The rediscovery owes a great deal, on the one hand, to Indian mathematicians, K. Balagangadharan and C. T. Rajagopal among them, who studied this work and wrote (starting from the 1940s) expositions of the work in modern language, which brought this work to the attention of the international mathematical community. On the other hand (at around the same time) a critical edition of *Yuktibasha* was published by scholars. The name 'Kerala School' is now familiar to the general public in India. Could it be that the long delay in the recognition of the remarkable contributions of the school was due to the hegemony of Sanskrit, because *Yuktibasha* was written in the local language, Malayalam?

Conclusion

The last part, titled 'Connections' treats many topics which are relevant to a proper appreciation of the course and sociology of the development of mathematics and is not easy to summarize. It does not avoid dealing with vexed questions like priorities, originality, transmission of ideas, and the role of proof in Indian mathematics. These are questions which evoke much passion among historians of mathematics (and mathematicians); for instance some eurocentric mathematicians would denigrate Indian mathematics and some Indian mathematicians would exaggerate Indian contributions. The author analyses the different viewpoints and presents his own conclusions which are sensible and non-dogmatic.

He also discusses the role of faith in individual mathematicians. Some successors of Madhava and also his biological descendants are thought to have adhered to Lokayata philosophy, but about Madhava we do not have enough information to know if he also did.

Concerning the transmission of knowledge, it is striking that while Indian mathematicians were receptive to Greek astronomy, there was no influence of Euclid's 'Elements', and no trace of any of the following in Indian mathematics: prime numbers, prime factorization ('the fundamental theorem of arithmetic'), the treatment of incommensurables as in Euclid's 'Elements' and a familiarity with axiomatic and deductive methods. Other intellectual activities in India which might have been relevant for mathematics also had no influence. The author says: 'It is futile but fascinating nevertheless to ponder how a wholehearted adoption of Paninian structural methods might have transformed India's mathematical landscape.'

As for the transmission from India, Indian mathematics, especially Algebra, was studied and developed by the Arabs (a generic term which included inhabitants of present day Iran, Central Asia and some Arabic speaking countries) and transmitted by them to Europe. The development of Algebra in the sixteenth century in Italy, influenced by the mathematics originating in India and Islamic countries, started modern mathematics and the renaissance of mathematics in Europe.

The knowledge of the decimal place value system was also transmitted to Europe by the Arabs.

Exposition

The exposition in the book is tuned to the matter under discussion. Those with little mathematical background can get a gentle introduction to what natural numbers are (Peano axioms), and what recursion and induction mean. They can also learn about the decimal system of enumeration (section 4.2). Those with some mathematical background would enjoy reading in modern notation and mathematical language, how the power series expansion for the sine function was derived by the Kerala School (section 12.2). Even someone with no interest in mathematics or history of mathematics can read with pleasure (in sections 9.2 and 9.3) a fascinating social history of Kerala at a certain period of its history.

I have passed over other topics treated in the book, like mathematics in the Indus Valley civilization, the influence of Greek Astronomy, Jaina and Buddhist Mathematics, and the Bakhshali manuscript.

The book is highly recommended for anyone interested in understanding in depth the history of mathematics of India. While the material in certain sections is somewhat densely packed, reading these sections with close attention would be a rewarding experience,

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Annual Review of Medicine, 2018. C. Thomas Caskey, Mary E. Klotman and Peter Scardino (eds). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, California 94303-0139, USA. Vol. 69. vii + 506 pages. Price: US$ 112.

Annual Review of Medicine is a must read for those physicians who are inclined to keep track of advancing frontiers in medicine and thus be aware of changing paradigms in diagnostic and therapeutic approaches. The book offers lucidly composed, authoritative, critical and comprehensive, yet concise reviews on selected topics in a variety of specialities. The latest volume has 34 articles; 11 of them are on themes related to cancer and 9 deal with cardiovascular diseases.

Articles on cardiovascular diseases are about atrial fibrillation, heart failure, hypertension, hypercholesterolemia, sudden death after myocardial infarction, peripartum cardiomyopathy, heart disease in athletes and cardiovascular complications in patients with cancer.

Catheter ablation introduced two decades ago, is a requisite treatment method for atrial fibrillation. Efficacy, efficiency and safety of the procedure have bettered in recent times, thanks to improvement in strategy and techniques of ablation. These include focal impulse and rotor modulation (FIRM)-guided ablation, availability of force sensing catheters, automated atrial mapping and cryo ablation therapy. Rakesh Latchamsetty and Fred Morady from the University of Michigan review the indications for and the goals of ablation, describe the advances in the technologies and strategies, assess short and long-term outcomes after ablation and discuss a multidisciplinary approach for the long-term management of patients with atrial fibrillation.

