

optical properties. Within this context, aerosol organic phase partitioning has been discussed in terms of partitioning thermodynamics and its limiting factors. Oxidative ageing has also been explained in terms of homogeneous and heterogeneous gas-phase and aqueous-phase oxidation.

Airborne bio-organic materials constitute a fraction of lower atmospheric aerosol loading and pose interferences on aerosol oxidative properties, cloud condensation nuclei, oxidative potential of the atmosphere and most importantly in transmitting diseases. The susceptibility of human and other life forms towards finer aerosols can be traced even up to the molecular levels^{3,4}. Ariya *et al.* explore several techniques for physical characterization of such airborne bio-organic compounds and subsequently evaluate their advantages, and limitations coupled with uncertainties in measured dataset. Techniques like gas chromatography, fourier transform ion cyclotron resonance mass spectrometer and nuclear magnetic resonance are mentioned, while applications of several particulate collection devices are also discussed. Explanations seem relevant for the beginners but not the advanced users. These biogenic aerosols do interact with solar radiation and also act as cloud nucleation nuclei (CCN). However, aerosol–ice-snow interactions still lack understanding at the molecular level as it consists of significant level of uncertainties. In the concluding section, McNeill *et al.* discuss the development of organic surface films on aerosols and suggest the need of understanding its mechanism as a function of aerosol composition. Aerosol micro-physical properties regulate its ability to act as CCN molecule and therefore, directly link with hydrological cycle and thereby, sustainability issues of the 21st century. Aerosol organics are typically hydrophobic, while some are amphiphilic and therefore surface-active. These surface-active aerosol species include organic acids, diacids, proteins and humic-like substances which also act as CCN. McNeill *et al.* discuss models as well as laboratory results for explaining the interaction between aerosol surfaces and organic compounds. Additionally, new research domains such as identifying organic surface films formation on aerosols as a function of its constituents, analysis of composition and functional group identifications and techniques for

in situ detection of organic films, were also proposed for prospective scholars.

In conclusion, we appreciate the editors' intentions to bring the state-of-the-art knowledge on aerosol and atmospheric chemistry. The book may be useful to scholars who wish to investigate aerosol and atmospheric chemistry in perspective of changing climate. However, the book should be substantiated with more fundamentals, for example *Atmospheric Chemistry and Physics* by Seinfeld and Pandis. Inclusion of some topics like processes in the formation of new particles, chemical evolution of organics from primary to secondary particulates, metals in aerosol chemistry and aerosol–water vapour interactions may also be within the scope of aerosol chemistry. Thus, this book would be worthwhile acquisition for institutions, academicians and atmospheric scientists.

1. Murari, V., Kumar, M., Barman, S. C. and Banerjee, T., *Environ. Sci. Pollut. Res.*, 2015, **22**, 1329–1343.
2. Kumar, M., Tiwari, S., Murari, V., Singh, A. K. and Banerjee, T., *Atmos. Environ.*, 2015, **104**, 162–175.
3. Kumar, M., Singh, R. S. and Banerjee, T., *Environ. Int.*, 2015, **84**, 201–202.
4. Singh, N. and Banerjee, T., *Curr. Sci.*, 2016, in press.

TIRTHANKAR BANERJEE*
VISHNU MURARI

*Institute of Environment and Sustainable Development,
Banaras Hindu University
Varanasi 221 005, India
e-mail: tb.iesd@bhu.ac.in

Annual Review of Nutrition, 2015. Barbara A. Bowman and Patrick J. Stover (eds). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, CA94303-0139, USA. Vol. 35. x + 604 pp. Price: US\$ 93.

Over the years, the relationship between diet and lifestyle diseases has elicited strong opinions and discussions. Historically, high-calorie, high-fat, especially high saturated fat diets have been associated with metabolic diseases, including obesity. Therefore, dietary recommenda-

