

thermodynamic system when there are a large number of them present? This is answered at the present day state-of-the-art from computer simulations in the article ‘Lattice QCD thermodynamics with physical quark masses’ by R. A. Soltz *et al.* The authors show how improvements of computer performance and algorithms allow us to actually reach realistic quark masses, which are only becoming possible now. In the past, the quark masses were always taken to be much larger than their physical masses due to limitations of memory and clock speed.

In this collection, we also find three articles that form a coherent whole in the state-of-the-art knowledge of the properties of neutrinos, those weakly interacting particles on which, performing experiments are notoriously difficult. While today we know that there are three types, we also know the squares of the mass differences between them; taken two at a time, we do not know their individual masses, nor do we know their ordering.

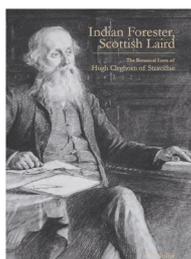
R. B. Patterson reviews the ‘Prospects for measurement of the neutrino mass hierarchy’, whereas Soo-Bong Kim and Kam-Biu Luk review the status of the mixing angle between the first and third type of neutrinos in their article ‘Measurement of θ_{13} . Finally, in the article by David Adey *et al.*, we read about ‘nuS-TORM and a path to a muon collider’.

In conclusion, this collection of important articles is a timely one, that brings the reader up to date on virtually every branch of elementary particle physics and nuclear physics at the frontier. The quality of the articles is of the highest calibre by the leading experts in the world and is a pleasure to read. A must for every library.

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Indian Forester, Scottish Laird: The Botanical Lives of Hugh Cleghorn of Strathivie. Henry J. Noltie. The Royal Botanic Garden, Edinburgh, Scotland. 2016. xii + 324 pp. Price: £15 (ISBN: 978-1-910877-10-4). **The Cleghorn Collection: South Indian Botanical Drawings, 1845 to 1860.** Henry J. Noltie. The Royal Botanic Garden, Edinburgh, Scotland. 2016. vii + 176 pp. Price: £20 (ISBN: 978-1-910877-11-11).

Henry Noltie, no stranger to Indian botanists, is an adorable botanist and avid plant and botanical-art historian of colonial India and of the Madras Presidency in particular. Many, I am sure, will recall his magnificent volumes on Robert Wight, another Scot, who revolutionized the understanding and management of economic plants of the Indian subcontinent^{1,2}.

This review pertains to Noltie’s latest 2-volume set on Cleghorn, who was a contemporary of Edward Green Balfour in Madras³. Hugh Francis Clarke Cleghorn was born in Madras on 9 August 1820. In 1824, the Cleghorns returned to Scotland. He qualified for M.D. from the University of Edinburgh (UE) in 1841 (ref. 4). During his stay at UE, he became interested in plants. He returned to Madras as an Indian Medical Servant. He first served in the Madras General Hospital, and later in Mysore (Shimoga). While at Shimoga, economically important plants fascinated him. In 1848–1851, he went back to Britain on sick leave. His association with John Forbes Royle – especially when Royle was busy cataloguing natural materials for the Great Exhibition in London in 1851 – enabled Cleghorn to get interested in plants. While in Britain, Cleghorn lectured on the reasons for the failure of Indian agriculture in different forums. He attributed tree loss in natural forests as the key reason. These observations stimulated the Government of India to think of introducing forest management and conservation practices to improve agriculture. The

Government of Madras requested Cleghorn to organize a new Forest Department in Madras in 1855. He was appointed the Conservator of Forests of Madras in 1856. Cleghorn considered railways, which were being developed in India then, a major threat to forests. His foresight in calculating that a mile (1.6 km) of train tract would utilize about 1800 wooden sleepers, given that each sleeper would weigh between 75 and 100 kg, is admirable. He was equally concerned with the quantity of wood that would be burnt to run steam locomotives⁵. In 1861, he was appointed the Joint Commissioner of Forest Conservancy of India, along with another distinguished forester of German roots, Dietrich Brandis. He was later requested to plan forest management in Punjab. During his secondment to Government of India from Madras, he explored the natural forests of North-western Himalaya and its neighbourhood. The forest-conservancy methods he had launched in Madras Presidency during his leadership were of high value and relevance in all-India forest management⁶. He officiated as the Inspector-General of Forests of India for a while, when Brandis was on leave. On retirement in 1869, Cleghorn returned to Scotland and lived in Strathivie, until his end in 1895. *Cleghornia* (Apocynaceae) erected by Robert Wight and *Capparis cleghornii* (Capparaceae) erected by Stephen Troyte Dunn, for example, celebrate the life and work of Cleghorn of Madras.

