another by a forbidden gap that results due to the underlying periodic atomic/ionic potential. The degree of filling up of the topmost energy band (valence band) gives rise to a classification of solids as metals, insulators and semiconductors. The properties of semiconductors can be tuned by impurity concentration. This leads to the formation of *n*-type (electron rich) and *p*-type (electron deficient or hole-rich) semiconductors. A junction of *p*-type and *n*-type semiconductor has a rectifying nature and forms the basis of another revolution called electronics.

The transition of atoms to solids has also been described using the Landau approach of broken symmetry. This approach is powerful. In a system obtained by broken symmetry, the distribution of energy among the entire set of particles can be approximately described as 'quasiparticles'. These new quantum entities can be either fermionic or bosonic in character and can be experimentally investigated. Different quantum objects such as phonons, magnons, plasmons, excitons, polarons and Cooper pairs that lead to superconducting state in solids have been described briefly in the third chapter. The effect of dimensionality that leads to observation of fractional quantum Hall effect has also been discussed here.

The development of quantum theory not only enriched our understanding of nature, but also led to many technological revolutions. The two such technologies that have revolutionized human life are electronics and lasers. Discovery of the transistor about 60 years ago, signifies the birth of a modern age. We have moved from bulky and cumbersome, valve-based devices to small and easy-to-use 'systems on chips'. The development of other semiconducting devices purely based on quantum fundamentals like tunnel diode, field effect transistor (FET), metal-oxide semiconductor FET (MOSFET), etc. have enabled us to reap benefits in terms of computers, communication and dissemination of information through the internet. Discovery and development of lasers is another area that has touched every sphere of our lives. Its important property of directionality immediately finds use in diverse fields like medicine, machine and tools, defence, nuclear and even entertainment industry. Another quantum phenomenon that has and will continue to revolutionize human life in general is superconductivity. The superconducting quantum interference device, which is based on Josephson tunnelling effect, is the most sensitive detector of magnetic flux and has been a boon to the field of neuroscience. The giant magneto resistance-based read–write heads useful in high-density data storage and transfer, carbon nanotube electronics, microelectromechanical systems which could also be called atomic machines are, to name a few, the other quantum technologies knocking at our doorstep.

Finally, the author describes some thought experiments that were designed to test the limits of quantum physics and have now been actually performed. One of the most famous examples is the Einstein, Podolsky and Rosen paradox, which has now been explained using arguments based on entangled spins. The other experiments described are those testing the wave particle duality of quantum objects, quantum decoherence, measurement without interaction, quantum zeno, etc. The recent discovery of cold atoms has made it possible to verify the findings of the Heisenberg microscope thought experiment, that uncertainty is not caused by transfer of momentum from photon to particle. These experiments are essentially performed, as the author himself has put it, with the spirit of a mountaineer. The experiments described in this chapter are quite recent and are expected to improve the precision of measurement techniques, but some of them also have technological possibilities like quantum cryptography, quantum computing, etc.

The final chapter conveys the overall message of this book. The book is well written and emphasizes the breadth, depth and utility of quantum approach as well as points out the futility of counter-intuitive ideas. Although the book is silent on discoveries and predictions of particle physics, it is a must read for all students of physics, as it will not only make them abreast with the recent developments in the field, but also help them understand the quantum phenomena in a better way.

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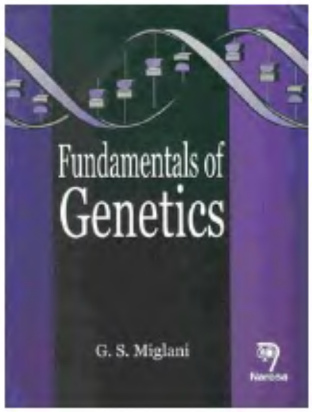

Fundamentals of Genetics. G. S. Miglani. Narosa Publishing House, 22 Delhi Medical Association Road, Daryaganj, New Delhi 110 002. 2008. 660 pp. Price not mentioned.

