and, looking up at the sky, allowed myself to float freely downstream for some time. As long as I was carried by the current in a straight line, I did not discern that I was moving. It was only where the river took a turn that I sensed a pull. I also noticed that if, while being steadily carried downstream in a straight line, I arched my neck and looked at the water a little beyond my head, the water appeared still. One day, the sky was overcast. After the bend at some distance from the Sandhya-mandapa, I kept going with the flow, without any sensation of movement, till I had almost traversed the length of Sringeri. Only when I happened to look sideways at the riverbank, I realized that I had come far. I then swam back to the Sandhya-mandapa. In view of this experience, I chose to consider a person floating downstream in a river on his back instead of a person in a ship travelling on the ocean.

His Holiness (continuing): One day, when I was floating downstream on my back and seeing the river beyond my head, I noticed a small bird flying a little above the water and heading straight towards me. It went over me, flying just a few inches above my face, chest, and feet. I do not know why it flew this way and that was the only time I saw a bird do so. Remembering this, I imagined a person floating downstream at two miles an hour and a bird flying in the opposite direction at the same speed. Instead of the stationary ships that I had thought of earlier, I assumed that three persons are crouching in the waist-deep water of the river, in a line. I supposed that the first person is positioned half a mile up the river with respect to the second person and that the third person is half a mile downstream with respect to the second person. The three, who are not moving with respect to one another, have watches that are running at the same rate and are showing the same time. I imagined that the swimmer who is floating downstream on his back has a watch and a stopwatch with him.

His Holiness (continuing): While the first person finds the swimmer floating downstream at two miles an hour, the swimmer discerns that he is still and that it is the first person who is moving in his direction at two miles an hour. Just when the swimmer is beside him, the first person notes that the time shown by his watch is 5 p.m. As for the swimmer, he starts his stopwatch.

Meanwhile, the bird flies past the third person who is positioned a mile downstream. The time of the bird passing him is noted by the third person to be 5 p.m. He also determines that the bird is flying a little above the water at two miles per hour.

His Holiness (continuing): Freely floating downstream, the swimmer moves from next to the first person to beside the second person, who is stationed half a mile downstream. The second person ascertains the time in his watch when the swimmer is next to him and also the speed of the swimmer. He finds the time to be 5:15 p.m. and the speed of the swimmer to be two miles per hour. The swimmer, for his part, stops his stopwatch. Exactly when the swimmer comes next to the second person, that is, at 5:15 p.m. as per the second person's watch, the bird too arrives there. The second person, like the third, finds that it is moving at two miles per hour.

Stationary ❶<-0.5 mile->❷<-0.5mile->❸ *Persons*

Swimmer Ⓢ>>Ⓢ>>>>>>>>Ⓢ>>>

<<<Ⓑ<<<<<<<<Ⓑ<<<<<Ⓑ ***Bird***

Person 1: Swimmer passes at 5 p.m., moving eastward at 2 mph
Person 2: Swimmer passes at 5:15 p.m., moving eastward at 2 mph
Person 3: Bird passes at 5 p.m., moving westward at 2 mph
Person 2: Bird passes at 5:15 p.m., moving westward at 2 mph
Swimmer starts a stopwatch as Person 1 passes him and stops it as Person 2 passes him

Three Unmoving Persons, Swimmer and Bird

His Holiness (continuing): The still, second person finds the swimmer approaching him from one side at two miles per hour and the bird approaching him from the opposite side at two miles per hour. At this stage, I supposed that the speed of light is two and a half miles per hour. Accordingly, the second person finds the bird moving towards him at 80 percent of the speed of light. I then considered the speed of the bird as determined by the swimmer. I realized that though he is moving in one direction at two miles per hour and the bird is moving in the opposite direction at two miles per hour, he cannot find it approaching him at four miles per hour. Else, from his perspective, the bird would be moving at a speed greater than that of light. I imagined that a flash of light emanated earlier from the bird's head. I reasoned that the swimmer must observe the light as approaching him at two and a half miles per hour, for the speed of light is the same for all observers. If he were to find the bird approaching him at four miles per hour, he would find the bird overtaking the flash of light. This cannot be. Therefore, I concluded that the swimmer must find the bird to be approaching him, not at four miles per hour but at some speed less than two and a half miles per hour, which I had taken to be the speed of light[1]. I surmised that if the bird were

[1] Under the assumptions made, the swimmer would find the bird approaching him at 2.439 miles per hour and not at four miles per hour.

stationary like the three persons, the swimmer would find it moving towards him, like the persons, at two miles per hour. On the other hand, even if he were moving downstream at almost two and a half miles per hour and the bird were flying in the opposite direction at almost two and a half miles per hour, he would find it approaching him only at nearly two and a half miles per hour, the assumed speed of light, and not at nearly five miles per hour. I comprehended that this is a consequence of the speed of light being the same for all observers and not due to any erroneous assessment of the swimmer.