J. D. Gladden and colleagues from Mayo Clinic, Minnesota survey the current knowledge of the epidemiological factors, clinical features and pathophysiology as well as the diagnostic approach and treatment options for heart failure with preserved ejection fraction (HFpEF), which is expected to be the most common form of heart failure in the coming decade. They conclude that diagnosis of HFpEF is a challenge and that it is necessary to discover newer diagnostic techniques and ways to

improve detection of HFpEF. Also, it is important to delineate the mechanisms that lead to HfpEF, as it is not clear whether HFpEF is one disease or it results from multiple causes. The current pathophysiological model has no sufficient proof. The authors also point out the lack of a single biomarker and a specific therapy for HFpEF.

The Systolic Blood Pressure Intervention (SPRINT) trial is a land mark study which indicated that intensive treatment for reduction of blood pressure in patients with high risk of cardiovascular disease results in lower rates of both fatal and non-fatal cardiovascular events and death from any cause. Be that as it may, it is still debated whether the SPRINT results can be generalized to populations which were excluded from the trial; for example, those with diabetes mellitus or heart failure, elderly residents of nursing homes, frail individuals, or those with dementia. Lama Ghazi and Suzanne Oparil from the University of Minnesota examine the applicability of the data of SPRINT trial to the general adult population with hypertension and various co-morbidities, the cost effectiveness of intensive therapy for lowering of systolic blood pressure and significance of developing hypertension guidelines for future clinical practice. Other issues raised are the difficulty in implementing SPRINT blood pressure measuring technique in routine clinical practice and the likelihood of achieving target systolic blood pressure in patients with very high blood pressure. There is a small risk of rapid decline in kidney function and the risk of incident chronic kidney disease, but blood pressure lowering outweighs both the risks. There are also other benefits such as lower incidence of small vessel ischemic disease in the brain and slower decline in cognitive function. Studies using a microsimulation model which estimates health care costs, clinical outcomes and quality-adjusted-life-years (QALYs) of intensive versus standard systolic blood pressure treatment have shown that intensive treatment is cost effective over a life time of treatment.

E. Ajufo and D. J. Radar from the University of Pennsylvania review the safety, mechanisms of action and efficiency of four novel agents with regulatory approval and six emerging, promising agents in development, for lowering low density lipoprotein cholesterol (LDL-C) levels in blood of patients with familial hypercholesterolemia. Those agents which have been approved for use are lomitapide, an inhibitor of microsomal triglyceride transfer protein, mipomersen, a second generation anti sense oligonucleotide that binds to apoB100 mRNA transcripts in liver and alirocumab and evolocumab, which are monoclonal antibodies to proprotein convertase subtilisin/kexin9 (PCSK9). Inclisiran, a small interfering RNA (siRNA) which causes sequence-specific degradation of the PCSK9 mRNA transcript, bempedoic acid, an inhibitor of hepatic adenosine triphosphate (ATP) citric lyase and an activator of AMP-activated protein kinase are being evaluated in phase III LDL-C lowering studies. Three cholesteryl ester transfer protein (CETP) inhibitors have failed in cardiovascular outcome trials. Another CETP inhibitor dalcetrapib is under trial in a genetically defined population. Angipoietin like protein (ANGPTL3) inhibitors and gemcabene which inhibits hepatic triglyceride and cholesterol production and apoC-III synthesis are in phase II trials. LDL receptor gene therapy has entered a phase I clinical trial. Use of PCSK9 inhibitors is a novel strategy to obtain significant reductions in blood LDL-C levels. C. N. Hess and colleagues at the University of Colorado School of Medicine describe the mechanism of action and metabolic effects of PCSK inhibitors (evolocumab, alirocumab and bococizumab) and present the results of large cardiovascular outcome trials of these inhibitors. The benefits of this class of drugs in lowering events such as non-fatal myocardial infarction and ischemic stroke or all cause mortality, and long-term safety are yet to be elucidated. Two negative effects of PCSK9 inhibitors that are of concern are neurocognitive injury and the increased risk for diabetes.

