

The elaborate tabular information painstakingly prepared for various chapters is extremely useful and provides handy information on classification, formulations and even methods of preparation.

The work of Valiathan is an important milestone in Charaka literature, reflecting the author's labour of love, resulting in an excellent presentation through a process of re-discovery of medical/socio-environmental knowledge based on the author's exciting and fascinating journey through the 'Charaka land', which breaks the barriers of time and opens new doors to the glorious past of India's medical and scientific heritage. The 're-telling' of Charaka's contributions in an altogether new, systematic, textual, tabular and graphic format is indeed effective. Some of the views/observations may or may not be accepted by puritans, but such attempts are still necessary and welcome.

This attempt by a dedicated scholar, trained basically in Western medicine, but endowed with special scientific insights and a passionate thirst for exploring 'unusual territories' will no doubt fulfil the expectations of Sri Raghavan Thirumalpad (as expressed in the preface of the book) of 'not only giving reading pleasure, but triggering new lines of thought' in serious students of Ayurveda as well as modern medicine.

With this historic work, in my view, Valiathan joins the illustrious list of redactors of Charaka like Dridhabala and through the introductory chapters of the book which can be considered as a 'mini commentary', the author deserves to be in the good company of renowned commentators like Chakrapani Datta. The fine description of the role of redactor (*Samskarta*), as given in *Charaka Samhita* itself serves to prove this point: 'The redactor enlarges or expands the aphoristic and condenses the prolix. In doing, so he renews the (old) knowledge and brings it up to date'.

चिन्तायति लेशोक्तं संक्षिपत्यतिविस्तरम् ॥
संस्कर्ता कुरुते तन्त्रं पुराणं च पुनर्नवम् ।

Charaka: Siddhi: 12:36

This is what actually Valiathan set out to do and has achieved considerable success in this challenging task.

I expect that the book will see many editions and even early revision and

further redaction by the author himself.

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Return of the Crazy Bird – The Sad, Strange Tale of the Dodo. Copernicus Books, 37 East 7th Street, New York 10003, USA. 2003. 216 pp. Price: US \$ 27.50/EUR 29.95.

In the middle ages, the maps of the world depicted just three continents: Europe, Africa and Asia, circled by oceans, and crossed by seas. These maps often had Jerusalem at their centre, the navel of the world. As in these mediaeval maps, Clara Pinto-Correia has used the dodo as a central point of reference, from which skeins run through a tapestry rich in tales of exploration, religious persecution, empire-building, colonization, patronage of the arts, museums, natural history, evolution, and inevitably, extinction.

How does, for example, Pinto-Correia connect the Defenstration of Prague to the dodo? To navigate these historical waters, one could begin with the Portuguese, whose geographical location at the outermost western promontory of Europe, virtually falling off the map into the Atlantic Ocean, could have prompted them to seek other shores, particularly to find a sea route to the spices, silks and precious stones of the Orient, to beat the

Arab traders who had the monopoly over the overland route. But even before the idea of reaching India, Portuguese maritime peregrinations were encouraged by Henry the Navigator, Prince of Portugal, who in the mid-fifteenth century, exhorted his mariners to conquer the north and west coasts of Africa, and their offshore islands, in the name of God and Portugal. All of this, we know, ultimately led to Vasco da Gama, rounding the Cape of Good Hope, and finally reaching Calicut in 1498, six years after Christopher Columbus discovered 'India' in the New World in the name of God and Spain.