His Holiness (continuing): I conceived that the first person subsequently walks up to the second person. They confirm that their watches show the same time and run at the same rate. When the swimmer was next to the first person, the time as per the latter's watch was 5 p.m. and when the swimmer was beside the second person, the latter's watch showed 5:15 p.m. Hence, the first and second persons conclude that the swimmer took 15 minutes to cover the half-a-mile distance between them. The swimmer started his stopwatch when the first person was at his side and stopped it when the second person was beside him. For him, the time interval between the first person going past him and the second person coming beside him is that recorded by his stopwatch. Because the swimmer moved past the first and second persons at

80 percent of my assumed speed of light, both of them found the swimmer's watch running much slower than their own watches. The swimmer, for his part, found the first and second persons moving towards him at 80 percent of my assumed speed of light and, hence, found the watches of the first and second persons running much slower than his. I conceived that upon coming to a bend in the river and feeling a tug, the swimmer realized that he had not been still but had been floating downstream. He turned, swam up the river, and joined the first and second persons. I gave thought to whether his stopwatch records the same time as that arrived at by the first and second persons or a greater or a lesser time. The swimmer was the one who decelerated from his uniform speed, reversed his direction of travel, and joined the second person. In view of this, I concluded, just as I had done earlier with regard to the stopwatch of the first ship, that the time recorded by the swimmer's stopwatch must be less than that determined by the first and second persons on the basis of their watches. That is, it must be less than 15 minutes.[1]

His Holiness (continuing): At this juncture, it struck me that the distance between the first and second persons made out by the swimmer as he freely floated

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[1] Under the assumptions made, the interval recorded by the swimmer's stopwatch would be nine minutes.

downstream must also be less than that discerned by the first and second persons. As ascertained by the first and second persons, the distance between them was half a mile, and the swimmer moved at two miles an hour for 15 minutes to reach the second person. On the other hand, as determined by the swimmer, the second person advanced towards him at two miles per hour and reached him in less than 15 minutes after the first person had done so. Therefore, for him, the distance between the first and second persons is less than half a mile. I understood that if the speed of light is the same for all observers, not only the passage of time, but also distances may be ascertained differently by two persons moving uniformly with respect to one another, and their findings, though different, are valid.

His Holiness (continuing): As I told you, at the close of his talk on the second day, Murthi mentioned two postulates of Einstein and stated that their implications were amazing. It was because my curiosity was aroused about what the startling implications might be that I cogitated as I have described to you. I discontinued my reflection when I found that about two hours had passed. This was the first time I had pondered on such a topic and unhesitatingly recognized that most or all of my conclusions might be erroneous.

His Holiness (continuing): Over the next two days, Murthi expounded Einstein's two postulates and what follows from them. I was pleasantly surprised to find that none of my conclusions were discordant with what he pointed out. From his account, I became acquainted with several implications that I had partially or wholly missed. For instance, I understood that the shrinking of lengths occurs in just the direction of motion. With the aid of an example, he made known that while two events may occur simultaneously to a person, those very events may occur at different times to another, who is moving at a uniform speed relative to the first. Murthi mentioned that a person may find one of two events occurring first, while another may find the other event occurring first. I asked him if such could be the case even if the two events were causally related. I had in mind the oddity of one of the two persons first seeing an arrow hit a target and later seeing it being shot. He said that when cause and effect are involved, none would find a reversal of the sequence of cause and effect. He explained how this is ensured by the speed of light being the same for all observers and one's speed being less than that of light. I asked him, "Suppose there is a lamp and a screen far away. A rod is moved in front of the lamp at almost the speed of light. The rod's shadow on the screen covers a much larger distance than the rod and, so, moves faster than light. How does such exceeding of the speed of light impact Einstein's postulates and their implications?" He clarified why such cases are not relevant.

His Holiness (continuing): Murthi thereafter explained a formula relating the extent to which time slows down and speed. A portion[1] of it involved two squares[2] and a square root[3]. He had computed the extent of slowing for several speeds based on the formula, written down the values on a sheet, and brought it with him for me. I later compared, in private, these values with what I had arrived at by making two measurements with a foot rule on each slanting line in my diagram. Though the accuracy of my measurements was limited, I found that my results were quite close to those provided by Murthi.[4] He also pointed out how the formula can be

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[1] $\sqrt{(1-v^2/c^2)}$, where *v* is the speed of the object and *c* is the speed of light.

[2] H.H. referred to 'square' by the Sanskrit term '*varga.*'

[3] His Holiness referred to 'square root' by the Sanskrit term '*varga-mūla.*' Of His own accord, He elucidated the terms '*varga*' and '*varga-mūla*' and added that Sanskrit mathematical texts such as the profound *Āryabhaṭīya* and *Līlāvatī* use them.

