Preface

How to read this book.

My aim is to give a general introduction to genetics for a wide readership. This will mean different things to different readers. I sometimes give detail or use terminology for the more specialist readers, which others will not need to know about. The first two chapters are basic biology, chapters 3 to 7 describe the technology, and chapters 8 to 13 contain the more detailed discussions.

For readers with little background in biology or genetics, it is important to get a basic understanding about genes and how they work. However, some of my readers found parts of the technical chapters heavy going. If you have the same problem, scan read the hard parts so you know what is covered, pick up the important things in "Take-Away Message" and move on. I cross-reference the basic techniques in the later chapters, so you can come back to them to refresh your memory.

Some readers will have had little exposure to the jargon so to help separate the wheat from the chaff, words which I think you need to know about will be in ***bold italics.*** Conversely, jargon that is not in ***bold-italics*** is not necessary for a general understanding of the book or of genetic engineering. I do this because it is better to define and use the accepted scientific word than to invent yet another word for the same thing. Sometimes a full explanation comes a bit later than the first use of a word, so if a new word is all gobbledegook to you, hang in there because the explanation will come. Keep a good modern dictionary, at least 5cm thick beside you. It will contain a surprising amount of scientific jargon.

For a quick reference the glossary has definitions of most of the jargon used in this book.

I am often referring to things that come in very large numbers. Don't take these numbers too literally as it makes little difference to a general understanding whether it is millions, billions or trillions. It's a good idea to be clear about scientific notation where numbers are expressed to the power of 10. Thus 1,000 is written 10^3 (think of it as 1 and three zeros) and conversely 1/1000 is written 10^{-3} (thus 1 millimetre is 10^{-3} metres). A million is 10^6. A billion is a thousand million (10^9) and a trillion is a thousand billion (10^{12}). For evolutionary time I use 1,000 years ago (kya) or a million years ago (mya). The magnification of images is indicated by X (100X, indicates a magnification of 100 times).

A few years ago it was estimated and generally accepted that the human genome encoded 70-80,000 genes. The Human Genome Project reduced this to about 30,000. More recently many of these genes have been found to be inactive relics of previously active genes and the number of active genes estimated at about 21,000. To keep things simple, I use the round figure of 20,000.

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I have minimized the number of references on the basis that few people will have the time or the library access to look them up. I acknowledge people, publications or websites where they have been a major source of my information and where possible have chosen recent papers which will give the more specialist reader an introduction to the scientific literature. In the index I list only pages that contain an explanation about a word, not every use of the word. I only index the first page of longer explanations, so always check the following page as well.

It will also be clear that many aspects of genetics I write about, I do so with no personal research experience. I have depended heavily on

published material, as well as help from scientists with special expertise. I acknowledge these specialist sources in the text. I have used many graphic images provided by other scientists: diagrams and photographs without acknowledgement are my own work. Where necessary for clarity, I have enhanced graphic images using graphics software, probably sometimes beyond what would be acceptable in a scientific paper.

The Protein Data Bank (PDB, *www.pdb.org*) provided the three dimensional structures. The database is run by the publicly funded Research Collaboratory for Structural Bioinformatics. I give the PDB number for each structure, so anybody can go to the website and look up the full references, and play with the structures. There are links to free software for visualising the molecules. I have mainly used Protein Explorer by Eric Martz (*http://proteinexplorer.org/*)

Valuable sources of information.

The internet is an amazing resource, but search engines look for words and cannot evaluate the information. You will get thousands of hits, and it is sometimes difficult to sort out the gems from the rubbish. Sometimes the very thing you are looking for comes up in the first page of hits, but more often it's a matter of sorting through a large amount of irrelevant or misleading information. The important thing is to put in a combination of key words to restrict the hits so you get the ones you want on the first few pages. For example, if you doubt my statements on the effect of banning DDT on malaria, type in "ddt malaria" and you will find a lot of good information on the first few pages of hits. Many of the large universities and government agencies have good information on their websites. "Encyclopedia Britannica" and "Wikipedia" can be useful, but are sometimes unreliable or incomplete as anybody can contribute information.

Searching for names can be problematical. I found I had to put in "Colin Sanderson", "CJ Sanderson", and "C.J. Sanderson" to get a cross section of my own work. Don't forget the " ", otherwise you get all the other Colin's as well as all the other Sanderson's.

The main problem for the non-expert is to decide which information is misleading, and to find the gems that exist on a server somewhere. With all the available information, my role has been to edit, interpret, and present it in a readable form. For me researching this book has been a steep and very rewarding learning experience that has taken me far from my own medical research. Here are some of my main sources of information:

The AgBioWorld (*www.agbioworld.org*) a non-profit Foundation based in Alabama, USA. They provide regular science-based information on agricultural biotechnology via a free email newsletter.

Bioscope (*www.bio-scope.org*), an information group based in Germany, collecting and relaying news and press items from around the world.

Food and Agriculture Organisation (FAO, *www.fao.org*) publishes a wide variety of information and hosts online discussion groups on many topics important to food and agriculture.

International Service for the Acquisition of Agra-biotech Applications (ISAAA, *www.isaaa.org*). Based in the Philippines, it provides annual global reviews of commercialised transgenic crops.

The Scientist (*www.the-scientist.com*), started as a new generation free access scientific journal. Unfortunately access to some material requires a paid registration.

Affiliations

I abbreviate my own affiliations: I refer to myself as CJS; WA, Western Australia; CUT, Curtin University of Technology (Perth, WA); UWA, University of Western Australia (Perth, WA); NIMR, The National Institute for Medical Research (Mill Hill, London).

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