

## BOOK REVIEWS

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organisms provide a basis for Spo11 (an endonuclease that introduces double stranded breaks in DNA) independent form of meiosis in the diploid macrocyst. The Spo11 independent meiotic recombination may use an additional topoisomerase II.

The article by Dolan and Welch provides a good account of the glyoxylate shunt pathway. The article talks about the crucial regulatory events that take place in organisms at the bifurcation point for glyoxylate shunt/TCA cycle, and how the enzymes (ICL and ICD) at the branch point through post-translational modifications and allosteric regulations function in different organisms. The next article by Müller *et al.* talks about flavin based electron bifurcation (FBEB), a phenomenon that allows generation of reduced ferredoxin ( $Fd_{red}$ ) using  $H_2$  or NADH as the reducing agents. FBEB is important in energy metabolism in anaerobic organisms, and in our understanding of how it helps in promoting endergonic reactions (in fact, more efficiently than ATP). The phenomenon of FBEB might have served important function during the course of evolution.

In yet another article on malarial parasite by Duraisingh and Skillman, we learn about the epigenetic changes that occur in the parasite chromatin that are associated with gene silencing/activation and key processes to facilitate transition of the parasite through various stages of its life cycle. Likewise, a little later in the book, the article by Kim addresses the epigenetic regulation of the various stages in the life cycle of *Toxoplasma*.

The article by Feurtey and Stukenbrock talks about how the next generation sequencing of >800 fungal genomes has been helping in our understanding of gene exchange in fungi, and the mechanism of their rapid evolution, especially the pathogenic fungi. The authors discuss the mechanisms of gene exchange and their relevance in adaptive evolution as also their importance in fungal biodiversity. The article by Ost and Round discusses the cross talk between our immune system and the commensal microbiota (and the metabolites they produce) in our body. The immune system needs to interact with the microbiota to prevent infection/invasion but at the same time not to evoke a detrimental response. The authors talk about the various cell types involved in this interaction. The immunomodulation by the

commensals can also indirectly modulate the host immune response to the surrounding organisms. The Ebola virus caused serious epidemic in West Africa in 2013–14 wherein ~30,000 cases of infection resulted in ~11,000 deaths. The chapter by Feldmann *et al.* discusses on the knowledge gained from human trials of the fast-tracked vaccine candidates (even though they did not have a major impact on the epidemic). Our innate immune system recognizes the bacterial pathogens using the pattern recognition receptors (PRR). The article by Tan *et al.* talks about how the host evokes self-defense following recognition of the pathogen's DNA/RNA by its receptors (PRR) by triggering production of interferons and proinflammatory reactions to generate antimicrobial response; and how the microbes overcome the host reactions. The authors focus on the mechanism of how the host recognizes the pathogen's DNA/RNA.

The gamete forms of the malarial parasite are taken up by the mosquito during its blood meal. The article by Josling *et al.* talks about the importance of the step of development of the gametes in the parasite following the asexual blood stage, for therapeutic intervention of malaria. The authors highlight the recent developments in the differentiation process leading to gametogenesis to provide a stronger basis for gene regulatory mechanism during gametogenesis. The last (but not the least) article in the book by Croucher *et al.* is devoted to pneumococcal vaccines. *Streptococcus pneumoniae* is an obligate commensal of the mucosal surface in nasopharynx (upper respiratory tract). However, its migration into the middle ear, lower respiratory tract and eyes can lead to severe disease consequences. The article discusses about the vaccine design, its interactions with the host and the population dynamics.

Finally, I must say that I enjoyed reading through the book. The articles are appropriately sized and sweet. English, in just a few of the articles, is a bit difficult to follow but they are prepared in a style that allows one to read them to a self-determined depth to provide a lasting impact of the topic. The book will most certainly serve as a reference to prepare for the teaching material as also to develop an in-depth knowledge of the various topics. The editors and the authors of all the articles (24 in all) have

done a remarkable job in producing this work of art in science. I highly recommend it to the students and the researchers alike.

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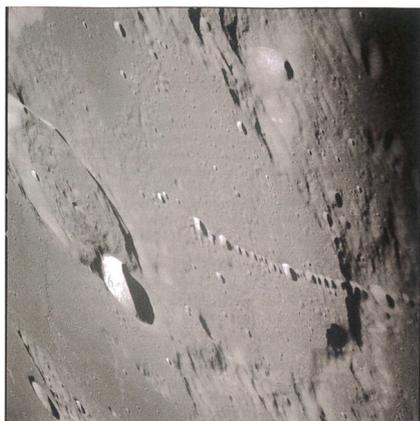
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**Annual Review of Astronomy and Astrophysics, 2018.** S. M. Faber and Ewine van Dishoeck (eds). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, California 94303-0139, USA. Vol. 56. xiv + 724 pages. Price: US\$ 112.