[4] It can be seen that in the diagram conceived and employed by His Holiness, each slanting line is one foot long and the distance of its end from the vertical line, expressed as a fraction of a foot, is *v*/*c*, where *v* is the speed of the first ship and *c* is the speed of light. After all, a horizontal distance of one foot corresponds to *c*. The vertical component of the slanting line is essentially a side of a right-angled triangle whose hypotenuse is one foot long and one side is *v*/*c* foot long. The distance of the end of the slanting line from the horizontal line is thus $\sqrt{(1-v^2/c^2)}$ foot. Hence, if the distances in the diagram were measured exactly, the diagram conceived and used by His Holiness would yield the same results as the formula.

used to compute the extent to which distance shrinks in the direction of motion, for different speeds. I noted that for any speed, the extent to which distance shrinks is the same as that by which time slows down.

His Holiness (continuing): He presented an example involving a pair of twins. One of them leaves the earth in a vehicle that travels at a speed close to that of light. He returns after one year, as ascertained by him. As determined by the twin on earth, several years have passed. When the two meet, they find that this twin has aged more than the twin who left the earth and returned.[1] The closer the speed of the latter's vehicle to that of light, the more the difference in their aging. Murthi added that the total length of the journey as determined by the twin who went in the vehicle is less than the length of his journey as ascertained by the twin who remained on earth.

His Holiness (continuing): I asked him, "Suppose one of the twins travels towards the sun at so very close to the speed of light that, as determined by the twin on earth, his watch is well-nigh still. Then, as found by

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[1] The example of twins who age differently was first described by Herman Weyl in 1918. Murthi may have come to know of it (during his trip to meet Bose and Saha) from the English version of Weyl's book (Hermann Weyl, *Space-time-matter*, Translated from the German by Henry L. Brose, Methuen and Co. Ltd., London, 1922, page 187). It came to be known as the "Twin Paradox" and has been extensively dealt with over the years.

the twin who travels, the distance to the sun will not be crores of miles but will be almost zero and his time of travel will also be almost zero. Am I correct?” He said that I was.

His Holiness (continuing): This led me to think, “Then, for light itself, the distance traversed to reach the earth from the moon, the sun, the Pole Star or anywhere else in the cosmos is zero and the time of travel too is zero.” I then realized that I had ignored a pertinent distinction between the case of light and that of the twin. While the twin travels at well-nigh the speed of light with respect to the earth or his destination, he is stationary with reference to his vehicle. A watch that does not move relative to him can determine the duration of his travel. Likewise, a means to measure distance can have him as a point of reference. However, there is nothing with respect to which light is at rest. Else, there would arise the contradiction of light being stationary with respect to something and simultaneously moving with respect to that itself at the speed c, since its speed is c for all observers. Hence, while the passage of time for the twin and the distance of something from him can be measured, this is impossible in the case of light. Thus, while it can be found through measurements that the distance to the destination and time of travel are almost zero for the twin, it is impossible to establish, likewise, that distance and time of travel are zero for light. I briefly conveyed to Murthi what I had surmised about time and distance with respect to light in order to know what all I might have got wrong. He did not object to what I told him.

His Holiness (continuing): Murthi familiarized me with the concepts of 'mass' and 'momentum'[1] and pointed out that a major implication of the speed of light being the same for all observers is that mass and energy[2] are equivalent. He described a simple equation[3] between the mass of an object that is at rest with respect to an observer and its energy; this involved the speed of light. He provided the example of a copper ball that is carefully weighed. It is heated and then weighed again. It weighs a wee bit more than before. As it cools, its weight decreases. Finally, it weighs the same as it did at the start. Likewise, less force is needed to accelerate it when it is cool than when it is hot. Thus, though no copper is added or removed, the ball's mass changes in keeping with the energy that is absorbed or given up by it.

His Holiness (continuing): I asked him, "There is a box made of mirrors. It has a small closable hole on one side. The box is weighed. A powerful beam of light is made to enter the box via the hole that is then closed.

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[1] His Holiness explicitly used the terms 'mass' and 'momentum.'

[2] His Holiness: *'śakti.'*

[3] $E = mc^2$, where 'm' is the rest mass (in kilograms), c is the velocity of light (in metres per second) and 'E' is the energy (in joules).

The light inside keeps getting reflected in the box's mirrors. The box is weighed again. Will it weigh more than before?" He said that it would but the difference would be minuscule. This is what I had supposed when conceiving the example and hence proceeded to pose my intended question, "Does the change imply that light has mass? As light is never at rest with respect to any observer, one cannot speak of any mass at rest for it. The equivalence that you described between mass and energy will thus not apply to it. Yet, the unmoving box with light in it has a greater mass than the same box without light in it. How?" He explained that what he had given is a special case of a general formula[1]. This equates energy with mass and momentum. An object, such as the copper ball, that is at rest has mass but no momentum. As for light, it has no rest mass but has momentum, like a moving ball. The box's weight rises because the light within it has momentum and, thus, energy. On account of the additional energy, the box weighs a little more than before just as it would if an unmoving object with minuscule mass were placed in it. Light's momentum is proportional to its frequency[2]. I then asked him, "Since light has momentum, does light

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[1] $E^2 = (mc^2)^2 + (pc)^2$, where 'p' is the momentum. For an object at rest, 'p' is zero and the equation reduces to $E = mc^2$. For light, the rest mass 'm' is zero and the energy $E = pc$.