J. W. Waks and A. E. Buxton of Harvard Medical School survey various tests that are available to stratify the risk for sudden death after myocardial infarction and examine the utility of clinical parameters for risk stratification. As sudden cardiac death (SCD) is precipitated by multiple mechanisms, no single test can identify all patients at risk for SCD. Zoltan Arany from University of Pennsylvania reviews the recent studies that have clarified the hormonal, vascular and genetic factors that contribute to the pathophysiology of peripartum cardiomyopathy, a leading cause of maternal mortality world wide. He also opines on how this progress can lead to new diagnostic, prognostic and treatment strategies for the disease. R. Lampert and D. P. Zipes from Yale University present the updated recommendations to reduce sudden cardiac death in athletes with heart disease. These recommendations are in a 'class and level of evidence' format. It has a patient centered, shared decision making model which emphasizes counselling and a change in recommendation from 'blanket restriction' to 'may be considered for participation in competitive sports'.

Cancer treatment related cardiovascular toxicity is now well recognized. Cancer survivors have increased likelihood for long-term cardiovascular morbidity. Cancers and cardiovascular diseases have overlapping risk factors and biological mechanisms as well. Vivek Narayan and Bonnie Ky of University of Pennsylvania summarize the cardiovascular effects of commonly used cancer therapies, mechanisms of cardiovascular toxicity of common anticancer drugs and the consequences of cardiovascular toxicity for long-term survival in patients with cancer. They also discuss how to improve risk prediction through imaging tools and use of biomarkers and how to prevent cardiovascular toxicities by phenotyping strategies to personalize cardiovascular disease risk and prediction, screening, pharmacological and or behavioural cardio-protective interventions and modifying cancer therapy on detection of cardiovascular toxicity. The utility of early risk assessment by the use of strain echocardiography and blood biomarkers are to be evaluated. Interestingly, in a prospective long term follow up study of women with non-metastatic breast cancer who received adjuvant therapies which are potentially cardiotoxic, exercise was found to result in a significant reduction in the incidence of cardiovascular events.

Seven reviews pertain to different forms of cancer treatment. Antigen–antibody drug conjugates (ADCs) are attractive options to provide selective delivery of drugs to antigen positive cancer cells, prevent entry of cytotoxic agents into antigen negative normal cells and increase the therapeutic index of anti-cancer drugs. A large number of ADC technologies have been developed

during the last decade and new generation linker chemistries provide exciting possibilities. A major challenge is to identify targets for developing active ADCs. More than 80 ADCs are in clinical evaluation. J. M. Lambert and A. Berkenblit of Immuno Gen Inc., Massachusetts write on two ADCs for treating solid tumours and haematologic malignancies and have been approved for marketing and another six that are in clinical trials or phase II clinical development. They enumerate the challenges in developing effective ADCs.

Molecular characterization of the genome has helped to understand the key drivers of metastatic clear cell type renal cell carcinoma (ccRCC) and identify the roles of angiogenesis and hypoxic stress in the pathogenesis of this tumour. This knowledge led to current treatment strategies which include the use of small molecule tyrosine kinase inhibitors, inhibitors of mammalian targets of rapamycin (mTOR) and combinations of immune and antiangiogenic therapies. Mamta Parikh and Primo N. Lara from the University of California at Davis review the state of the art in immune-based combination therapies for ccRCC.

F. L. Jacobson and M. T. Jaklitsch from the Brigham and Women's Hospital at Boston discuss the lung cancer screening trial guidelines of the United States Preventive Services Task Force and the Fleischner Society 2017 guidelines for management of incidentally detected pulmonary nodules in adults. National Lung Cancer Screening Trial (NLST) provided in 2011, evidence that early detection of lung cancer using low dose computerized tomographic (CT) scans can lower deaths from lung cancer among chronic smokers. Since then, CT screening has been in clinical use. The authors also opine on how to calculate lung cancer risk in the selection of patients for screening.

J. H. Dayan and colleagues from the Memorial Sloan Kettering Cancer Center, New York provide the current concepts on the pathogenesis of lymphoedema and an overview of the novel treatments for the disease. Lymphoedema seems to be an immunological process resulting in chronic inflammation, fibrosis and faulty lymphangiogenesis. Therapies aimed at enhancing lymphatic function, reducing fibrosis and increasing lymphangiogenesis are hence, when compared to surgical treatments, likely to lead to better outcomes. In India, millions of patients are estimated to have filarial lymphoedema. The numbers are many times more than the burden in Americans who mostly have lymphoedema secondary to lymph node removal as part of treatment for breast cancer. To my knowledge there are no efforts either to understand the pathogenesis of filarial lymphoedema or to develop medical therapies for the disease.

