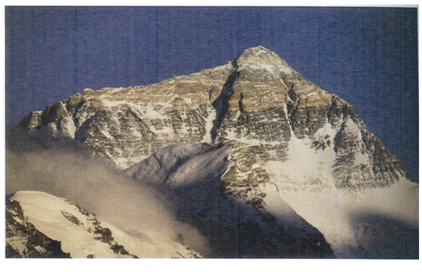
Annual Review of Earth and Planetary Sciences, 2016. Raymond Jeanloz and Katherine H. Freeman (eds). Annual Reviews Inc., 4139, El Camino Way, P.O. Box 10139, Palo Alto, CA 94303-0139, USA. Vol. 44. 813 pp. Price: US$ 109.

We are going through interesting, but uncertain times. Some call it as post-truth cultural milieu where debates are framed largely by appeals to emotions rather than factual realities. Needless to say that it is antithetical to scientific method that revolves primarily around falsification (read Kathleen Higgins in *Nature* dated 1 December 2016, for those who are 'perplexed' about post-truth). The current environmental crisis has become a fodder for post-truth campaigns. It is well known that some climate change skeptics, in spite of energetic counter campaigns by the American Geophysical Union (AGU) and other professional organizations, refuse to budge on nay saying for climate change. They are of the opinion that climate change is a hoax and a conspiracy by the far left and liberals. Geoscientists have become a punching bag of so-called climate change skeptics, who even go to the extent of denigrating the whole discipline of earth sciences. It is interesting to note how this attitude affects the question of federal funding in the area of earth sciences, and how it is going to impact the international treaties on climate change mitigation that are in the making, which impinge on hard earth sciences research.

Margaret Leinen (President of the AGU) in one of her statements emphasized that, 'Of course the geosciences are part of the hard sciences. They provide us with very fundamental knowledge about the way the planet works, knowledge grounded in the physical sciences.' She further mentioned that geoscientists are involved in 'analyzing the complex mixtures of physical processes and chemical reactions in the atmosphere and the ocean to characterizing earthquakes, in which geoscientists have made important contributions to physics and chemistry'. She pointed out to the world's most powerful computer 'Earth Simulator' in Japan, and how it can be used to model and simulate future earthquakes and said, 'Our entire exploration of Mars is based on analogies with the Earth'. That's also true, she adds, for the search for extraterrestrial life on water-rich planets and moons. In the past, climate had indeed changed over millions of years due to natural causes, but now because of anthropogenic activities, the rate of change has increased exponentially. Earth has never gone through this kind of accelerated change in its history and the runaway consequences can be unpredictable. Earth scientists are trying to numerically model the anticipated changes, but models may not be always realistic due to paucity of data and little known feedback mechanisms. So we keep improving models with new inputs as fresh observational data pour in. This is not a drawback, but it shows only the strength of scientific method. If you require hard proof for the defence of earth sciences, then turn through the pages of this book under review. You will be convinced that each of the articles in this volume is a fitting reply to those who try to browbeat the importance of earth sciences research just because it reveals some disturbing truths about human-induced environmental changes that have implications for future sustenance of life.

Among the 26 articles in this volume, seven articles deal either with past or present climate, and the tools to study the same. Two articles examine the proposed models of equilibrium climate sensitivity (ECS: the ratio of temperature change to a doubling of CO_2) from changes in the earth's energy budget and address questions on surface temperature changes and greenhouse gas (GHG) concentration. Forster focuses his review on earth's energy budget and feedbacks on decadal scales. He suggests that effective ECS over the historical period of around 2 K holds up to scrutiny, but points out the fear of underestimation for want of clear understanding of the relationship between ECS and biological and physical feedbacks that might either have a positive or negative impact on the warming trend. Royer looks at climate sensitivity from a long-term perspective of the last 500 million years (called Phanerozoic period by the geologists), and concludes that both proxy records and model simulation agree that climate is about twice as sensitive to CO_2 on long timescale, contrary to the results of shorter-term timescale studies. Warming also leads to thawing of permafrost in the cold latitudes, exposing the protected organic matter for microbial degradation and production of GHGs. Mackelprang *et al.* introduce the reader to the latest protein and genomic sequencing technologies as tools to explore permafrost microbial ecology while frozen soils thaw due to climate change. In an article linking climate change to the collapse of lowland classic Mayan civilization, Douglas *et al.* focus on the linkages of unusually extreme droughts and the eclipse of the classic lowland Mayan civilization. This review compiles the proxy data to show that the severe droughts during the 9th and 11th centuries led to the undoing of the Mayan civilization. There are disquieting parallels throughout the human history, where connections of environmental deterioration and decadence of human societies can be established globally, brought out dramatically in a more popular mode by Jared Diamond in his book *Collapse*. In that book under the chapter 'The Mayan Message', Diamond asks, 'we have to wonder why the kings [Mayan] and nobles failed to recognize and solve these seemingly obvious problems…. Their attention was focused on … enriching themselves, waging wars, erecting monuments, competing with each other and extracting enough food from the peasants to support all those activities …'. Doesn't this sound too familiar?