Why weren't the Spanish in the Indian Ocean? This was because of the 1493 Treaty of Tordesillas, according to which Pope Alexander VI divided up conquests of the New World between Spain and Portugal by drawing an imaginary line that ran north-south through the Atlantic Ocean; Spain was to lay claim to everything approximately 1800 km west of the Portuguese Cape Verde islands, while to the east, the world belonged to Portugal. Thus the Portuguese were the first to enter the Indian Ocean, which inevitably led to the discovery of the Mascarene Islands – Mauritius, Réunion, and Rodrigues, the three isles at the fulcrum of the story. Mauritius, the isle of the dodo, owes its present name to Maurice of Nassau, captain-general and admiral of the Netherlands. The Netherlands under Maurice was a sanctuary for Protestant refugees, especially French Huguenots, victims of religious persecution. These diaspora contributed to the commercial prosperity of the Netherlands, resulting inevitably in the quest for new trade routes via maritime expansions. The Dutch followed the Portuguese into the Indian Ocean, to capture the source of the valuable spices: nutmeg, cinnamon and pepper, after several abortive attempts to find a northern polar route to the East Indies or the Spice Islands. They ultimately established a base at Jakarta, then called Batavia, and were later to use Mauritius as a convalescent isle for Dutch settlers who could not withstand the humid climes of Java.

Where is the dodo in all of this? As an inevitable consequence of this exploration and expansion, mariners who used the Mascarene Islands as staging posts in their voyages to India and the East Indies, found the dodo to be easy prey, and although its flesh was barely palatable, which led to it being called *Walckvogel* or

nauseating bird by the Dutch, the dodo population declined both because it was consumed by the mariners, and because of the predation on its terrestrial nests by feral pigs, monkeys, rats, dogs and other domesticated beasts that were introduced onto these islands. A Dutch admiral, Jacob van Neck, who claimed Mauritius for Holland, even brought back dodos alive to Amsterdam. One dodo apparently reached Rudolf II of the Hapsburg empire, King of Hungary and Bohemia. Rudolf II, patron of Tycho Brahe and Kepler, was also a great collector. He acquired art treasures, exotic beasts and also commissioned artists to paint his possessions and menageries. He supported Roelandt Savery, who is responsible for the several celebrated dodo paintings that Pinto-Correia writes about enthusiastically. Under Rudolf II, Bohemia was a haven for Protestant refugees. After his death, his successor revoked the privilege under which this religious tolerance was guaranteed. The outraged Protestant Bohemians threw several governors out of a window of the Hradčany castle in protest, an act that has come to be known as the Defenestration of Prague. Pinto-Correia thus uses the dodo as a referential hub from which these and many other stories radiate.

One could, of course, quibble with the digressions, and demand a more direct connection to the dodo in all the tales. However, the author herself states at the outset that she has crafted this book as a version of the *Arabian Nights*, where fabulous stories continually unfold.

The choice of the title *Return of the Crazy Bird*, was not immediately obvious. Crazy bird, apparently, derives from *doudo* which corresponds to crazy, clumsy or stupid in sixteenth-century Portuguese. But what does the author mean by the 'return' of an extinct bird? This theme occupies the rest of the book. The taxonomic affiliations of the dodo, and similar large, flightless birds on Réunion and Rodrigues, have been a source of confusion ever since the sixteenth century, when the dodo was variously affiliated to swans, ducks, chickens, and received a litany of scientific names, including *Dodo lusitanorum* (the dodo of the Lusitanians) and *Cygnus cucullatus* (cuckoo-like swan). Linnaeus named the dodo *Didus ineptus*, but that name has now been superseded by its present name *Raphus cucullatus* (the genus name is a Latinized version of a Dutch vulgar word for 'rump'; hence cuckoo-like bird with a prominent

