development, pattern formation in the embryo, seed dormancy and germination, development of the root, the vegetative shoot apical meristem, the leaf, the transition to flowering, and flower development leading to the stage from pollination to fertilization. Seven chapters on growth discuss ethylene – a unique plant signalling molecule, gibberellin and abscissic acid biosynthesis and response, auxin and cytokinin, light signal transduction and the control of seedling development, circadian rhythms, the physiology of tropisms, and modulation of root growth by physical stimuli. Five chapters on biotic and abiotic stress examine interaction between *Arabidopsis thaliana* and viruses, microbial pathogenesis of *Arabidopsis*, plant-parasitic nematodes, environmental stress and gene regulation, and *Arabidopsis thaliana* as a model for studying mechanisms of plant cold tolerance.

This leaves us with ten chapters on biochemistry and cell biology, which include articles on amino acid, nucleotide and vitamin biosynthesis, glycerolipids, starch, photosynthesis, the plant cell wall, and secondary metabolism, among other topics. Of the two appendices, (A) describes the Internet and Electronic *Arabidopsis* Information Resources, and includes a useful introduction to the Internet for newcomers, together with details of the two electronic resources: AAtDB Project and AIMS database, how to get at them and what information they contained at the time of writing the article. This information includes physical and genetic maps, seed stocks and clone resources, DNA sequences from GenBank and EMBL, protein sequence similarities between the known *Arabidopsis* DNA sequences and all known protein sequences, etc. and even a list with details of *Arabidopsis* researchers, and 'much much more' as the advertisers say.

Appendix (B) gives a list of *Arabidopsis thaliana* genetic variations with gene symbol, name, location when known, origin, alleles, references and phenotype, and is obviously subject to frequent updating using the electronic resources described in Appendix (A). The book ends with 32 pages of index, for which the compilers deserve a vote of thanks.

The authors have certainly made out a very good case for the value of their little cruciferine weed as a model for a broad study of the biology of the flowering plants; and the Arabidopsis community are in the fortunate position that no other small weed has a chance of replacing it as a favoured model. This makes a dramatic comparison with the bacterial parallel, as we learn from recent reports in *Science*. Frederick Blattner's progress in sequencing the 4·7 million kbp (kilobase pairs) of *Escherichia coli* was halted at 40% of its target, i.e. about 1·9 million kbp sequenced, because of loss of his grant (but there is now hope that his funding may be continued, which is devoutly to be desired). Meanwhile, in the next number of *Science* (28th July 1995) 40 scientists, led by J. Craig Venter and Hamilton O. Smith, publish the complete DNA sequence of the much simpler bacterium *Haemophilus influenzae*, which has only 1·83 million kbp of DNA in total – slightly less than the sequenced fraction of *E. coli*. Venter *et al.* begin their article by claiming that 'A prerequisite to understanding the complete biology of an organism is the determination of its entire genome sequence', and Venter is quoted as saying that the success with the *H. Influenzae* sequence has 'raised the ante world-wide for sequencing the human genome'. Hype of this kind is perhaps necessary to get funding in the United States, but I trust it won't cause the Arabidopsis community to drop all their fiddling with mutations, gene cloning, cell biology and biochemistry of the weed to concentrate on Venter-style sequencing of its 80–100 million kbp of chromosomal DNA. That would have made this book much less readable.

As it is, I look forward to learning how far the narrow evolutionary base of the angiosperms will permit this multi-disciplinary attack on the biology of the model weed to proceed.

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Domestication of Plants in the Old World: The origin and spread of cultivated plants in West Asia, Europe, and the Nile Valley. By DANIEL ZOHARY and MARIA HOPF. Second edition. Clarendon Press, Oxford. 1994. 279 pages. Paperback. Price £15.00. ISBN 0 19 854896 6.

The first edition of this book, which came out in 1988, was based on research published up to 1985. Since then, the authors tell us, 'archaeobotanical investigations and the study of the Old World's crops and their wild relatives continued, frequently at an accelerated pace. An impressive body of new evidence was added, both crop-wise and site-wise. Significantly, the new information does not contradict the main conclusions arrived at five or six years ago, but confirms them'. The second edition appeared in hardback in 1993 and led to the paperback edition we are reviewing, which includes a supplementary list of very recent references not available for the 1993 edition. The two versions of the second edition also include a chapter on dye plants (of which more later) and a good deal of new information on vegetables, fruit trees and minor grain crops.