Cleghorn believed in preserving natural forests, since he was convinced that they encouraged better hydraulics and therefore better landscapes. He was conscious how private timber enterprises in Burma indiscriminately destroyed forests and the consequences of such destruction impacted negatively on the hydraulics and landscape of Burma⁶. Brandis⁶ writes:

‘He (*sic*. Cleghorn) justly laid great stress upon the necessity of acquiring a good knowledge of the principal trees and shrubs, as well as of the climate, soil, and forest growth in the different forest tracts; and in regard to the protection of the forests, he studied the chief sources of injury, indiscriminate cutting, fires, and Kumri cultivation.’

Kum(a)ri cultivation was the shifting cultivation practiced in the slopes of Western Ghats of the Peninsular India,

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about which Cleghorn has written in his *Forests and Gardens of South India*⁷.

Cleghorn's birth in Madras determines him an 'Indian', similar to Ronald Ross, who was born to Campbell Claye Grant and Charlotte in Almora. Interestingly, both Cleghorn and Ross spent their professional lives in India and I see no reason to reiterate that Ross encountered the mosquito in India and his work in India on the role of this 'immense' arthropod in the transmission of the malaria parasite won him the Nobel Prize. With a modest sense of parochialism, I would refer Cleghorn as 'Cleghorn of Madras', when Noltie refers to him as 'Cleghorn of Stravithie'.

Noltie presents the Cleghorn story in 450 pages as two volumes: the first on the life and work of Cleghorn in colonial-time Madras (hereafter, Madras) and elsewhere in India; the second refers to his botanical acumen and the details of plants he recorded as exquisite artworks, while serving in Madras and the rest of India. Curiously, the two volumes are of different sizes: the principal volume includes pages of octavo size (240 × 150 mm), while the companion volume includes pages of quarto size (320 × 210 mm).

First on Noltie's principal volume, the *Indian Forester, Scottish Laird*: the term *laird* is classically Scottish, which implies the English term *lord* – owner of a large estate. In 283 pages, under 15 chapters, Noltie has tightly packed sumptuous information that directly and indirectly relate to Cleghorn. Chapter 1 refers to his genealogy, childhood, and education (1820–1841), chapters 2–7 to his Madras stay (including his brief sojourns in Britain) (1842–1864), chapters 8–10 to his stay in Northern India (1865–1869), and Chapter 11 to his retirement in 1869. Chapters 12–15 speak of Cleghorn, broadly, as a scientist, polymath, administrator, and the legacy he has left behind. The companion volume *The Cleghorn Collection: South Indian Botanical Drawings 1845 to 1860* deals with artworks of plant materials enabled by Cleghorn over the time indicated in the volume's title. In 163 pages, Noltie deals with these details in seven chapters. Pages 11–38 and 39–98, forming the bulk of the book, refer to drawings of plants (most of them reproduced vibrantly and colourfully) done in Shimoga in 1845–1847 and in Madras (the town and the Presidency) until 1864. Chapters

4, 5, 6 and 7 refer to 'Copy Illustrations', 'Drawings by European Artists', 'Alexander Hunter and the Madras School of Art', and the 'Edinburgh University Cleghorn Collections' respectively. Because Noltie speaks elaborately on the subtleties and nuances of botanical artworks created by various Indian artists who worked for Cleghorn in pages 5–163, the introductory chapter on Indian artists is relevant.

