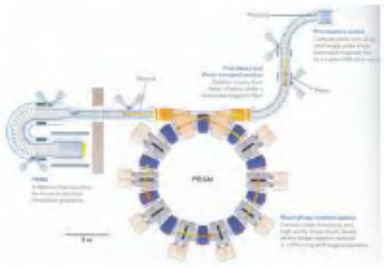
Annual Review of Nuclear and Particle Science, 2008. Boris Kayser, Barry R. Holstein and Abolhassan Jawahery (eds). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, CA 94303-0139, USA. Vol. 58. 382 pp. Price not mentioned.

Annual Reviews, an organization located in Palo Alto, California has been publishing one review volume every year in each of the 35 specialized areas of science. Such a volume typically consists of a dozen or so state-of-the-art review articles penned by leading researchers working on those topics. The articles usually extend over 25 to 50 printed pages each. Nuclear and particle science is one such area and the 2008 volume has just come out.

An uninformed concern about these volumes might be that the topics chosen would reflect the speciality biases of the editors. Such is emphatically not the case in the present instance. The respective areas that the editors of this volume work in are neutrino phenomenology, low energy field theory and experimental heavy flavoured meson physics. While these areas are well represented in this volume, it also includes reviews on Higgs and W bosons, quark–gluon plasma, weak gravitational lensing in cosmology, experimental tests of general relativity as well as search experiments for dark matter and charged lepton flavour violation. It is heartwarming that the selection reflects the coming together in physics of the very small and the very large.

The first two articles cover theoretical topics at the interface of nuclear and particle physics. Furstahl, Rupak and Schaefer consider many-body effective field theory, as applied to nucleon scattering, finite nuclei and nuclear matter. The essentials of perturbative diagrammatic techniques, including chiral effective field theory, are first covered. Later topics treated are approximate wave function methods, including renormalization group effects, the Euclidean lattice method and relevant aspects of density functional theory. Analytical results are laid out in compact and self-contained discussions, while computational ones are displayed in well-illustrated figures. The second article by Deltuva, Fonesca and Sauer is more focused. It considers two-, three- and four-nucleon scattering with the Coulomb interaction within the framework of momentum space integral equations. The essential physics is first explained before the heavy duty equations are presented. While analytical calculations hold the pride of place in the first process, more stress is given on numerical results for the last two.



Heavy quark systems are considered in three articles. Artuso, Meadows and Petrov provide a useful survey of theoretical predictions and experimental results on D-decays. Leptonic, semi-leptonic and purely hadronic final states are covered separately. There is also a nice discussion of mixing and CP-violation in the neutral D system containing an informative table of contributions from new physics models. Then Godfrey and Olsen review the status of charmonium-like mesons. Their inclusion of the fragmentary evidence for exotic multiquark and hybrid configurations alongside the well-established charmonium states is questionable. Though this is largely an experimental survey, the success of the QCD-motivated quark potential models is mentioned. The third article by Demina and Thomson summarizes our current knowledge of the mass and (strong as well as electroweak) interactions of the top quark. Both top pair and single top production processes are discussed covering leptonic as well as jetty final states. Alas, no projections are made for the forthcoming Large Hadron Collider experiments.

Fries, Greco and Sorensen review coalescence models for the formation of quark–gluon plasma in relativistic heavy ion collisions. Recombination mechanisms are discussed in the context of parton hadronization. Current results from RHIC on hadron spectra and baryon-to-meson ratios are presented. Moreover, the observed elliptic flow showing the liquid nature of the coalesced object is explained and issues related to quark number scaling as well as particle correlations and fluctuations are highlighted. There is, however, no mention of the intriguing viscosity to entropy density ratio of the liquid and current theoretical attempts – both from lattice QCD and string theory – to explain it.

Three articles relevant to cosmology and general relativity appear in the volume. Hoekstra and Jain discuss the role of weak gravitational lensing in determining the large-scale structure of the universe. Their focus is on shapes of distant galaxies, the distribution of dark matter around galaxies and their clusters, as well as on probing dark energy by cosmic shear correlations and other cosmological parameters. The authors first develop the weak lensing basics, test the developed codes on simulated images and then apply them to extant observational data stressing both statistical and systematic uncertainties in the latter. Prospects for planned future surveys are also outlined. Next, Turyshev covers experimental tests of general relativity. A review of the basic theory is followed by discussions of alternative scenarios, such as scalar–tensor extensions and modified gravity models motivated by string/M-theory, some which have candidates for dark energy. Both deep space and laboratory experiments are then taken up. A clear distinction is made between tests of the strong and weak versions of the equivalence principle. Planned tests of local Lorentz and position invariance as well as of the inverse square law are described. The search for time variation in the fundamental constants is also covered. The constant interrelation made by the author between planned experiments and proposed theories is refreshing. The final article in this broad area by Hooper and Baltz focuses on experimental programmes aimed at identifying the particle nature of dark matter. Both direct and indirect detection efforts, including collider experiments on the anvil, are thoroughly surveyed. A notable omission, though, is that of the so-called invisible axion as a dark matter candidate and its detection prospects.