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Every year the community of astrophysicists looks forward to this volume of reviews that informs them of the current state of research in a few select fields. These reviews not only try to find the important threads of research in the past years or decades, but often also set the tone for future research in these fields. This makes them valuable not only for the beginners, who may want to familiarize themselves with the past works, but also for the active practitioners, for new insights and ideas for further research. In addition, every volume comes with a memoir of a well-known astrophysicist, whose story of research serves as a resource material for historians, and inspiration for young astronomers.

The review volume for 2018 begins with a memoir by Jaan Einasto, a cosmologist who did most of his research in Estonia. His account gives a rare glimpse into the astrophysical community in the erstwhile USSR, during the height of the cold war. It is interesting to read how scientists there had often thought and worked on ideas that became fashionable in the West later on, but whose names are not remembered in the annals of science because their papers were published in Russian journals. The figure of Yakov Zel'dovich naturally occupies a central place in the narrative, and Einasto describes a number of radical shifts in the cosmological ideas during this era, from the introduction of dark matter, to the cosmic web of structure formation.



The Catena Davy on the Moon, as captured in an image (AS12-51-7485) from Apollo 12.

Among the reviews on stellar systems, one on the formation of high mass stars and massive star clusters describes the multiscale nature of the phenomenon, and how recent observational surveys have led to new ideas. It also projects that submillimeter facilities will have a profound effect on this topic in the near future. Another review on globular clusters discusses a very puzzling phenomenon of variation in elemental abundances among stars, for which there has not been any satisfactory explanation.

Planetary astrophysics takes up a major chunk of the book with six extensive reviews. One review on the early solar system discusses the idea of a possible lost ice-giant, whose effect on the outward migration of Neptune could have left signatures on the orbits of Kuiper-belt objects. An interesting implication of this hypothesis is that asteroids probably did not cause the Late Heavy Bombardment, rather the left over planetesimals from the process of terrestrial planet formation were the culprits. Then there is an overview of the new findings from the New Horizons spacecraft, which flew by Pluto and its satellite Charon, and discovered their surface phenomena, as well as uncovered many new dynamical complexities of the Pluto sys-

tem. There is another review on relatively small asteroids, which have sizes between 200 m and 10 km, the so-called rubble pile asteroids. These objects are bound by self-gravity, but they are rather porous. Most of these asteroids are probably the by-products of collisions among the main asteroid belt. A review of disks formed around stars in the early stages of planetary formation discusses the structure, dynamics, properties of dust and gas and the connection between soon-to-be-formed planets and these disks. Lastly, there is a review on the models of formations of ‘hot jupiters’ – massive planets close to stars.

The topic of diffuse gas in the galaxies, called the interstellar medium, occupies a central part in modern astrophysics. One review in this volume brings out the details of microstructures in this diffuse gas, with length scales as small as thousand times the distance between Sun and Neptune. These tiny structures may have important roles to play in the energy budget and dynamics of the interstellar gas, and may be created by stellar processes, such as supernovae and winds. Another review on dust in the interstellar medium of nearby galaxies. The topic of dust grains embedded in gas is a complicated one, involving many different fields such as solid state physics, plasma physics and so on. Nearby galaxies are important in the study of cosmic dust, after Milky Way, because they allow astronomers to study dust in a variety of environments. The review discusses various observational diagnostics and how they constrain the microphysics of dust grains, and then discuss the overall evolution of dust in the universe and connect it to the evolution of other structures in the universe.

There are three reviews on different aspects of galaxies. The review on the connection between galaxies and their dark matter halos discusses the new findings from galaxy surveys. These studies have revealed some hitherto unknown properties of galaxies. For example, the fact that galaxies with the mass of Milky

Way hold a pivotal role in the universe – they are the ones with the largest fraction of stars (compared to the total mass). This is being called the ‘golden mass’ of galaxies in the universe. Lower and higher mass galaxies than Milky Way have smaller fraction of stars – a fact for which astrophysicists would have find an explanation. Another review on the bulge of the Milky Way – a spheroidal distribution of rather old stars around the central region, especially the chemical and dynamical history of its stars, points out the difficulties in modelling the system. It appears that the bulge stars formed within a relatively short timescale of about 2 billion years, but it has been difficult to come up with satisfactory models that can connect the bulge in the cosmological framework. The third review discusses active galactic nuclei that are obscured by dust grains. As revealed from the articles in this volume, dust grains in different environments – from planet formation to gas between galaxies to active galaxies – have become a major topic of research in astrophysics.

In comparison, cosmology is represented by a single review on weak lensing. The shapes of background galaxies are distorted by the variation of mass distribution in the universe, and this technique has been used to constrain cosmological models of the universe. The review discusses the difficulties involved in interpreting the data, and how they can be overcome in the near future.

Modern telescopes use adaptive optics in order to avoid the blurring caused by our atmosphere. Two reviews on this topic discuss various new techniques that have been developed and are being developed to broaden the capabilities of telescopes.

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