Biomarker research into molecular fossil record has made significant advances. Two articles – 'Cellular and molecular biological approaches to interpreting ancient biomarker' (Newman *et al.*) and 'Biomarker records associated with mass extinction events' by Whiteside and Grice deal with genetic and cellular biological tools as biomarkers. The first article uses biomarkers to understand the early history of life and the second one to understand the key processes (eutrophy, euxinia, ocean acidification, changes in atmospheric CO_2 and other factors leading to mass extinction during different geological intervals). In a global warming scenario and



The north face of Mount Everest (8,848 m) with low snow cover.

consequent higher water temperatures the efficiency in organic matter (OM) storage in the coastal areas may deteriorate. Bianchi *et al.* review the overall impact of changes involving expanding oxygen minimum zones, higher water temperatures, changing riverine inputs of OM, etc. on OM storage capacity in the coastal oceans. Norris *et al.* caution on the environmental consequences of fracking – a technology aiming at hydraulic fracturing of shale formations to extract oil and gas. Although modern fracking has contributed to greater availability of hydrocarbons, the environmental damage it causes is a serious concern, which needs to be addressed.

As quoted from Leinen earlier, the scientific ventures into other planets are helping us obtain analogies of climatic evolution over a scale that was unimaginable in the past. In the strange world of Titan, a moon in the Saturn system, surveyed by the Cassini Huygens mission, we come across lakes of seas not made of water but of methane. There are two reviews on Titan – one by Mitchell and Lora, and the other by Hays. The former review opens up the wonderland of Titan and discusses the climate of Titan, as obtained from observations and models. Titan's cold surface temperatures going as low as ~90 K render methane to form clouds and precipitate analogous to earth's water in hydrological cycle. It is the methane cycle (like water cycle on earth) that sculptures Titan's surface. Hays in his review suggests that Titan's lakes and seas differ from aqueous environments on Mars or Europa, and any organisms that could thrive in Titan's environment would have a fundamentally alien biochemistry, unlike that of any known terrestrial life. It looks like the concept of alien life would require drastic revisions as new worlds open up new possibilities.

Robin Wordsword discusses early Martian climate (~4 billion years ago). The geological evidence indicates that during that time the planet oscillated between cold and warm phases for a while before it slumbered permanently into a cold state. A small window of opportunity existed 3–4 billion years ago and Mars at that time probably may have had the wherewithal to sustain some form of elementary life. The Tunguska event in Siberia in the morning of 30 June 1908, which flattened a large tract of forest, remained a great mystery for over a hundred years. It was generally considered to be an airburst or a meteor impact, but no impact crater was found at the site. Artemieva and Shuvalov compare the 1908 Tunguska event with the 2013 Chelyabinsk (again in Russia) and the 1994 Shoemaker-Levy 9 comet impact on Jupiter. They review the Tunguska event and suggest that it is consistent with that of a typical airburst caused by a meteoroid 40–100 m in diameter entering the atmosphere obliquely at cosmic velocity. This object disintegrated several kilometres away from the surface, which explains the lack of a crater. The 2013 Chelyabinsk event was a smaller version repeat and the authors caution that such impacts remain a risk despite the earth's atmospheric shield. In some other planets (e.g. Mercury, Mars and Venus) or satellites (e.g. moon), such hyper-velocity impacts are the main contributors to rock-forming processes. The disaggregated materials thus formed are called regoliths that may be up to several tens of kilometres thick or sometimes make up the entire crust of a planetary body and new rocks like breccias are formed through re-amalgamation from this regolith material. This is the topic of discussion in the article by Spray, where he explores various mechanisms and processes that form new rocks in the regoliths of inner planetary bodies.