M. Gromeier and S. K. Nair from the Duke University School of Medicine, Durham address whether one can develop safe viral agents with antitumour cytotoxic properties and whose actions are not foiled by innate anti-viral responses in the host. They also deliberate on whether using viruses, one can provoke antitumour immune responses by inducing inflammatory changes favourable for tumour antigen-specific immune priming. They focus on strategies that use recombinant live attenuated type 1 polio virus vaccine (PVSR1PO) which contains a foreign internal ribosomal entry site of human rhino virus type 2. This vaccine is in phase I clinical trial in patients with glioblastoma.

M. Hashimoto and colleagues from the Emory University School of Medicine, Atlanta describe the role of immune check point molecules and epigenetics in mechanisms of CD8 T cell exhaustion associated with chronic infection and cancer. They present potential treatment targets and ways to enhance immunotherapies for stimulating T cell responses. They mention about the novel discovery of a stem cell-like PD-1^{+} CD8 T cell subset that responds to programmed cell death (PD-1) targeted therapy. This subset of CD8 T cells has different patterns of expression of inhibitory receptors and co-stimulatory molecules, as well as a dissimilar tissue distribution and localization when compared to terminally differentiated CD8 T cells.

Cancer care in future, is expected to be more and more genome driven. Future directions in precision oncology is introduced by J. T. Tao, A. M. Schram and D. M. Hyman of the Memorial Sloan Kettering Cancer Center at New York. They enumerate the lessons learnt from 'basket studies', a new clinical prototype, where patients are recruited based on the presence of a specific genomic change rather than the histologic type of a tumour. They conclude: 'To translate genomic knowledge into clinically meaningful outcomes, trials need to have improvements in biomarker selection, biostatistical design and development of genomic knowledge base.'

The other articles pertaining to cancers are on (i) techniques to process and analyse circulating tumour DNA (ctDNA) and current trials assessing the clinical utility of measuring ctDNA, (ii) personalized, surgery-based multimodality treatment for malignant pleural mesothelioma, (iii) recent progress in our knowledge on the genomic, transcriptomic and molecular features linked to response and resistance to cancer immunotherapy using immune check point inhibitors, the limitations for adequate prediction of effective immune response and integrated approaches to optimize durable clinical response for individual patients, (iv) benefits of novel radiation therapy techniques such as three dimensional conformal therapy, intensity proton therapy and volumetric modulated arc therapy, and (iv) evidences for genotypic associations with and the modifying effects of genetic variants for the late effects such as infertility, neurocognitive and neuropsychological deficits, decreased bone mineral density, obesity, cardiovascular disease and secondary malignancies, which are commonly seen in survivors of childhood cancers.

Studies in cells and animals have indicated that blocking the receptor for advanced glycation end products (RAGEs) can attenuate both inflammation and progression of chronic inflammation. B. I. Hudson and M. E. Lippman of the University of Miami examine the biology of RAGEs, their role in chronic inflammatory diseases such as diabetes, neurological diseases, cardiovascular diseases and cancer and the relevance of various small molecule RAGE inhibitors in the treatment of these diseases as revealed in clinical trials.

E. L. Tsalik and V. G. Fowler from Duke University School of Medicine and R. A. Bonomo from Case Western Reserve University School of Medicine have co-authored an article on the innovative approaches in the diagnosis of infectious diseases and anti-bacterial resistance. The emerging diagnostic technologies focus on the host responses to infection. While the popular diagnostic approaches use molecular tests which detect and

characterize the pathogen, the newer technologies are based on the detection of the host biological pathways that are highly specific to the pathogen.

Two reviews are related to treatment of human immunodeficiency virus-1 (HIV-1) infection. Effective HIV-1-specific broad neutralizing antibodies (bNAbs) have been recently identified. Their potential for prevention and treatment of HIV-1 infection are discussed by L. Gama from National Institute of Allergy and Infectious Diseases, Bethesda and R. A. Koup of Johns Hopkins School of Medicine, Baltimore. These new generation anti-HIV-1 bNAbs are potent, have multiple specificity, lower plasma half-life and improved effector function. In the second article on HIV-1, A. M. Spivak and V. Planelles from the University of Utah School of Medicine describe the current pharmacological approaches in the search for agents for HIV-1 cure. These aim to target and clean the reservoir of latent long-lived resting T cells harbouring replication competent, late proviruses.