[2] His Holiness used the Sanskrit word '*āvṛtti*' for 'frequency' and '*anupātī*' for 'proportional.' Hindi texts on science do so.

striking a mirror push it?" He replied that it does, but the force is minute. All this was interesting.

$\boxed{\text{§5.6}}$ **His Holiness (continuing):** Murthi then touched upon what he said relates to a general theory developed by Einstein. He began with an example. There is a closed compartment and a person is in it. It is far from the earth, in empty space. Irrespective of whether it is not moving or is moving at a uniform speed with respect to the earth, the person in it finds himself at rest and weightless. A ball tossed by him moves straight across the compartment, at a uniform speed. It does not head in a curve to the floor. Next, the compartment is close to the earth. It is falling freely, accelerating as it does so, like a stone dropped from a height. In this case too, the person in it finds himself stationary and weightless. A ball tossed by him moves straight, with no change in speed, just as it did earlier. He cannot differentiate by means of investigations whether his compartment is falling freely and accelerating, or is far away, in space, without any acceleration. Thus, during a free fall, the effect of gravity[1] is essentially nullified.

His Holiness (continuing): I asked him, "The force with which the compartment is drawn to the earth would be less when it is 100 miles from the earth than when it is one mile away. Hence, as the compartment falls

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[1] His Holiness said, in Hindi, '*gurutvākarṣaṇ*'; this term is used in Hindi texts on physics to refer to 'gravity.'

from 100 miles to one mile, the person in it can know from the varying acceleration itself that he is falling. The example cannot, therefore, apply to a long, free fall towards the earth, the moon, or any such big mass. Is it that what is considered is a small portion of the drop over which the change in acceleration is negligible?" Murthi said that such is the case and that, in view of its relevance, he was about to mention this himself. Thinking of the moon going around the earth, I asked him, "Suppose the compartment orbits the earth at some distance. While its speed is uniform, its direction of motion keeps changing steadily on account of the earth's gravity. When the compartment is in a free fall, while its direction of motion is uniform, its speed keeps increasing due to gravity. Are its orbiting the earth and its falling freely to the earth equivalent for the person within it?" Murthi replied that they are.

His Holiness (continuing): He proceeded, with another example. A closed compartment with a person in it is kept on the ground. He weighs himself. Then, he drops a ball and notes how it falls to the floor, accelerating as it does so. Every such gravity-related study confirms to him that he is on the earth. The compartment is now in space, far from the earth. It is accelerating at the same rate as does a ball when it is dropped on the earth. The person within it weighs himself. His weight is the same as it was on the earth. He drops a ball. It accelerates to the floor of the compartment exactly as it did on earth. As every such investigation yields the same result as on the earth, he cannot distinguish between being in the compartment when it rests on the earth and when it steadily accelerates far away, in space. Likewise, he cannot differentiate between being in the compartment on the moon and when it accelerates far away, in space, at the same rate as does a ball that is dropped on the moon. The upshot of all this is that steady acceleration and unchanged gravity at a place are equivalent.

His Holiness (continuing): Murthi proceeded to point out that gravity affects light as it does an object like a ball. He said that while the compartment accelerates far away from the earth, light enters it through a small hole three feet above its base. Were the compartment at rest, the person in it would see the ray go straight across the compartment and strike the opposite side three feet above the base. On the other hand, when the compartment is accelerating, he finds it curving downward and hitting the opposite side less than three feet above the floor. The effects of steady acceleration are equivalent to those of gravity. Thus, the ray would curve even if the compartment were at rest near a big mass. As he was speaking, I visualized the person in the accelerating compartment and the ray curving towards the floor, like a ball. I made out that where the light hits the opposite side depends not only on the steady acceleration but also on how fast the compartment is moving when the light enters it. If the cubicle were moving at a steady speed, the ray would have travelled in a slanting line. The more the speed, the more the slope. In the present case, the upward speed is rising steadily with time, and so, the later the beam enters the compartment, the lower will be the spot where it strikes the opposite side. The light's curved path in the accelerating compartment, thus, depends on when the light enters, but the effect of constant gravity on light would not, presumably, keep growing with time. This impeded my fully grasping from the example that acceleration and gravity affect light in a comparable way. However, I promptly realized that while the ray would hit a lower spot if the initial speed were greater, the extent to which light deviates from a straight line depends on just the acceleration. The realization that the extent of curving depends on just the acceleration removed the difficulty in my appreciating the example. I did not say anything to Murthi about this. However, I did ask him, "If gravity affects light as it does a ball, does the light emanating from a torch that is pointed upwards lose momentum as it proceeds upward, away from the earth? Likewise, does the momentum of a ray that moves closer to the earth rise as it does so? You had told me that light's momentum is proportional to its frequency. In case the momentum of the beam decreases or rises as it moves away from or towards the earth, does its frequency also vary accordingly?" He said that light's frequency changes due to gravity, but such change is minute in the case of the earth and was yet to be measured[1]. He added that the downward shift in the frequencies of light leaving a star had been measured about 15 years before[2] (that is, in the 1920s).