rump). Pinto-Correia traces the fate of one of van Neck's dodos that landed in the taxidermic collections of John Tradescant, a celebrated English horticulturist and an avid collector, not just of biological specimens. On the demise of the Tradescants (father and son), these collections ultimately passed into the Ashmolean Museum at Oxford University, where the dodo specimen nearly suffered a further final extinction, as this was the last known stuffed dodo specimen. In a cleaning spree at the Museum in 1755, the mouldy specimen was consigned to the flames, and just in time, a portion of the head and a foot were saved by a curator. What prompted this fortuitous, zealous action is unknown. However, this act had important consequences for the 'return' of the dodo in modern times, although it had a nineteenth century revival through Hugh Strickland, President of the Ashmolean Society in Oxford. Strickland wrote an important book in 1848 on the dodo, in which he attempted to establish that the dodo was real and not just a mythical, exaggerated beast of the middle ages, and also to rationalize its extinction. The last report of a live dodo on Mauritius was in 1681. The demise of the dodo was therefore the first instance of a human-caused extinction. Pinto-Correia traces the debate over the dodo between Strickland and the great comparative anatomist Richard Owen, which became fairly acrimonious, especially as Owen considered himself an authority on large, flightless birds such as the prehistoric New Zealand moa *Dinornis*. It is in this latter part of the book that Pinto-Correia falls short. Much of her material appears to have been guided by the delightful essay by Stephen Jay Gould on Strickland, Owen and the dodo¹. Although she quotes heavily from Strickland and Owen's original manuscripts, her presentation of the real nature of the controversy on the origin and decline of the dodo as understood in the nineteenth century, could have been more lucid. Essentially, Strickland defended the clumsiness of the dodo and claimed that as God's creation, the dodo must necessarily be perfect, while Owen was more inclined to view the tiny wings and flightlessness of the dodo as a consequence of a Lamarckian degeneration from a perfect type. In order to explain away the extinction of the 'perfect' dodo, Strickland advocated the inevitability of extinction: *It appears, indeed, highly probable that Death is a law of Nature in*

The Mogul Dodo

Mention of the dodo (OT 11.2) reminded me of a remarkable miniature of the bird, probably painted by Ustad Mansur, in about 1624, on the orders of Jahangir, the 4th Mogul Emperor (1605–27). Scholars believe that the specimen was a late survivor of the by then almost extinct bird which may have been given as tribute to the Emperor in the early 1620s. Though a dissolute monarch, Jahangir was a remarkable naturalist. His passion



was so widely known at the time that foreign emissaries visiting the Mogul court took care to bring with them some curious or beautiful bird or beast from their country as a present. The Mansur dodo (see picture) is lithe and energetic. It looks very different from the portly specimen in the much better-known painting by Roelandt Savery from the live bird which reached the Netherlands in around 1627–8. The latter could, of course, have been the same bird, after several months without exercise.

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the *Species* as well as in the *Individual*. Strickland further believed that the dodo was a pigeon, while Owen at one time believed it to be a vulture.

As it turns out, Strickland was right, at least about the fact that the dodo was a pigeon. This is where Pinto-Correia stops her story, only briefly mentioning the molecular evidence currently available to prove this, and showing that van Neck, Tradescant, and Ashmole did indeed have a significant role to play in the modern revival or return of the dodo. What is this story? Because of the unresolved taxonomic position of the dodo, wherein it has been linked with groups ranging from ratites to raptors, Beth Shapiro, Alan Cooper and collaborators at the Ancient Biomolecules Centre at the University of Oxford, and at the Department of Zoology at Oxford and the Natural History Museum in London, extracted DNA from the only available fragments containing soft tissues (the van Neck–Tradescant–Ashmole specimen at Oxford). They analysed 12S rRNA and cytochrome *b* from mitochondrial DNA of 37 species of pigeons and doves, including the dodo and the solitaire of Rodrigues (*Pezophaps solitaria*) which is also considered to be a large, flightless pigeon. They found that the Laridae (gulls, skuas and jaegers) formed the most appropriate outgroup for this clade. They constructed a maximum likelihood tree for the phylogenetic relationships of the combined dataset². The analysis revealed that the closest living relative of the dodo and the solitaire is the Nicobar pigeon (*Caloenas nicobarica*), that the sister taxa to this group are the crowned pigeons *Goura* of New Guinea, and that the tooth-billed pigeon from