As mentioned in the Preface, this textbook aims 'to make concepts and principles of genetics clear to the undergraduate students, using a simple language'. Although students are introduced to the area of genetics right from their school days, a large percentage of the undergraduate as well as postgraduate students only knows facts (like ratios obtained from different crosses), without really understanding the reasons or concepts behind these observations. Thus, a book explaining the fundamentals of genetics is of prime importance to students. Keeping in line with the recent trends, the book also envisages to explain various phenomena of genetics at the molecular level, wherever possible. The book is organized in 28 chapters ranging from principles of inheritance, chromosomal theory of inheritance, gene–gene interactions, genetic analysis of haploid and diploid organisms, gene function and regulation, population genetics, developmental genetics, etc. The book ends with a chapter on probability and chi-square. Each chapter apart from stating the concerned phenomenon cites examples, some of which are interesting, and ends with a section on 'Some useful reading hints', which is followed by questions.

However, after going through the book I felt that it does not meet the goal which the author has projected in the Preface. A book on the fundamentals of genetics, which introduces probability as the last chapter is not expected to help students understand the concepts of genetics. At best the book is a bag of facts, some in-

teresting examples, and reference to some interesting papers, but marred by mistakes. The last point is what troubles me the most, as it could lead to misconceptions. The following illustration from the chapter on 'Chromosome theory of inheritance' highlights one of the several glaring misconceptions that this book contains:

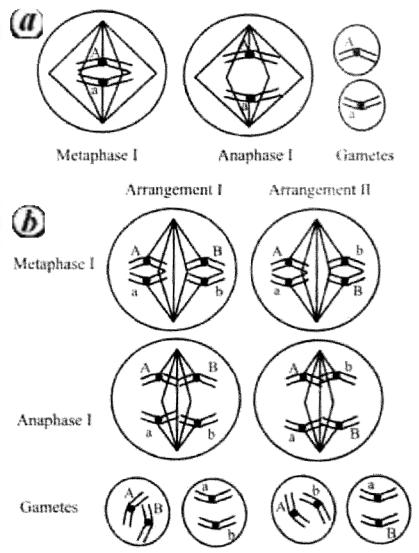

Figure 1. ***a***, Segregation and ***b***, Independent assortment of chromosomes and genes.

A book on genetics which shows the presence of two chromatids of a chromosome in gametes is best avoided by students and teachers alike.

While dealing with sex-linkage in poultry in the chapter 'Sex-linked, sex-limited and sex-influenced inheritance', the author mentions that 'females have only one X chromosome (XO condition) and male is homogametic (XX)'. The XO and XX nomenclature was used earlier[1]; however, this has since changed and now ZZ/ZW nomenclature is used for sex chromosomes of male and female birds respectively.

In the chapter on linkage, the author presents F_2 progeny for a dihybrid cross to demonstrate the linkage between two characters of sweet pea. He finds the genetic distance between the two genes by calculating the percentage of the phenotypic recombinant classes of F_2 progenies instead of that obtained from a test cross. Learning such erroneous methods will churn out students with little understanding of the abstract concepts of genetics. On a lighter note, peas also turned to flies in the text. This questions the author's 'attention to detail' as highlighted in the Foreword to the book. Coincidentally, the genetic distance of 10.7 calculated in this example matches the one used as an example by Griffith *et al.*[2]. In the book by Griffith *et al.*[2], the chapter on linkage starts with the example of sweet pea phenotypes observed in the F_2 progeny by Bateson and Punnett, followed by the results of a testcross observed by Morgan in *Drosophila* from where Griffith demonstrates the calculation of recombination frequency, the result being 10.7%. In the book under review, the section starts with the same example of Bateson and Punnett, has no example of *Drosophila*, but concludes the discussion highlighting that the least number of 'flies' belong to the category of classes arising due to crossing over and calculates the percentage based on numbers presented for the F_2 progeny of 'peas' to be 10.7.