The first definite signs of plant cultivation in the Old World appear in a string of early Neolithic villages that developed in the Near East at least 10000 years ago and showed evidence of domestication of eight or nine local grain species, dominated by emmer wheat, einkorn wheat and barley. These clearly provided the basis for a settled agriculture to replace the previous hunter–gatherer, nomadic form of life, and the farmers soon afterwards domesticated sheep

and goats, followed by cattle and pigs. Conversion of grasses into cereals that would feed a settled population required a number of revolutionary changes. Thus plants in the wild are constantly selected for quick shattering of their mature ears to promote maximum seed dispersal, and the various wild cereals have also evolved elaborate dissemination devices; but cereal cultivation, based on sowing the seed in tilled fields, reaping the mature spikes or panicles and threshing the grains, requires the selection of non-shattering mutants, which make the crop fully dependent on the farmer by preventing it from constantly crossing with its wild progenitors. Other changes were required to make these early cereals more suitable for threshing, as the authors explain.

Wheats are the universal cereals of Old World Agriculture and, together with barley, they constituted the principal grain stock which founded Neolithic agriculture and were the main element responsible for its spread. Today, wheats rank first in the world's grain production and account for more than 20% of the total food calories consumed by humans. The stages of their domestication, from the diploid *Triticum boeoticum* einkorn wheat, through the tetraploid emmer, durum, Rivet etc., to the hexaploid bread wheats of the *T. aestivum* group, make a very interesting example of man-controlled evolution, as described and illustrated in detail by Zohary and Hopf, but that is only a small part of what the book covers.

Other cereals include rye, whose non-shattering cultivated varieties are valued for their winter hardiness, resistance to drought and ability to grow on acid, sandy soils, while rye bread and rye whiskey were important products. Oat, Broomcorn millet, Foxtail millet and the latecomers sorghum and rice were important cultivated cereals in different parts of the Old World, on which less archaeobotanical information is available.

Pulses (annual legumes cultivated for their seed) were important in early agriculture because of their ability to fix atmospheric nitrogen with the help of the root bacterium *Rhizobium*, and because they are exceptionally rich in storage proteins, making them an effective complement to a cereal diet. Among the pulses, pea, lentil, chickpea and bitter vetch appear to have been taken into cultivation more or less together with the main cereals domesticated by the first farmers in the Near East Neolithic settlements, and characteristic changes under cultivation occurred, such as retention of the seed in the pod, and the production of much larger seeds and pods than is found in their wild progenitors. The plant habit was also changed under domestication.

Oil and fibre crops discussed include Flax (*Linum usitatissimum*), the earliest source of vegetable fibre, which was stronger than cotton or wool, and of cooking oil made from cold pressing the seed; but its fibre has been replaced by cotton and synthetic fibres since the industrial revolution. Hemp (*Cannabis sativa*) was a source of fibre from the main stems, oil and animal feed from the seeds, and a psychotomimetic drug from its glandular hairs. Other crops in this group include Old World cottons, Poppy, False Flax (*Camelina sativa*) and Sesame. *Sesamum indicum* is a traditional warm season crop in south-west Asia and the Mediterraneum basin, highly appreciated for its oil which keeps fresh for a long time without turning rancid. It appears to have been a late arrival, domesticated in India.

Fruit trees make an interesting contrast to cereal crops, since they are perennials which start to bear fruit only 3–8 years after planting, and successful domestication requires a change from sexual reproduction to vegetative propagation. Archaeological excavations indicate that olive, grape vine, fig, date palm, pomegranate and sycamore fig were the first fruit trees cultivated in the Old World, while apple, pear, plum and cherry were only taken into cultivation much later, probably because they do not lend themselves to simple vegetative propagation but need to be maintained by grafting. The Greeks and Romans were already familiar with the art of grafting and applied it to apples and pears.