L. I. Labzin from the MRC laboratory of Molecular Biology at Cambridge and M. T. Heneka and E. Latz from the German Center for Neurodegenerative Diseases at Bonn deliberate on innate immune system in the brain and the role of microglial dysfunction in the pathogenesis of neurodegenerative diseases such as Alzheimer's disease, Parkinson's disease, amyotrophic lateral sclerosis and Huntington's disease. They suggest: 'It would be beneficial to better define, how microglial function can be tuned by changes in cellular metabolism or innate immune training induced by local or systemic triggers and how diet, life style and aging impact this.'

Epidemiological aspects, pathogenesis, treatment, vaccines and control of Zika and Chikungunya virus infections and Mayaro, Oropouche, Dengue and Yellow fevers are the topics covered in another review. There is another essay on the pharmacology and behavioural effects of opioids. The authors write on issues such as misuse, overdose and addiction risks associated with the use of opioids in the management of chronic pain and resulting public health problems.

The first article in the collection is on precision medicine. A higher level of precision in identification of disease risk has been possible thanks to the development of several non-invasive high-throughput and high content technologies that provide functional measurements and information for action. Thomas Caskey from the Baylor College of Medicine, Texas, reviews the advances in high-throughput technologies such as genomic sequencing, metabolomics, proteomics, mass spectrometry, pharmacogenomics, bioinformatics, advanced imaging tools and machine learning that have helped progress in the identification of risk of diseases and strategies for specific intervention and prevention of diseases. Integration of these advances into standard of practice of medicine would require a shift from the current accent on disease diagnosis focused on organs. Increase in cost and uncertainty of test results are the other issues to be addressed.

Affordable Care Act (ACA) of United States of America (USA) was considered as a chance to provide comprehensive high quality and equitable health coverage to all who live in the USA. Thanks to ACA there was an evident rise in the number of uninsured persons gaining health coverage. Three reviews deal with the ACA, which has been for the past few years, a focus of debate in the United States of America because of the rising cost of health care and concerns of access to coverage. Vivian Ho of the Rice University, Houston analyses the criticisms of the Patient Protection and Affordable Care Act (Obama Care) and the major reasons for many people's dislike for ACA. He recommends various ways to address the concerns and refine the Act. O. Carrasquillo and M. Mueller of the University of Miami Miller School provide the limitations of ACA and possible areas for refinement. They conclude that ACA attained neither the goal of universal nor equitable coverage. ACA could also not control health care costs. M. McClellan and M. Japinga of Duke University in their article, examine the future of the ACA and delineate several novel options for reforms to lower the cost of high-quality health care and spread access to affordable coverage. They emphasize the necessity for obtaining evidence on efficiency of available models of care delivery as well as the need for innovations in care for patients with the highest risk. Managers of *Ayushman Bharat Yojana* would certainly profit by studying these reviews.

The last two articles are on outcome measures that assess surgical quality. One of them presents the essential elements and requisite steps in the development of a patient-reported outcome measure (PROM) in plastic and reconstructive surgery. The authors also apprise the validity, reliability, responsiveness and limitations of PROM, future priorities and the use of PROM in clinical care and research. The second article interrogates how to recognize variations that are seen in surgical quality and how to choose the appropriate measure to assess surgical quality, and describes the advantages and drawbacks of the 'structure-process-outcomes' model proposed by A. Donabedian to measure quality in health care.

In summary, the recent volume of *Annual Review of Medicine* contains instructive and stimulating essays valuable to both physicians and medical scientists.

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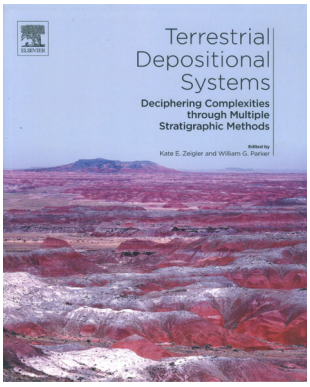

Terrestrial Depositional Systems: Deciphering Complexities through Multiple Stratigraphic Methods. Kate E. Zeigler and William G. Parker (eds). Elsevier, Radarweg 29, P.O. Box 211, 1000 AE Amsterdam, The Netherlands. 2017. xiv + 346 pages. Price: US$ 130.

Modern depositional systems make available observable interactions between agents and processes of erosion, transport and deposition, and sedimentary