The last two articles are on leptons. Marciano, Mori and Roney cover charged lepton flavour violation. A review of the history of flavour changing neutral currents is followed by discussions of electromagnetic transitions, the g-2 parameter of the muon, rare muon decays and muon–electron conversion. Turning to tau decays, the authors present extant experimental bounds and project future prospects for improvement. Finally, lepton flavour

violating decays of mesons and the Z boson are discussed. Camilleri, Lisi and Wilkerson take up neutrino masses and mixing. Some of the excitement generated by the recent progress in this area is conveyed by the authors through a synthesis of the different strands of development. The basics are reviewed first, covering oscillations between massive neutrinos both *in vacuo* and in matter. Atmospheric as well as accelerator-generated neutrinos are covered in one section and solar plus reactor neutrinos in another. The absolute mass probe in tritium beta decay and the Majorana mass probe in neutrinoless nuclear double beta decay are also discussed. The authors then project prospects for long baseline experiments and provide an overview of neutrino masses. Efforts at detecting ultra high energy astrophysical neutrinos in giant terrestrial detectors are briefly mentioned. Missing is any discussion of current theoretical ideas, such as the three types of the proposed seesaw mechanism and their linkage with leptogenesis.

In summary, this is not a book for beginners. Rather, it provides a perspective to researchers involved in high energy physics and allied areas. Despite a few omissions here and there, this will be a valuable and useful review-cum-reference volume to them. Every library with a high energy physics section needs to acquire it.

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Annual Review of Biomedical Engineering, 2008. Martin L. Yarmush, James S. Duncan and Martha L. Gray (eds). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, CA 94303-0139, USA. Vol. 10. 427 pp. Price not mentioned.

Biomedical engineering is an established area of research that encompasses many disciplines. It is often difficult to define its scope in terms of the fundamental subjects of engineering or science. When one probes deeply into a specific biomedical engineering topic, it becomes biology, chemistry, medicine or physics, or a combination thereof. If the investigation is focused on an application, it is not different from an engineering study – chemical, electrical or mechanical, albeit applied to a biomedical problem. Putting together an *Annual Review* on this topic too is equally difficult: the topics of current research in this area are too varied and too many to capture in a single book of 15 chapters. Fifteen reviews presented in this edited volume can be divided into six categories: biomechanics, biosensors, devices, drug-delivery systems, electronics and circuits, and imaging. Thus, it is only a sampler of ongoing work in this interdisciplinary field. Nevertheless, the authors of individual chapters have made a commendable effort in making each chapter self-contained to provide a bird's-eye view of the topic with a good dose of references.

Biomechanics, an important component of biomedical engineering for a long time, deservedly occupies one-fifth of the book. Biomechanics of today is not just focused on bones and muscles; its focus is more on the smaller scales than it was before. The changes in the mechanical behaviour of cells and tissues are correlated to their state of health or disease. A mechanical property such as stiffness can well be a new biomarker. There are a number of studies in this direction, but this topic has not been considered in the present volume. The chapter on modelling catch bonds – the adhesive bonds that become stronger and longer-lived in the presence of a force that tends to break them – comes closest to this aspect. This type of modelling requires a delicate balance of classical mechanics and statistical mechanics, so that the molecular behaviour and microscopic cellular behaviour are correlated well. Experimental measurements can be made at both the levels today, although with debatable accuracy. Therefore, modelling effort should manage with the uncertainties in the measured data and lack of complete physical understanding of the underlying mechanisms. Many simplifying assumptions are made only to relax and refine them later. Most studies on cellular mechanics give an impression that the field is still in its inception. A better developed area in biomechanics is the modelling of blood flow (haemodynamics) and the complex mechanical behaviour of tissues. Thus, one can see in the chapter on simulating the fluid–solid growth behaviour of aneurisms in intracranial and abdominal arteries. Here, the modelling is much more advanced, wherein continuum mechanics of solids and fluids is brought to bear properly. The latest advances in imaging can be combined with these sophisticated modelling techniques so that patient-specific assessment can be made for personalized diagnosis and therapy. The third chapter on biomechanics addresses an entirely different topic in a completely different way. It describes techniques that are useful in scientifically assessing mechanical trauma and abuse in young children due to vigorous shaking, falls and hitting. It uses computer models of humans to estimate the extent of abuse and trauma. The biomechanics modelling tends to be empirical and software-oriented because of the nature of understanding required here.

Investigations on biosensors form a significant part of biomedical engineering research today. It requires a close collaboration among biologists, chemists, bioengineers, and the modern-day manufacturers – the micro- and nano-fabrication researchers. It is an exciting field that poses many intellectual challenges in making the sensors selective and accurate, small and portable, fast, and finally affordable to people around the world. The chapter on point-of-care diagnostics addresses this important need and provides a good overview of different settings ranging from a modern-day, fully equipped hospital laboratory in a developed country to a hospital in an underdeveloped country, where basic facilities and trained personnel are lacking. The authors correctly note that critical need for diagnosis of infectious diseases is more in the latter setting than the former. A number of research issues related to this global healthcare are discussed in this chapter. It makes a good reading to understand the societal needs as well as basic scientific and technical challenges involved in it.

The impact of biomedical engineering on healthcare needs of the society comes to the surface in two other aspects covered in this book. These pertain to the prosthetic devices and drug-delivery systems. Prosthetic devices of today are not limited to artificial limbs and hearing aids; they are available for internal organs. Two chapters in this book deal with mechanical circulatory support devices for treating heart failure and devices for prosthetic vision. Both these chapters