In the conclusion to the chapter on gene–gene interaction, the author mentions 'Discovery of gene–gene interaction dispelled the notion that each gene produced a single, non-overlapping individual effect and that these effects fitted together like a mosaic to produce the organism. This viewpoint is called 'preformationism'. I do not think that 'preformationism' was ever talked about in this context, but is known to have been used long before the birth of genetics to explain the viewpoint in embryology, wherein the sperm or egg was believed to contain within itself the entire organism in a perfect miniature form.

The book does not discuss how genetic maps are developed, although under a chapter on genetic engineering a paragraph has been written about high-density molecular maps, enlisting the names of all kinds of molecular markers like AFLP, ALP, SCAR, RFLP, etc. If the general concept of developing maps is not explained, knowing the names of these so called 'modern' techniques is least useful to the students. Similar 'name droppings' have been done in several instances. For example, in the chapter on cell division, although the names and the function of several genes involved in cell cycle control have been enlisted, the basic general terms like cyclins and CDKs have not been introduced. In fact, CDK has not been mentioned in this section. The chapter however has a section on measuring duration of cell cycle, which could have been explained more elaborately. Such techniques though in use by researchers, have been left out in many of the recent textbooks. Similarly, in a section on DNA structure, the structures of C, D, E and P-DNA have been introduced, which I feel has no relevance if not put in the proper perspective.

For reasons not clear to me the concept of penetrance, expressivity and phenocopy has been explained under the chapter on transcription, RNA processing and genetic codes. This would have been appropriate if these concepts were explained in terms of the molecular events that are actually responsible for these phenotypically observed phenomena. However, this has not been done and thus their inclusion in this chapter seems aberrant.

C-value paradox has been described as the anomalous situation of the human genome, wherein the estimated number of genes is much less than what was predicted. The book states (p. 13.17), 'Each human diploid cell has 3.5×10^{12} Daltons (Daltons of what?), which measures 174 cm. If a polypeptide has 300 amino acids, this will need 1,000 bp for its synthesis, which is 0.67×10^6 D. If haploid genome content in humans is 2.8×10^7 bp, which is 1.8×10^{12} D, then this genome size should contain 3×10^6 genes. However, estimated number of genes in humans is 32,000 to 35,000. This anomalous situation has been described as C-value paradox'. I do not agree with this description of C-value paradox, since the real cause of the paradox is something different: C-value paradox primarily (and historically) relates to a lack of correlation between biological complexity and the C-value (haploid DNA content) in different taxonomic groups, e.g. amphibians or even the 'simple' amoeba having much higher C-value than humans! Perhaps the author was trying to explain the presence of non-coding DNA in large measures, which is the other feature of C-value paradox and also called as C-value enigma[3] by some. One also wonders why a gene coding for a 300 amino acid long polypeptide should be of 1000 bp, since the coding ratio would predict 900 bp. I do not know if the additional 100 bp accounts for introns, UTRs, promoter, etc. for a given gene, but if so, this conveys a misfounded concept to the readers.

An interesting question has been asked in the chapter on 'Genes in development': How many genes are necessary for development of *Drosophila* fly? The answer as given in the text (p. 27.14) is a

categorical 1617 genes necessary for normal embryogenesis and metamorphosis. Further, it is stated that the total number of genes in the *Drosophila* genome is 5000, quoting Raff and Kaufman (1983). As with many other references, this has not been listed in the Bibliography section. Presently the estimated total number of genes in *Drosophila* is approximately 13,000 and my search for information for the total number of genes needed for development of *Drosophila* was futile; but I am sure there is no exact number.

A positive point of this book is that it presents many of the older (some may like to call it 'classical') experiments and observations, which are no longer mentioned in the recent editions of books on genetics. However, these examples have not been properly utilized to explain the ideas or concepts which emerged out of such observations.

There are mistakes in the Glossary. Just to cite two examples, null allele has been defined as an allele whose protein product shows no histochemically detectable activity and a strong promoter as a promoter whose copy number is under strict control. The second is probably a mistake during publishing and actually defines a stringent plasmid. Kozak (of the 'Kozak sequence' fame) has been mentioned everywhere (text as well as in the glossary) as Konzak. Many terms have been used in the glossary and text which is not currently in use, e.g. trailer sequence to define 3′UTR in RNA and antitrailers as their corresponding DNA sequence. The terms Train and Antitrain have been used to describe the same in figure 16.8. Terms like these may have been used at some point of time, but a textbook should use the latest terminologies. The older terminologies could be however mentioned, as it is sometimes interesting to know how terminologies evolved.