tions in the 1970s and 80s focused mainly on reducing intake of saturated fat-rich animal foods like red meat. However, in the past decade, the blame has shifted to the consumption of processed foods and carbonated beverages which are rich in simple sugars^{1,2}. In this context, it seems appropriate that this volume of the *Annual Review of Nutrition (ARN)* begins with the autobiography of George Bray, who has spent a lifetime researching to understand and elucidate various processes leading to obesity. The highlight of his work has been to establish that high-fructose corn syrup, which is used in sugar-sweetened beverages, leads to increasing incidence of obesity in the US. His view, that this single ingredient has led to the emergence of a new metabolic disease – non-alcoholic fatty liver disease (NAFLD), appears to be justified by the number of publications in this area in the last decade³. NAFLD, which occurs when fat is deposited in the liver due to reasons other than alcohol abuse, is currently the most common liver disease in developed countries. The etiology of NAFLD is not yet well understood. In this volume of *ARN* Martinez-Lopez and Singh offer a possible explanation for the same. Autophagy, specifically, lipophagy, which is the process of sequestration of cellular lipids into lysosomes, followed by degradation⁴, is a tightly controlled process involving more than 30 autophagy (*Arg*) genes. Dysregulation of lipophagy results in hepatic lipid accumulation, leading to NAFLD. This opens up a new direction for research in the area of obesity and insulin sensitivity.

Although NAFLD has been reported in certain non-obese populations⁵, it remains essentially one of the numerous metabolic problems whose primary cause is obesity. According to WHO, about 13% of the world's adult population was obese in 2014, and the global weight management market is currently estimated to be a US\$ 385 billion industry. Long-term benefits of weight loss include improvement in health-related quality of life; however, the amount of weight loss required to achieve this remains controversial. In this volume, Rueda-Clausen *et al.* summarize the evidences available and suggest that while lifestyle modifications alone can only provide modest beneficial effects, combination with pharmacologic and surgical interventions has been effective in

producing significant and sustainable weight loss (15–30% body weight loss after 10 years). While benefits of weight loss are clear in many metabolic conditions such as T2D, CVD, NAFLD, the potential relationship between failed weight loss attempts and suicide opens up an area for further research.

In addition to the effects of obesity on metabolic diseases, increasing evidences point to its strong link to cancers⁶. The mammalian target of rapamycin (mTOR) signalling is a well-known regulator of metabolism and lifespan in model organisms. The activation of mTOR complex1 (mTORC1) by amino acids has been the subject of intense research in the last decade. However, its role in promoting lipid biogenesis is gaining recognition only now⁷. mTORC1 increases lipogenesis via activation of the sterol regulatory element-binding proteins (SREBPs), and inhibits lipolysis through multiple pathways that are still not clearly elucidated. In this volume of *ARN* Caron *et al.* delineate the pathway of mTOR activation in response to food intake, resulting in increased lipogenesis and decreased autophagy in the white adipose tissue.

A number of articles in this volume of *ARN* have also focused on different aspects of lipid metabolism and the processes leading to lipid accumulation. The rapid packaging of dietary fats into chylomicrons in the intestine, followed by secretion into circulation has been a target for control of metabolic diseases. Dash *et al.* review the regulatory mechanisms in this process, and describe why the side effects of this target are currently unacceptable.

The identification of brown adipose tissue in adult humans⁸ has sparked a lot of interest in the continuing quest to find suitable targets to combat obesity. Unlike the white adipose tissue, the brown adipose tissue (BAT) has the unique ability to dissipate energy by producing heat rather than storing it as fat globules. This is done through the activation of the BAT-specific uncoupling protein 1 (UCP1), which uncouples ATP production from mitochondrial respiration and converts energy into heat. In this volume Symonds *et al.* discuss data both from animal and human studies, which suggest that BAT and mitochondrial uncoupling can be targeted for interventions to prevent and treat obesity.

In the previous volume of the *ARN*, Pepino *et al.*⁹ had discussed the possibil-

ity of the fatty acid translocase or CD36 as a possible target in the treatment of obesity. In this volume, Ulven and Christiansen elucidate the possible role of the G-protein coupled receptors that serve as free fatty acid receptors, specifically FFA4/GPR120, in metabolic disorders. FFA4 has a number of functions related to inflammatory and metabolic disorders and is activated by a variety of medium- and long-chain free fatty acids. Whether activation of FFA4 could be a target to counteract metabolic diseases remains to be studied.