His Holiness (continuing): He then said that a watch runs slower where the effect of gravity is more than where it is less. Thus, if a person standing on the moon were to view a watch on the earth, he would find it running slower than his watch. In keeping with this, a person on the earth would find the watch on the moon running faster than his own. I asked him, "Then, a watch far away in space must run faster than one on the earth. Even on the earth, a watch in Bangalore must run faster than one in Madras (which has nearly the same latitude but has a lower altitude). Also, in a single place itself, a watch on the roof of a house must run faster than one on the ground below. Is it not so?" He said that this was correct, but till then[3] there was no means to measure such infinitesimal differences.

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[1] A fully terrestrial measurement was first reported in 1959. The change in a gamma ray over a height of 22.5 metres was measured.
[2] The values reported by Walter Adams in 1925 are inaccurate.
[3] There are atomic clocks now that are accurate to a second in hundreds of millions of years and the difference due to a change of height of less than a metre has been measured (C. W. Chou et al., *Optical Clocks and Relativity*, *Science,* vol. 329, issue 5999, pp. 1630-1633, 24 September 2010).

His Holiness (continuing): Murthi then told me about an interesting effect of mass on space-time[1]. I knew from his exposition of the implications of Einstein's two postulates that space and time are interrelated and that events can be regarded as located in space-time, rather than just in space or time.[2] This space-time has four dimensions[3], three of space and one of time. He had said that far away from massive entities like the sun, it is flat and uniform. I had asked him if the flatness that he was referring to could be verified by any experimental means. He had said that it could be, in principle, and started by pointing out that the sum of the three angles of a triangle[4] on a flat paper is 180 degrees. In the case of a triangle on a curved surface, such as that of a ball, the sum is different. I knew this. Three points in a region of space are considered. A ray of light passes from the first to the second point, a second ray from the second to the third point, and another ray from the third to the first point. A triangle is thus formed by light, with the three points at its

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[1] His Holiness said '*ākāśa-kālaḥ'* and then 'space-time' (spelt thus in several dictionaries and as 'spacetime' by many physicists).

[2] Introducing the concept of space-time, Hermann Minkowski, a noted German mathematician who taught Einstein at Zurich, said in a lecture in German in 1908, "Henceforth, space by itself and time by itself are doomed to fade away into mere shadows, and only a kind of union of the two will preserve an independent reality."

[3] His Holiness said '*āyām*,' a term used in Hindi for 'dimension.'

[4] His Holiness said '*koṇa*' for 'angle' and '*trikoṇa*' for 'triangle.'

ends. If the sum of the angles of every such triangle in a region of space is 180 degrees, that space could be deemed flat. I do not know if he had conceived this test just then or had read about it somewhere. I found it ingenious but did recognize that it pertained to the flatness of just space. He had told me a definition of the distance between two points in flat space-time and that this distance is the same for all observers moving at uniform speeds relative to each other. Recapping some of what he had stated earlier about space-time, Murthi said that mass curves space-time. He stressed that light always takes the shortest path between two points in space-time. This path, he said, may even be curved. Where space-time is flat, such as far away from massive bodies like the sun, this is a straight line, and where space-time is curved, such as close to the sun, this shortest path is curved. He gave the example of a tiny ant walking straight ahead from a point to another on a flat sheet of paper and of that ant doing so on the surface of a big ball. Since it is tiny and the ball big, as it walks on the ball, it finds the surface flat and just walks straight ahead, like on the flat sheet. On the flat sheet, its path is a straight line and on the surface of the big ball, it is curved, but in both the cases, its path is the shortest between the points. He then pointed out that in flat space-time, a free object moves, like light, in a straight line, at a constant speed, taking the shortest path between two points. In the vicinity of a massive body, the path of this object becomes curved as it falls freely, accelerating towards that body. It may land on the massive body, or curve towards it but go past it, or finally end up orbiting it. In all the cases, its curved path is the shortest between points on it in the curved space-time. The earth is more massive than the moon and, hence, curves space-time more than the moon. A consequence of this is that a watch on the earth runs slower than a watch on the moon. He then said that Einstein had computed and predicted the amount by which the light from a distant star would bend as it passed by the sun and came to the earth. He added that this prediction was verified 22 years before (that is, in 1919) through measurements made during a total solar eclipse.

His Holiness (continuing): I asked him if scientists see empty space or time as some stretchable and bendable material like heated glass. His response was, "No." My question was a prelude to my next ones, which were, "How then can any mass physically stretch and curve space and time and, hence, space-time? Is it that the curvature of space-time is basically a concept in terms of which the slowing of clocks, the curving of light and other effects near massive bodies are mathematically accounted for?" He replied that space-time itself is a concept. While space, per se, is intangible, its flatness and curvature have been defined mathematically and can be distinguished by measurements on objects in it.