Samoa, *Didunculus strigirostris*, is the basal member of this clade of large, island-dwelling endemics. The analysis further showed that the Nicobar pigeon and the Mascarene birds (dodo and solitaire) separated around 43 million years (m.y.) ago during the Eocene, while the dodo and the solitaire diverged around 23 m.y. ago in the Late Oligocene. The third large bird of the Mascarenes, present on Réunion island, has been found to be a flightless ibis named *Threskiornis solitarius*, a fact that Pinto-Correia does not mention in her book. Since there is geologic evidence that Mauritius emerged as a volcanic island only about 8 m.y. ago and that Rodrigues is still younger at only 1.5 m.y., while areas around the Mascarene Plateau were probably above sea level in the Oligocene, the ancestor of the dodo and solitaire must have come into the Indian Ocean from Southeast Asia using the land ridges as stepping stones. It is, of course, impossible to say whether these ancestral birds were flighted and whether flightlessness only developed once they reached their final destination.

Is the modern-day story of the dodo over yet? Apparently not, because although dodo DNA is in very short supply, several dodo skeletons were recovered from the swampy Mare aux Songes in Mauritius in the mid nineteenth century. Biomechanical studies on these skeletons, especially by Andrew Kitchener in Scotland seem to indicate that the dodo was much thinner than it has been traditionally portrayed. At least half as well padded, bringing down its size from a hefty 25 kg to a more realistic 12 kg. This may tie in well with the fact that explorers that sketched live dodos *in situ* on Mauritius portrayed them as thinner birds, while the dodo apparently developed its fat, waddly persona in the paintings of Roelandt Savery, who may have sketched from live or stuffed specimens in the court of Rudolf II. The middle ages was a time when people were fascinated with the grotesque, and used allegory to impart moral attributes to animal forms. At this time, bestiaries were elaborately painted and embellished. A bestiary is a collection of descriptions and illustrations about real and imaginary animals. These were inhabited by the fabulous manticores with a lion's body, human face and ears and poisonous spines in its tail, and the monoceros with the head of a stag, the tail of a boar, the body of a horse and the feet of an elephant. Modern-



day bestiaries dwell in the creations of Lewis Carroll and James Thurber. Did Savery, therefore, exaggerate the dodo? We do not know. While ancient molecules do not lie, we may never know the veracity of all the tales about the dodo.

Pinto-Correia also needs to correct some inaccuracies in the book. On his maiden voyage to India in 1498, Vasco da Gama landed at Calicut and not Goa. Malinda or Malindi is not a port close to Goa; however it is a port on the east coast of Africa. The famous Portuguese shipbuilding port, Bassein, is not in Myanmar, although there is a port called Bassein on the mouth of the Irrawaddy. The Bassein of Portuguese ship-building fame is close to Mumbai on the west coast of India. Apart from these and a few earlier-mentioned inadequacies, this is a charming book that serves several purposes, no less being taking the reader on an eccentric ride through the middle ages to modern times.

Tradescant's collections were open to the public during his lifetime and they were then popularly, and in hindsight, appropriately called Tradescant's Ark. As Pinto-Correia points out, without Tradescant, and the entire chain of dodo enthusiasts, we would not have had the ancient dodo DNA to solve a most important mystery about the origin and evolutionary relationships of the dodo.

Is the fate of the dodo the fate of all island endemics? Was the dodo more vulnerable because it was flightless and laid just a single egg in ground nests that could be easily preyed upon by rats, pigs and dogs which the island settlers had brought along? It is entirely possible that if the dodo and the solitaire had not inhabited islands that were on maritime highways in the great colonial conquests in

the Indian Ocean, they would still be alive today.

This recalls the wisdom of Solomon: *I returned, and saw under the sun, that the race is not to the swift, nor the battle to the strong, neither yet bread to the wise, nor yet riches to men of understanding, nor yet favour to men of skill; but time and chance happeneth to them all.* Ecclesiastes 9:11.

1. Gould, Stephen Jay, *Nat. Hist.*, 1996, **105**, 22–33.
2. Shapiro *et al.*, *Science*, 2002, **295**, 1683.

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Lectures on Quantum Mechanics. Ashok Das. Hindustan Book Agency, India, P-19 Green Park Extension, New Delhi 110 016. 2003. 528 pp. Price: Rs 600.