Finally, the articles by Siri-Tarino *et al.* and Shen *et al.* in this volume round off those related to obesity and lifestyle disorders by discussing the role of diet and lifestyle on cardiovascular health. The public at large has been informed over the last few decades that saturated fats are deleterious to health; however, numerous studies now clearly indicate that this may not be true¹⁰. Saturated fats of different chain lengths appear to have different effects, and it is now evident that the focus should be on a combination of food as well as lifestyle modifications in order to have beneficial effects on metabolic risk. The much-touted ‘Mediterranean diet’ is a combination of diet and lifestyle habits that make it an ideal pattern. However, it is alarming to note that globalization, food marketing and changing lifestyles – including changes in the role of women in society – are altering consumption patterns in the Mediterranean, away from fruits and legumes towards more meat and dairy products¹¹. This is predominantly due to the huge marketing efforts to promote junk foods, combined with the cheap availability of meat, fat and sugar, compared to a healthy Mediterranean diet of fresh fruits, vegetables, olive oil and fish.

With increasing evidence of the associations between diet and disease, it is equally important to be able to accurately assess the dietary exposure of specific nutrients. Thus the development of objective biomarkers of diet has become a critical area of research. Traditional methods of diet assessment, which relied heavily on self-reported intake of food, are now being replaced by modern metabolomic and modelling methods using mass spectrometry-based measurement tools. Deficiencies and excesses of specific nutrients can now be measured in a number of body fluids; however, many of these methods are still not

feasible in large-scale, field-based data collections. One such issue is the assessment of salt intake in a population, and the challenges of measuring this in urine are described by Cogswell *et al.* in this volume. One method that is gaining prominence is the measurement of stable isotope ratios that are present naturally in all foods. The advantage and utility of this method in assessing short- and long-term sugar, meat and fish intake in certain populations has been described by O’Brien.

The role of micronutrients in health and disease is a continuing thread of interest in the *ARN*. In this volume, the role of coenzyme Q10 (CoQ10) in ischaemic heart disease has been described by Ayer *et al.* CoQ has been touted as a miracle vitamin that can treat blood pressure and heart disease, enhance the immune system, reduce high cholesterol and provide an energy boost. This article provides the basis for these claims and suggests that it is time for a large-scale, placebo-controlled, phase-III study to definitively resolve the question of whether CoQ is a beneficial adjunct therapy in the treatment of heart failure. The antioxidant role of vitamins E and C is well known; however, two articles in this volume of *ARN* highlight some interesting, hitherto unknown functions of these two vitamins. In the role of an antioxidant, vitamin E is known to scavenge reactive oxygen and nitrogen species. However, Zingg describes the effects of different vitamin E analogues on signal transduction and gene expression. It is interesting to note the different methods through which vitamin E brings out these various effects – direct binding to enzymes, altering their redox status, prevention of oxidation of lipids and by influencing lipid raft structure on membranes. And finally, an interesting article by Young *et al.* describes the ability of vitamin C to regulate the epigenome. Dietary regulation of DNA and histone methylation is of great interest, especially with respect to methyl donors like choline, folic acid and vitamin B12. This article introduces an entirely novel pathway through which vitamin C affects the epigenome, mainly through its influence on iron- and 2-oxo glutarate-dependent dioxygenases that regulate DNA demethylation. This also opens up new areas of research on the role of other micronutrients such as iron, as possible modulators of the epigenome, suggesting that micronutrients may have

BOOK REVIEWS

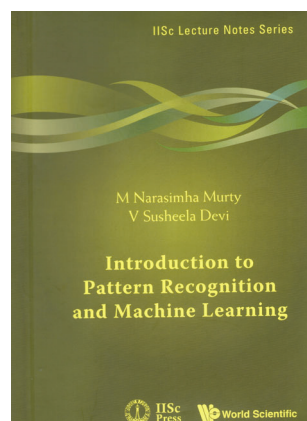
functions that are far beyond their current known roles.

On the whole, this volume of *ARN* offers extremely interesting information on areas of research that are likely to become prominent in the next few years.