A major theme of this volume is earth's deep history of biosphere and some of those aspects are covered in three articles. One of the articles in this category (Fischer *et al.*) deals with the genesis of oxygenated environment – a major game changer in biogeochemical cycles that initiated oxygenic photosynthesis. Another article (Smith *et al.*) reviews the research developments in understanding the life evolution in the first 3.6 billion years of earth's history. During this time the organisms diversified from simple, unicellular to complex, multicellular forms. Study of ontogeny and development, population genetics, ecology, physiology and biogeography of brachiopods both from biological and geological perspectives is discussed in an article by Carlson. Interestingly, brachiopods, the hard-shelled marine organisms had greater diversity prior to end-Permian mass extinction, but have markedly lower diversity today – a major question that deserves committed research. Lithospheric evolutionary trajectories are discussed in the articles by Muller *et al.* and by Hodges. The former article presents revised global plate motion model starting from 230 million years (Triassic) to the present. The higher mean plate motion rates of 9–10 cm/yr between 140 and 120 million years is attributed to a sequence of igneous emplacements and a later deceleration of plate velocities to 4–5 cm/yr, ca. 50 million years ago owing to India–Eurasia collision and ridge subduction events in the Pacific. Hodges reviews the current understanding of the thermo-mechanical models of wedge architecture in two orogenic systems of geologically younger Himalaya and much older East Greenland Caledonides.

This volume has given ample importance to the burgeoning field of isotopic investigations. Bao *et al.* discuss the triple variation isotopes of oxygen, as influenced by liquid and atmospheric processes on earth and their application in the study of earth processes, in addition to the principles and concepts. Foster and Rae show how using boron isotopic composition of marine calcium carbonate (from foraminiferal shells), the past ocean pH can be tracked and ultimately atmospheric CO_2 concentration can be estimated. This knowledge will be able to provide some important constraints on the anticipated changes of current ocean chemistry in the wake of increased atmospheric concentration of anthropogenic CO_2. Dauphas and Schauble make a scholarly exposition of mass fractionation and isotopic anomalies and their signatures in different nuclide isotope systems, and how they are useful to gain newer insights of the isotope systems in the solar system and planetary genesis. Dutta's review brings out the role of natural drivers like solar magnetic activity and ocean circulation, and anthropogenic perturbations (fossil fuel and nuclear detonations) that pose challenges to high-resolution radiocarbon dating. The rising proportions of carbon emissions in the atmosphere due to fuel emissions and industrial discharges will have serious implications on dating samples younger than 2000 years (after ~30 years, if 'business-as-usual approach' prevails in carbon emission standards – as stated in a paper by Graven, *Proc. Natl. Acad. Sci.*, **112**(13)). Another set of articles in this volume focuses on how some analytical techniques employed in earth sciences research can be used for more practical applications. Under this category, Cerling discusses the use of stable isotopes in forensic studies to answer questions related to the provenance of illicit materials. Kemp explores the usefulness of environmental sensing of nuclear activities, which is important in the verification processes of nuclear treaties. The evolving methodologies are now assuming greater relevance in detecting covert nuclear activities.

In summary, this volume has done an excellent job of showcasing the best of earth sciences research. In my last review of the 43rd volume published in *Current Science* (2016, **110**, 919–921), there was a mention on the lack of articles from Indian researchers. This time that quibble is compensated with Kaushik Datta's excellent article. The editors have also made a categorization of articles under various themes at least in their introductory article, which helps the readers to focus their attention according to their individual choice and interest (see my review of the 42nd volume (*Curr. Sci.*, 2015, **108**, 283–285)). This practice can also be extended to the contents page, where titles can be brought under various categories as done this time in the introductory article. The prefatory article in the latest volume ('Tektites, Apollo, the crust, and planets: a life with trace elements') is written by Stuart Ross Taylor, a planetary geochemist. With 10 books and 240 papers, he has made foundational contributions to the understanding of composition and evolution of the moon. His other interests include baroque and classical music (Mozart, Beethoven, Schubert and others) composed before 1820, previous to the Romantic Period. When I read about his interest in music, one question that came to my mind was the link between scientific success and art. There is enough proof to show that the firing of imaginative powers of scientists can also be correlated with their abiding interests in various non-scientific creative activities. Lives of many scientists give credence to this proposal, and Taylor is no exception.