In the chapter 'Madras Polymath', Noltie speaks of the multidimensional personality of Cleghorn. Pages 56–61 feature Cleghorn's association with the Madras Medical College (MMC). The foundation-stone superintendent of MMC (then known as the Madras Medical School) was William Mortimer and not William Montgomery^{8,9}. Because Cleghorn was the professor of botany at MMC, to teach *Materia Medica*, which necessarily included learning about various medicinal plants, he used accurately depicted illustrations of plants as a teaching tool. Noltie indicates that this tactic of using accurately drawn illustrations was a capability Cleghorn acquired from John Hutton Balfour of the Royal Botanic Garden of Edinburgh (RBGE). Page 59 includes an inspiring description of the manner in which Cleghorn taught botany to students at MMC. At Cleghorn's initiative, a museum of vegetable productions and a botanic garden appear to have been established in MMC. Woeefully, no trace of these exists today. Cleghorn also concurrently played a key role in the management of the Madras Horticultural Society Garden (MHSG) (later, the Madras Agri-Horticultural Society Garden), which was established by Robert Wight in 1835. Recognizing its variety and vanity, Cleghorn, as the Secretary of MHSG, enumerated the plants occurring within MHSG. He (over)enthusiastically titled this work *Hortus Madraspatensis* and got published it through MHS in 1853. At the Madras Exhibition of Raw Products, Arts, and Manufacturers of Southern India (1855), held during the governorship of George Harris, Cleghorn further to playing a key role in the arrangement and management of the Exhibition, displayed 28 gums and resins obtained from the trees in MHSG, 43 wood specimens he had collected while he was at Shimoga, and a range of botanical drawings. Chapter 5 (Forests of South India, 1856–1860) offers interesting details not only from

the perspective of and the role played by Cleghorn in Madras and to southern-Indian Botany and Forestry, but also through stories and snippets that bear a link with him. Chapter 6 (Gardens of South India) is a repository of rich science history of Madras, which speaks of Cleghorn's role in the development of the Government Garden at Ootacamund (Ooty) (then managed by William McIvor, which bears significant relationships with the introduction of *Cinchona* into India¹⁰), the Lal Bagh at Bangalore, a few private gardens both in Ooty and Madras, and the People's Park, Madras. The design and development of the People's Park in Madras is of immense importance in the annals of Madras's history, since it housed the Madras Zoo until the late 1960s.

Bulk of the companion volume includes reproductions of carefully chosen, representative illustrations from the Cleghorn plant collections (I imagine that these are archived at the Royal Botanic Garden Edinburgh – RBGE) made during his stay in Shimoga, Madras environs, and elsewhere in India. Noltie presents details starting with the currently valid name (+ authority), family name, English and various Indian-language names, the artist who made the drawing, followed by other relevant details. As an example, I will refer to pages 12–13, which allude to *Tectona grandis* (Lamiaceae). Noltie provides a crisp commentary on *T. grandis* populations as noted by Francis Buchanan (known as Francis Buchanan-Hamilton in later days) during the survey of the Mysore region in 1800–1801 (ref. 11). With the fall of the Mysore Tiger, Buchanan was requested to survey southern India in 1799; his survey resulted in *A Journey from Madras through the Countries of Mysore, Canara and Malabar*. Cleghorn visiting the site previously visited by Buchanan, 45 years later, recognized the declined numbers of *T. grandis*, which he attributed to the shifting cultivation (*kum(a)ri*) practised in that area. This observation made in 1845 triggered Cleghorn to intensify his interest in forest conservation and to writing a seminal report on the effects of deforestation for the British Association for the Advancement of Science¹². The page that includes Noltie's remarks also includes a photograph of the herbarium sheet of *T. grandis* (Cleghorn material) and a fascinating 31.3 × 19.4 cm artwork of the same done

by an unknown Maratta artist. I was highly impressed by the details in that artwork and its brilliance of colour, which indeed hint at the artist's skill and Cleghorn's meticulousness. Every detail, vitally necessary for a sharp plant explorer, geographer, and taxonomist, is captured in these expressive illustrations. Photographs of herbarium sheets do not occur with every documented plant, but many do. Overall the colour reproductions, which Noltie has painstakingly selected and presented, are brilliant and vibrant. Orthographs of some *Tamizh* (Tamil) names, provided in the notes do not match exactly the way they are spoken. I recognize that Noltie had relied on an Indian source for such local Indian names. For example, *poorsha* and *pooverisha* refer to *Thespesia populnea* (p. 16), whereas it should be *poo-arasu* (or *poovarasu*), which literally translates into 'flowering *arasu*'. *Arasu* (*Tamizh*) is *Ficus religiosa* (Moraceae). Since the leaves of *T. populnea* resemble those of *F. religiosa*, in high likelihood, ancient *Tamizh* people recognized *T. populnea* was a 'kind' of *F. religiosa*. Perceptibly, they were struck by the showy yellow flowers of *T. populnea*, whereas the flowers of *F. religiosa*, because they occur within syconia, the *Tamizh* people did not know and probably saw them as 'fruits'. Therefore, possibly, they preferred to call *T. populnea* as flowering *arasu*, viz., *poo-arasu*. A convincing etymological link to *F. religiosa* is reinforced in *T. populnea*'s Sanskrit name *pārśva-pippala*, wherein *pārśva* means 'near', 'adjacent', 'close to' and *pippala* is *F. religiosa*. *Tamizh* Sangam literature (350 BC–300 AD) refers to *T. populnea* as *Kāñçi*, which may have offered the name to the town *Kāñçipuram* near Madras¹³ (also see verse # 56, *Ahānānuru*, *Étu-ththōgai* by *Madurai Aruvai Vānikan Ilavēttanār*, *Marudam ṭinai*; <https://learn-sangamtamil.com/akananuru/>).