1. Te Morenga, L., Mallard, S. and Mann, J., *BMJ*, 2013, **346**, e7492.
2. Hu, F. B., *Obes. Rev.*, 2013, **14**, 606–619.
3. Zhang, T. S., Qin, H. L., Wang, T., Li, H. T., Li, H., Xia, S. H. and Xiang, X. H., *SpringerPlus*, 2015, **4**, 776–784.
4. He, C. and Klionsky, D. J., *Annu. Rev. Genet.*, 2009, **43**, 67–93.
5. Das, K. *et al.*, *Hepatology*, 2010, **51**, 1593–1602.
6. Gilbert, C. A. and Slingerland, J. M., *Annu. Rev. Med.*, 2013, **64**, 45–57.
7. Bakan, I. and Laplante, M., *Curr. Opin. Lipidol.*, 2012, **23**, 226–234.
8. Nedergaard, J., Bengtsson, T. and Cannon, B., *Am. J. Physiol. Endocrinol. Metab.*, 2007, **293**, E444–E452.
9. Pepino, M. Y., Kuda, O., Samovski, D. and Abumrad, N. A., *Annu. Rev. Nutr.*, 2014, **34**, 281–303.
10. de Souza, R. J. *et al.*, *BMJ*, 2015, **351**, h3978; doi: 10.1136/bmj.h3978.
11. Debs, P., Cardone, G. and Driouech, N., White paper on Mediterranean food consumption patterns, diet, environment, society, economy and health; <http://www.fao.org/3/a-i4358e.pdf>

INDU MANI

Department of Nutrition,
St. John's Research Institute,
Koramangala,
Bengaluru 560 034, India
e-mail: indu2004@gmail.com



Introduction to Pattern Recognition and Machine Learning. M. Narasimha Murty and V Susheela Devi. IISc Press and World Scientific Publishing Co. Pte. Ltd, 5 Toh Tuck Link, Singapore 596224. 2015. 404 pages. Price: US\$ 125.00

Over the last couple of decades there has been a phenomenal increase in the amount of data, documents and other information available in electronic form. This has naturally given rise to renewed interest in techniques for analysing data and terms like ‘big data analytics’ have become part of common vocabulary these days. Machine learning can be defined as a field that is concerned with techniques for analysing data, fitting models for data and for making useful predictions or inferences based on data. Thus, there is a lot of interest today in this field and many universities are offering both undergraduate and graduate courses in machine learning. Many industries are interested in professionals trained in machine learning and there are also special initiatives from Government agencies such as the Karnataka Knowledge Commission in promoting better training in machine learning in the engineering colleges. Hence, Indian textbooks in this area are very much needed. In this context, this book written by two prominent researchers from the Indian Institute of Science (IISc), Bengaluru is a welcome addition.

Machine learning is largely seen as a subfield of computer science. Pattern recognition, which essentially addresses similar issues, is an older term which has its origins in electrical and systems engineering in the 1960s. Today, the field of pattern recognition is seen to be mainly concerned with classification and regression problems, while the field of machine learning is seen to be somewhat wider in scope as it deals with many other data

analysis problems as well. However, these two terms are now closely interlinked and this is reflected in the title of the book.

Writing a textbook on machine learning today is a challenging task. Due to the enormous amount of research work done in this area over the last three decades, there are now many principles and techniques that are useful in machine learning. Therefore, it is difficult to fit all the information into any modest-sized book. Also, there does not appear to be any consensus among the practitioners on what constitutes the core of machine learning, or what is a good logical sequence for presenting the material. One can see this difference in viewpoints by comparing some of the recent and popular books in the field^{1,2}. The field of pattern recognition is more or less defined by the very influential textbook by Duda and Hart³ published in 1973. These authors brought out a new version of this book in 2001 (ref. 4) and comparing this with the two books mentioned earlier^{1,2}, would make this difference of viewpoints even more clear. Having taught a course on this subject for many years at IISc, this reviewer has first-hand experience of the difficulty in selecting a coherent set of topics that can fit in a one-semester course for students with limited mathematics background. Incidentally, the book by Bishop has about 800 pages and the one by Murphy has over 1000 pages.

Given the above, the authors of this book have done a commendable job in bringing out a volume of about 350 pages that introduces the reader to most of the essential topics of machine learning in an easily understandable manner. The book contains a good overview of many issues in machine learning in the first chapter. In the next few chapters, it discusses most of the standard topics such as Bayes classifier, maximum likelihood and Bayesian estimation of density models, classification techniques such as *k*-NN, SVM, logistic regression, random forests, artificial neural networks, etc. It also discusses semi-supervised classification techniques and multi-label classification. The book assumes that the reader has some knowledge of the field and hence it may not be suitable as an undergraduate textbook though the style of writing is such that most students would easily follow the material. In any effort of this kind, there are bound to be different opinions on what subset of topics should be included. Thus, personally, I think the authors should have included, in some detail, topics such as