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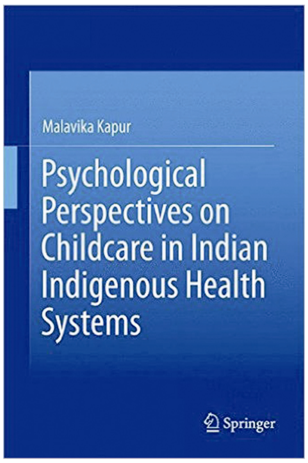

Psychological Perspectives on Childcare in Indian Indigenous Health Systems. Kapur Malavika. Springer, Barakhamba Road, Fire Brigade Lane, Barakhamba, New Delhi 110 001, India. 2016. xx + 264 pp. Price: Euro 99.99.

Traditionally health and illness were interpreted in a cosmological and anthropological perspective, and were dominated by magical and religious beliefs. Given the limited knowledge on health and medicine, and low advancement of science, the archaic man attributed diseases, human sufferings and calamities to the wrath of Gods, invasion of the body by evil spirits and even malevolent influence of stars and planets. Subsequently, both Siddha and Ayurveda healthcare systems of medicine evolved in ancient India, which supported sustainable medical practices and disease control in the country. Hygiene was given importance in ancient Indian medicinal practices and played a significant role in many parts of Asia. However, in contemporary times, when medicinal practices and disease control mechanisms are being led by scientific knowledge and technological innovations, the erstwhile traditional medicinal practices such as Ayurveda, Siddha, Unani and Tibetan system have proved their relevance and presence. The book under review provides a comprehensive, yet focused account of indigenous health system from psychological perspective in the context of childcare. The book has 22 chapters classified under five major parts. Ayurveda, Siddha, Unani and Tibetan systems of medicine have been discussed at length in the first four parts. Basic principles, developments with particular significance to childcare, disorders in the newborn and common childhood disorders and treatments are described. The final part of the book brings together the four indigenous healthcare systems from a developmental perspective and underlines implications for theory, practice and research.

The author argues that childhood begins from the time of conception and has a lifelong impact on the human body, mind and personality. Ayurveda represents many indigenous healing traditions of great antiquity that include the folk healing traditions. The basic principle of Ayurveda is the 'science of life'; it deals with creation as a whole, and follows a holistic approach of Samakhya tradition with special emphasis on the biological living being. The major Ayurvedic treatises were compiled by sages such as Charaka, Sushruta, Vagabhata and Kashyapa during 400–200 BC to AD 600, especially for children's diseases. The author argues that sadhya (curable) and asadhya (incurable) are two types of diseases in Ayurveda, and proposes chikista (treatment of disorder) using fast-acting drugs in Ayurveda which consist of natural elements having no negative effects on the body. Emphasizing the relevance of *Sushrata Samhita*, the author goes on to elaborate the developmental approaches in the field of childcare (p. 31). She argues that children should be produced not by accident, but by conscious effort, which means that parents as well as the whole family should be physically and psychologically ready for the newborn.

The author also highlights how both physical (such as reproductive elements) and psychological states of the parents through food habits and temperament of the mother influence the formulation of prakriti (personality) of the child. The constitution of the child is determined during the formation of the foetus, and inadequate growth of the embryo is attributed to imbalance in the dosa (constitutional traits) or guna (temperamental traits). By referring to Kashyapa, an Ayurvedic scholar, the author highlights the importance of clinical observation for young children who cannot report their symptoms. Hence, treatment of infants was considered a highly specialized subject in ancient India.

The word 'Unani' owes its origin to the Greek word 'Ionia'. This system of medicine dates back to 1000 BC. Fundamentals of Unani medicine are material (Maadi) substances and energies on