$\boxed{\text{§5.7}}$ **His Holiness (continuing):** Thereafter, Murthi took up another topic; that of the electron. With the pertinent background, he apprised me about the discovery of the electron as a particle with a negative charge (by J. J. Thompson in 1897).[1] When I saw an oscilloscope for the first time many years later, I understood that the beam of electrons that produced a green glow in the front of its tube was the type of beam that had been investigated by the discoverer of the electron. Murthi then introduced me to the finding that illumination can cause the emission of electrons from a substance and to an experimental study of this phenomenon.[2] He said that when the illumination's frequency is below a threshold, no electrons are emitted even if its intensity[3] is high. Above the threshold, the speed of the electrons emitted rises as the frequency is increased. Change of intensity does not affect the speed of the electrons; what increases with the rise in intensity is the number of electrons emitted. These findings, he pointed out, cannot be accounted for if it is accepted that light is a wave and that an electron receives energy from it and becomes free. The reason that he mentioned was that the energy of a pure wave depends on its intensity and

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[1] His Holiness used the English words, 'electron' and 'charge.'

[2] J. J. Thompson discerned in 1899 that electrons are emitted. Philipp Lenard experimentally studied the effect of varying the frequency and intensity and reported his findings in 1903.

[3] His Holiness: '*dyuti-parimāṇa.*'

not on its frequency. Hence, the speed of the electrons should have depended on the illumination's intensity and not on its frequency. He summed up that while the formation of bright and dark bands on a screen when light passes through a pair of slits shows that light is a wave, the observed dependence of the emission of electrons on the illumination's frequency disfavours the view that light is a wave.

His Holiness (continuing): Murthi then told me that Einstein explained the findings about the emission of electrons by proposing (in 1905) that light consists of discrete packets of energy. Such a particle of light came to be known as a 'photon'[1]. The energy of a photon is, as per Einstein, directly proportional to the frequency of the light. It is independent of the light's intensity. Thus, a photon of red light has less energy than one of blue light, regardless of the intensities of the red and blue rays. An electron is emitted when a photon that has enough energy to free the electron transfers all its energy to that electron. Consequently, when the light's frequency is below a threshold, no electron is emitted even if its intensity is great. At frequencies above the threshold, an electron receives more energy and emerges with greater speed. Different materials have different thresholds. When the light's intensity is more, the number of photons is what is more, not their

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[1] His Holiness explicitly said 'photon.' This term was coined in 1926.

energy. Thus, when the light's intensity is more, more electrons are emitted, not speedier ones. Murthi said that some years after Einstein published his theory, it was experimentally found (in 1915 by R. A. Millikan) that electrons are emitted from illuminated materials as predicted by Einstein. I asked him, "What becomes of the photon that transfers its energy completely to an electron?" He replied that it vanishes, having been fully absorbed by that electron. I then asked him, "Can an electron receive a part of the energy of a photon? If so, will there arise a photon that has just the remaining energy?" He said that such partial transfer of energy does occur in an interaction involving a photon with high energy and a nearly free electron. He added that the discovery and study of this distinct phenomenon[1] supported Einstein's view that light comprises photons.

His Holiness (continuing): He thereafter informed me that scientists had come to regard light as possessing a dual nature; that of a wave and that of a particle. The wave-nature of light shows up in, for example, the formation of light and dark bands in the experiment with slits and its particle-nature in, for instance, the emission of electrons from an illumined material. I asked him if the two aspects can be observed at the same time and, if not, what determines which aspect

[1] The phenomenon that is now known as 'Compton scattering' was discovered by A. H. Compton in 1923.

is found when. He said that the prevailing scientific view was that the two are not observed together and that the set-up determines the aspect observed.

His Holiness (continuing): Murthi then told me that a French scientist (Louis de Broglie) proposed (in 1924) that just as light has two aspects, so does any particle. Every particle, such as an electron, is associated with a wave. The particle's energy is directly proportional to the frequency of the wave. This is like the energy of a photon being, as per Einstein, directly proportional to the frequency of the light. Murthi then stated that a few years after the French scientist proposed that a particle, such as an electron, is associated with a wave, scientists[1] experimentally ascertained that electrons do behave as waves, like light passed through slits. He added that microscopes that rely upon the electron's wave-aspect have, since the 1930s, been built and used to study minute objects.

His Holiness (continuing): He thereafter told me that a scientist (Erwin Schrödinger) formulated (in 1925 and reported in 1926) an equation that describes the wave of any particle[2]. A rough analogy is an equation that

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[1] C. Davisson and L. Germer fired an electron beam at crystalline nickel. G. P. Johnson directed cathode rays at a thin film.