The 'Madras Nature Prints' chapter is illuminative. I have not known of the Madras Nature Prints. Noltie explains these prints are direct images made from plants, especially leaves, as a way of capturing intricate patterns, such as leaf venation. In practice this effort did away with the reliance on an artist. Noltie indicates that Cleghorn accumulated close to 300 of such monochrome colour Madras Nature Prints, most of which are archived under the Cleghorn collections in RBGE. A majority of such prints were

made by Cleghorn himself, about which he indicates in his letter to John H. Balfour. While reading this segment, I remembered using various synthetic compounds (e.g., nail varnish, collodion, and cellulose acetate) to create leaf-epidermal replicas that were amenable for microscopic observations following Long and Clements¹⁴, while I was studying with the late Bangalore Gundappa Lakshminarayana Swamy in Presidency College, Madras. I wondered whether the 19th century Madras Nature Prints had inspired Frances Louise Long and Frederic Edward Clements of Carnegie Institute at Washington for developing the collodion-imprinting technique! I would not know.

Reading the chapter that refers to the Madras School of Arts (MSA) started by another Scottish medical doctor in Madras, Alexander Hunter (the Hunter's Road in Vepery, Madras, commemorates Hunter), as a private art school in Popham's Broadway in 1850 kindled pleasant thoughts in me. Today MSA functions as the Government College of Fine Arts in a different, but at a not-far-away location, in Madras. Cleghorn in 1851 found students trained at MSA useful to him in creating artworks of plants and items of medical relevance (e.g., human anatomy). Cleghorn especially used the services of one P. Moorogasen Moodaliar (read as Murugesu Mudaliar), a graduate of MSA and later a teacher at MSA, who created artworks for Cleghorn (see p. 154 for two sample reproductions of Moorogasen's artworks). Pages 156–159 talk briefly about some of the artworks that were created at MSA, especially those relating to plants, have found a place in the Cleghorn collection at RBGE. Fig. 41 (page 159) enticed me, which displays an aesthetically represented twig of *Momordica charantia* (Cucurbitaceae) as the motif; the illustration is captivating because of intricately precise, repetitive pattern (*guilloché*), with a delicate sense of symmetry, created in Hunter's MSA, possibly for use as a decorative vector, page separator in printed books.

In conclusion, Noltie has done a yeoman service recapturing the science history of Madras and India, as he chronicled the life and science of Cleghorn, who played a vital role in recognizing the scientific merit and aesthetic and economic values of Indian forests. Although Brandis too played an equally

vital role, Cleghorn's role in enabling forestry to evolve as a science in India, while spending most of active career life in southern India is worthy of recognition. Cleghorn, assuming charge as the Conservator of Forests of Madras toured various locations of the Eastern Ghats, and thus scoped knowledge on timber trees and forests. Cleghorn's role as a forester cannot be gainsaid in the context of Indian forestry and forest management.

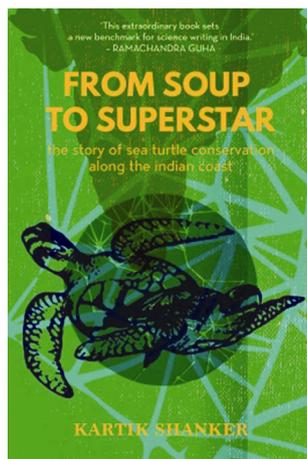
Reading Noltie volumes has been enjoyable. As an amateur chronicler of Madras's science, I learnt many details that were new to me. I revelled seeing the illustrations, which eloquently spoke to me of the 19th century Madras, connected either directly or indirectly with Cleghorn. Let professional historians lock horns and debate whether Cleghorn's (for that matter other botanists and zoologists of those days, as well) works had foreshadowed modern concepts – such as climate change and the effects of such changes – on the present-day human endeavours. But, to me, as a simple-minded student of science, reading Cleghorn's life and work, featured in breezy prose and embellished with impressive illustrations, was enlightening. The Noltie volumes speak the science of plants – treated both as basic botany and as applied forestry – in the context of the work of Cleghorn and his contemporaries, simply and lucidly. The volumes made me experience the charm of plants and at the same time feel their vibration in terms of their relevance to humans. The layout of the book and the imaginatively integrated artwork reproductions (engravings and etchings) transported me to Cleghorn's time in Madras.