Quantum mechanics provides the basic structure on which most of modern physics and chemistry is built. The fundamentals of the subject were developed almost a century ago by scientists who were mainly trying to understand the nature of electromagnetic radiation, atoms and molecules, and the interactions between the two. Since then, the domain of applicability of quantum mechanics has broadened to encompass a vast range of natural phenomena and objects such as radioactivity, chemical bonds, superconductivity and neutron stars. Some of the most useful devices invented by mankind directly use the principles of quantum mechanics, such as transistors, lasers and nuclear magnetic resonance imaging.

Quantum mechanics is unusual in that many of its concepts seem to contradict the intuition we build-up through our daily

observations which are made at length, time and mass scales typical to human beings. Learning quantum mechanics therefore requires putting aside many of our notions which are based on classical mechanics, and a willingness to think about the world in some strange ways. Even people who have many years of familiarity with quantum mechanics are sometimes struck by its apparent contradictions with common sense. This explains why new ways of understanding or applying quantum mechanics continue to be developed even after a century, some examples being geometric phases, Bell's inequalities, entanglement, decoherence and quantum computation.

As already mentioned, some knowledge of quantum mechanics is essential for working in most areas of modern science. Considering the importance of the subject, it is not surprising that there are many textbooks at the elementary level. Most of these textbooks cover more or less the same material and use similar mathematical techniques. The main feature which distinguishes different books from each other is the way in which the authors explain the physical concepts.

The book under review covers most of the topics which are usually taught in a two-semester course on quantum mechanics, such as a brief review of classical mechanics and the essential mathematical concepts, the basic postulates of quantum mechanics, solutions of the Schrödinger equation in one and three dimensions in the presence of various kinds of potentials (in particular, the harmonic oscillator and the hydrogen atom), orbital and spin angular momentum, the variational method and the WKB approximation, time-independent and time-dependent perturbation theory, scattering theory, the Klein–Gordon and Dirac equations, and path integrals.

A distinctive feature of the book is that the author presents the complete details of almost every calculation. Indeed, the author says in the preface that the material almost follows word-to-word the lecture notes of some two-semester courses on quantum mechanics that he has taught in the University of Rochester over the years. This makes it possible for a reasonably motivated student to work through the entire book, with no help from anyone else. I cannot say this of any

other book on quantum mechanics that I have seen.

The physical explanations that the author provides at various points and his choice of examples to illustrate different ideas are generally excellent. For instance, when discussing tunnelling, he works out in detail the rate of cold emission of electrons from a metal, and the lifetime of alpha decay of heavy nuclei. Similarly, the connection formulae in the WKB formalism, the ground state of the helium atom, the fine structure of the hydrogen atom, and inelastic scattering are discussed with a thoroughness which is unusual for an elementary book on quantum mechanics. I also appreciated the inclusion of certain topics such as the dynamical symmetry of the hydrogen atom (the Runge–Lenz operator), some general remarks on groups, and path integrals, which are not always covered in books at this level.

On the other hand, this book omits several topics which are present in many other textbooks, such as the occurrence of bands in a periodic potential, the Aharonov–Bohm effect, the Landau levels of an electron in a magnetic field, the Zeeman effect, the Wigner–Eckart theorem, the hyperfine structure of atoms, the vibrational and rotational spectra of molecules, and electromagnetic transitions between different atomic states. Also, the book does not provide a large collection of problems for students to work out, and it does not discuss, even briefly, any of the new developments in quantum mechanics mentioned above. For the sake of completeness, I hope that the author will take some of these suggestions into account in a future edition.

Based on my experience in teaching quantum mechanics to Ph D students, I feel that the contents of the book can be covered in one and a half semesters rather than two semesters. I would strongly recommend the book to libraries and to students who are interested in learning the basics of the subject.

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