[2] Known as the 'Schrödinger wave equation', it is a linear, second order, partial differential equation, whose dependent variable is the wave-function ψ.

describes a wave of water and gives the height of that wave at any location and time. For a particle such as an electron in an atom, the equation provides, for any location and time, a number with two parts (that is, a complex number).[1] A German researcher (Max Born) interpreted the square[2] of this (the absolute square of the complex number) as the probability[3] of detecting the particle there at that time. When a measurement is made, an electron, for instance, is found at any one of its possible locations. I asked him, "What determines where the electron will be detected? Does its being detected somewhere imply that it was there prior to being detected?" He explained that the outcome of a measurement is random[4], and the electron could very well have been detected elsewhere. All that can be specified is how probable it is that it will be observed somewhere. Prior to its being detected somewhere, an electron is not looked upon as having any specific location. He said that he had based his response on one scientific viewpoint (the Copenhagen Interpretation).

His Holiness (continuing): He then informed me that a German scientist (Werner Heisenberg) had arrived at the conclusion that the less the uncertainty in the

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[1] The value of the wave-function ψ of an electron at a given point in space and time is a complex number.

[2] As done by Him earlier, His Holiness used the term '*varga.*'

[3] His Holiness: '*prāyikatā.*' It is a term for mathematical probability.

[4] His Holiness: '*yādṛcchika.*'

position of a particle at any time, the greater is the uncertainty[1] in its momentum at that time; likewise, the less the uncertainty in its momentum, the more is the uncertainty in its position. By way of elucidation, he described an experiment that had been imagined by that scientist. A person wants to precisely measure the position and momentum of an electron. He sets up a powerful microscope and illumines the electron. The shorter the wavelength of the light, the sharper is the identification of the electron's position. However, the less the wavelength, the more is the momentum of the photons. The higher the momentum of the photon that interacts with the electron, the greater is the change that it causes in the momentum of the electron. Thus, more precision in an electron's position is only at the price of higher indefiniteness in its momentum.

His Holiness (continuing): I asked him, "You had said earlier that, before measurement, an electron has no specific location, and only the probability of its being detected at a place at some time can be known. The present example, however, seems to presume that an electron has some specific position and some specific momentum before it is illumined and that this position cannot be found without disturbing the momentum. Is the indefiniteness in an electron's position and in its momentum only on account of the measurement-

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[1] His Holiness: '*aniścitatā.*' It is a term for quantitative uncertainty.

related disturbance[1], or is it intrinsic?" He mentioned that the scientist's mentor (Neils Bohr) had clarified the example and the indefiniteness in an influential article[2] in a prestigious British journal and that he was basing his reply on it. Electrons, like light, behave as particles and as waves. Indefiniteness in an electron's position and momentum is due to its having such dual aspects. Suppose an electron were to have, in its aspect as a wave, a specific wavelength, and frequency. Then, it would have a precise momentum. However, being a pure wave of unbounded length, its position would be totally indefinite. For there to be low indefiniteness in its position at any time, its wave must have a small extent. Such a wave-packet is obtainable by adding (sine) waves of different frequencies. Murthi explained this with some sketches. When the wave-packet has a small spread[3], the indefiniteness in the electron's position is correspondingly small, but, as this wave-packet is equivalent to a combination of (sine) waves of different frequencies, there is indefiniteness in the electron's momentum. Murthi told me that the smaller the spread of the wave-packet, the more is the spread in the frequencies of the waves needed to give rise to this wave-packet. Thus, at a fundamental level itself,

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[1] His Holiness: '*māpanasambandhi-vikṣepa*.'

[2] N. Bohr, *The Quantum Postulate and the Recent Development of Atomic Theory,* Supplement to *Nature,* 581-590, 14 April 1928.

[3] His Holiness used the Hindi word '*phailāv.'*

the less the spread in an electron's position, the more is the spread in its momentum, and, likewise, the less the spread in its momentum, the more is the spread in its position.[1] He added that the scientist who first identified this relationship (Werner Heisenberg) also specified one between indefiniteness in energy and time. An electron that is in a stable state[2] in an atom may, such as when it absorbs a photon, shift to and briefly remain in an excited state[3]. The shorter it is in that excited state, the more is the indefiniteness in its energy.

His Holiness (continuing): Murthi then mentioned an intriguing phenomenon, which, he said, occurs since a particle such as an electron has a wave-aspect and the indefiniteness that he had spoken of. A marble that is on one side of a barrier cannot pass on to the other side unless it is moving energetically enough to be able to climb over the top of that barrier. However, in the case of an electron, there is a small probability that it will be detected on the other side of even an electrical barrier

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[1] That the basis of the uncertainty principle is not measurement-disturbance is corroborated by the evidence that measurement-disturbance can be much less than is essential to account for the uncertainty relationship (A. Lee et al., *Violation of Heisenberg's Measurement-Disturbance Relationship by Weak Measurements, Physical Review Letters,* vol. 109, 100404, 6 September 2012).

[2] His Holiness: '*sthirāvasthā.*'

[3] His Holiness: '*uttejitāvasthā.'*

that it basically does not have the energy to surmount. This probability, he said, can be worked out by means of the electron's wave-equation. The greater the width or height of the barrier, the less is the probability of the electron being detected on the other side. This phenomenon, he pointed out, would not have been possible if an electron were analogous to a marble.