Every chapter cites several references, especially in the section on 'Some useful reading hints'. Although this is a good feature of the book, the purpose of this section is lost as a number of them have not been listed in the Bibliography section.

These are but a few examples which make this book highly unsatisfactory for imparting basic concepts in genetics to teachers and students. The book obviously needs critical editing to correct factual, conceptual and other errors.

1. Strickberger, M. W., *Genetics*, Macmillan Publishing Co, USA, 1976, 2nd edn.
2. Griffiths, A. J. F., Miller, J. H., Suzuki, D. T., Lewontin, R. C. and Gelbart, W. M., *An Introduction to Genetic Analysis*, W H Freeman and Company, USA, 1993, 5th edn.
3. Gregory, T. R., *Ann. Bot.*, 2005, **95**, 133–146.

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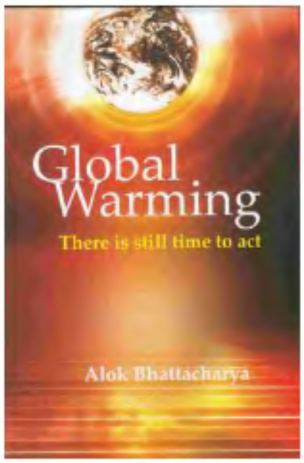

Global Warming: There is Still Time to Act. Alok Bhattacharya. Rupa & Co., 7/16, Ansari Road, Daryaganj, New Delhi 110 002. 2008. 150 pp. Price: Rs 395.

As evident in the subtitle, this is not a book of gloomy predictions or dire warnings, but one that echoes the optimism of IPCC, the Intergovernmental Panel on Climate Change. And the note of optimism is backed by a road map to mitigate the adverse effects of global warming, which forms the last chapter of the book under review.

What sets the book apart is its viewpoint, which is that of a concerned, informed, and long-standing observer of the world. The author says in the preface to the book, 'I was fortunate to live in the developed world during the late sixties, around the time when their conspicuous, consumption-oriented lifestyles started becoming environmentally unsustainable. Being a student from a poor developing country, I used to feel a degree of discontent . . . I started making notes of those events and news items from the printed media which I felt showed the dark underbelly of their glamorous lifestyle. The habit continued long after I came back to India, although I did not know to what purpose these notes could serve'.

The increasing attention given to the phenomenon of climate change in mass media spurred the author to write, drawing on the notes gathered over the last four decades, to 'give a sense of direction to readers' as a pointer to the right course of action. Most books on global warming present or support the 'official position' with data and scientific explanations; some aim at dramatizing the issue to jolt readers into action; and a few present the contrary view, again marshalling either science or rhetoric. This book takes a historical perspective – in fact it is liberally peppered with statistics of all kinds, from speed of the camel to the amount needed to achieve MDGs, the millennium development goals – and comes to the conclusion that reviving villages should be a key component of India's response to the threat of climate change.

The first chapter sets the scene with a concise yet up-to-date account of the concept of global warming and its international ramifications. The second chapter covers climate change with reference to different habitats or ecosystems around the world. The next two chapters trace the roots of the problem, largely to the Industrial Revolution, whereas the one that follows shows how urbanization and the consumerist lifestyle have served to aggravate the problem to its current staggering dimensions. The last but one chapter talks about reviving the villages. The last chapter, although titled 'A road map for mitigation of global warming', is anything but that – instead, it is a miscellany of measures touching different sectors and exhorting a medley of agencies to act.

Given such an eclectic choice of topics and sources, the text is bound to ramble: if you are looking for a rigorous treatment of the subject, the book will not serve your purpose; if you are game for a leisurely walk with a studious yet cheerful companion, you will not be disappointed.

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