Considering the quality of production, especially that of the colour images, £35 (approximately INR 3200) is reasonable by any stretch of imagination. The Scottish botanist–historian Noltie richly deserves our thanks for having elegantly warped and woofed fine strands of Madras's history, while creating a charming fabric on Cleghorn. My hope and desire are that every Indian student of biology will read this book and know how biology and its applied disciplines have evolved over time in the Indian subcontinent. Students of history, interested in science history, too will find these volumes highly relevant and to know how to present science and scientific facts simply, crisply, and enchantingly.

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From Soup to Superstar: The story of sea turtle conservation along the Indian coast. Kartik Shanker. Litmus, An Imprint of HarperCollins Publishers, A-75, Sector 57, Noida 201 301, UP. 2015. 368 pages. Price: Rs 550.

‘Can science inform conservation?’ asked Kartik Shanker. Seven first year PhD students (year 2007) at Centre of Ecological Sciences (CES) were dumbfounded. This question probably never crossed the minds of these naive aspiring ecologists, some of whom were infatuated with their study system and zealous about its conservation. I was one of the bemused students and I have been pondering this question ever since. Is mere common sense sufficient to craft long term conservation strategies? Or is there relevant scientific knowledge to envision viable conservation programmes, but we are limited in our creativity to harness the full power of this knowledge?

In the prologue to his book on the story of sea turtle conservation in India, Kartik writes ‘but the domains of biology and conservation intersect more significantly in the sea turtle world than perhaps for any other animal group’. I wondered in what way these two domains intersected and what Kartik truly thought about the role of science in conservation. The title of the book, *From Soup to Superstar* thoroughly whetted my appetite for a story about food and fame.

I actually started reading the book from the middle, because I could not resist the beautiful colour photographs of sea turtles and the emotive black and white photographs of turtle biologists and conservationists. The charismatic physiognomy of the turtles with large innocent eyes set in benign rounded

heads instantly trapped my pre-existing sensory bias. There is potential for stardom for sure. But far more powerful gastronomical biases and survival instincts of people can easily eclipse the visual charm and land the turtle in hot soup. Is the turtle egg hatchery of Students’ Sea Turtle Conservation Network (SSTCN) still an unpretentious thatched hut? Decades of monitoring and conservation efforts by Rom Whitaker, Satish Bhaskar and others – were it in vain? I could hardly wait to read the book from the beginning and see the story unravel.

Kartik lures us into the world of the olive ridleys by vividly describing the hatching of a clutch of eggs and the frenzied scramble of the juveniles down the sandy slope into the sea. He provides a brief history of turtle research in India and then introduces us to the two most riveting personalities in the drama of sea turtle research and conservation – Satish Bhasker and Rom Whitaker. Kartik engagingly narrates many incredible and legendary feats of Satish on his survey and monitoring trips and his remarkable discoveries. Can you believe that anyone would be willing spend five months in isolation on a remote island to document the nesting of green turtles? Moreover, there was no guarantee that a boat would arrive for the pick up before the rations ran out! Kartik also interlaces the prose with excerpts from letters that Satish wrote from remote places to his family and friends. One of them was actually a ‘message in a bottle’ to his wife, set afloat in the sea and found by a fisherman in Sri Lanka! Satish’s letters are not merely fascinating in content; they are utterly beautiful in language and style.

Rom Whitaker started a conservation programme in Chennai in 1973 that relocated turtle eggs to a hatchery. He explored the islands of Andaman and Nicobar for initiating survey and monitoring programmes. Rom took up Indian citizenship so that he would be permitted to work on these islands. A true patriot – a citizen by choice and not by default of birth! That or he is just extremely passionate about conservation. Many other players such as Robert Bustard, C. S. Kar and E. G. Silas in the early stages of sea turtle conservation and biology are introduced to us. But Satish and Rom are omnipresent in this narrative. This book is a homage to the extraordinary efforts of these enigmatic outliers and justifiably dedicated to them.