His Holiness (continuing): Murthi then said that about a decade earlier, it was found (by Carl Anderson in 1932) that a ray of extremely high frequency (a gamma ray), whose photon has much energy, may create and give place to an electron and another particle. This particle is called a positron. While it has an electron's mass, its charge is the opposite of that of an electron. Reminded of the equivalence of mass and energy that he had told me about earlier, I asked him, "If a photon can become fully replaced by an electron and a positron, can these two particles unite and give place to a photon that has their total energy?" He said that when an electron and a positron come together, not one, but two photons arise, each of which has half their total energy. These two photons fly off in opposite directions.[1]

[1] Electron-positron annihilation cannot result in the creation of a single photon because not only energy but also momentum is conserved in interactions. Likewise, though having the requisite energy, a single photon cannot create an electron-positron pair in isolation but can do so when there is a nucleus nearby to absorb some momentum. Two photons can create the pair on their own.

§5.8 **His Holiness (continuing):** He stopped here as I had told him at the start of his daily expositions of science to complete them in a week. Even as he was about to prostrate, I appreciatively told him that he presented the subject-matter cogently and that all the sessions were informative, thought-provoking, and engrossing.

His Holiness (continuing): In the middle of his stay in Sringeri, I taught him how to worship Kr̥ṣṇa mentally, and he practised this *mānasa-pūjā* thrice daily. On the day of his departure, he asked me whether he may, in addition to this, worship an image of Kr̥ṣṇa every day at Brindavan. On my assenting, He entreated me for an idol and instructions on worship. I fulfilled his request. On two earlier occasions and before leaving, he deeply expressed his gratitude and said, “This has been the most uplifting, meaningful, and joyful time of my life; but for God having kindly given me a terminal disease, I would have surely missed it.” By my Guru’s blessings and God’s grace, his fervent desire to spend his final months centred on Kr̥ṣna was consummated.[1]

§5.9 A day after concluding His account of His exposure to physics (in 1941) from Murthi, His Holiness graced me with the following information at Kalady in July 1984.

[1] After settling down in Brindavan, Murthi communicated to His Holiness that he was practising, without any impediments, all that His Holiness had imparted to him. His elder brother, who had taken up employment in Delhi, was with him in his final week and performed his last rites. His Holiness mentioned this.

His Holiness: The day after Murthi left Sringeri, I recalled that when an electron and positron come together, they disappear and are replaced by a pair of photons. Did this imply, I asked myself, if the electron-positron pair that existed earlier totally ceased to exist and if two photons that were non-existent earlier came into existence and if, consequently, the clear teaching of the scripture[1] that every effect has no existence other than as its material cause, just as an earthen pot has no existence apart from its cause, clay, that an effect is latent in its cause prior to its manifesting and that something cannot arise from what is non-existent is negatively impacted? To buttress the hypothetical problem, I recalled that a photon may be absorbed by an atom and, in terms of its electrons, that atom may pass from a stable to an excited state; though Murthi did not directly tell me this, I supposed that the atom in the excited state returns to its stable state not in a single step, emitting a photon, but in two steps, emitting two photons, the energy of each of which is different from that of the photon that was absorbed; another option that I envisaged on the basis of Murthi's information that illumination can result in the emission of electrons from a substance was that upon the first photon being absorbed, an electron becomes free of the atom and does not emit any photon. I straightaway realized that all this was actually no problem at all for

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[1] *Chāndogya-upaniṣad* 6.1.1-7; 6.2.1-4; 6.4.1-7. *Bṛhadāraṇyaka-upaniṣad* 1.4.7. *Bhagavad-gītā* 2.16. *Brahma-sūtra* 2.1.14-20.

the teaching of the scripture about causality. From the viewpoint of the *Śāstra*, the electron-positron pair is not the material cause of the photons that arise; likewise, the absorbed photon is not the material cause of the photon or photons emitted when the atom returns to its stable state in one or in two steps nor is it the cause of the freed electron; the cause is energy, which is what is conserved in all the interactions and not the number of photons, electrons or positrons; it is what is on par with the clay of the scriptural example[1]; just as clay is the material cause of the products of clay such as an earthen pot and an earthen jug and the pot is not, per se, the cause of the jug even if the pot be powdered and the jug fashioned thereafter, so too, it is energy that is the material cause of the photon, electron and positron and it is not the electron-positron pair that is the material cause of a pair of photons nor is a photon that excites an atom the cause of any emitted photon; just as we do not see pure clay as fully without any shape but see it with some form such as that of a lump, pure energy is not what is explicitly detected and it is energy manifest as a photon, electron or positron that is detected; just as apart from clay, no product of clay has any existence, a photon, electron or positron would, bereft of mass and momentum, be non-existent if it had zero energy.

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[1] His Holiness cited *Chāndogya-upaniṣad* 6.1.4. He then proceeded, as reported, to apply its teaching to the photon, electron, and positron.