Of particular interest are the dye crops native to south east Asia and the mediterranean basin which entered cultivation before classical times. Woad (*Isatis tinctoria*) whose dye, indigo, was extracted from the leaves (rosettes) by drying, powdering and fermenting – a tedious and very smelly process, say the authors, who may have tried it. Dyer's Rocket (*Reseda luteola*) produced a flavon-type yellow pigment, while Madder (*Rubia tinctorum*) was, until the end of the nineteenth century, extensively grown for its yield of the brilliant red pigment alizarin. True Indigo (*Indigofera tinctoria*) was another source of indigo dye. Safflower (*Carthamus tinctorius*) had yellow-red flowers whose colour was used to dye textiles and colour food. Extraction and application of these natural dyes was a very laborious process, and they have all been replaced by the invention of synthetic alinine dyes during the second half of the nineteenth century. So these classically important dye plants now have the status of agricultural dropouts, with only a few forms surviving in Botanical Gardens. The authors quote an interesting description by Pliny of the technique of madder dying in Egypt, on page 192, which the amateur might like to try out.

Fruit in archaeological sites obviously collected from wild species, including beech, hackberry, raspberries and blackberries, strawberries etc. are discussed in chapter 9, and chapter 10 summarizes the information on plant remains retrieved from representative Neolithic and Bronze Age sites in west Asia, Europe and the Nile Valley. 150 sites or groups of sites were chosen to present the archaeological evidence as it stands today, and the site locations are given in a number of maps.

The authors' conclusions are presented in detail in chapter 11, and there is a list of about 540 references with titles and journal names in full, including the supplementary references on page 272. Among the references I happened to notice one by Badler, McGovern and Michel (1990) with the title 'Drink and be merry! Infrared spectroscopy and ancient Near Eastern wine'. There is, finally, what looks to me like a very useful index, and I should have said that there are a number of helpful illustrations.

This book should be of interest to evolutionists, botanists, plant geneticists and any others who want to know how our ancestors tricked grasses (fodder only for specially designed teeth and stomachs) into becoming their main source of food. It is very cheap, at £15, for the large amount of interesting information ably presented. I first came across a copy in a general book shop in the middle of Princes Street, Edinburgh, and hope this review will force them to increase their stock.

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Molecular Biology: Current Innovations and Future Trends. Part 1. Edited by ANNETTE M. GRIFFIN and HUGH G. GRIFFIN. Horizon Scientific Press 1995. 165 pages. Price £19.99. US$39.99. ISBN 1 898 486 018

One could be led to believe that a molecular biologist armed with a copy of 'Maniatis', or one of the Current Protocols publications, would have adequate technical support to successfully accomplish most experimental procedures. In the real laboratory world, we know that even established methodology is adapting and changing at an alarming rate and that new experimental approaches are regularly appearing on the horizon. This small book fills an important niche in the market, for it aims, and I believe succeeds, in bringing the reader up to date with recent innovations in established techniques as well as introducing us to more state of the art methodology.

The book contains ten chapters, all written by experts in the particular fields and interestingly, the editors have recruited over half the authors from the commercial sector. These contributors tend to bias their chapters towards products available from their particular companies, although in general they seem to have covered their subjects fairly comprehensively. Each chapter covers a review of the technique, concentrating on recent innovations and then discusses likely future trends. Most chapters end with protocols covering recent advances or more specialised approaches. Each chapter is also accompanied by an extensive list of references, in most cases concentrating on papers published in the last five years. All chapters refer to material published last year, which is a good indication that the editors and publishers have succeeded in bringing this book to the bookshelves without undue delay.

The first chapter covers general PCR techniques and is written by a group of authors from Stratagene. In addition to covering recent advances in PCR methodology and instrumentation, the authors describe specific techniques such as cloning PCR-generated fragments and using PCR for site-directed mutagenesis. Sadly, the accompanying figures are black and white copies of coloured diagrams from the company's catalogue and some of the detail has been lost during reproduction. A specific utilisation of PCR, thermal cycle sequencing, is described in the next chapter, which contains a generalised protocol for the technique. This is followed by a chapter devoted to methods for isolating plasmid DNA from mini-preps using silica-based resins. Whilst there are a profusion of commercial kits available, the author very rightly draws attention to the dangers of total reliance on these products and so presents a very extensive protocol utilising common laboratory reagents and equipment.

Electrophoresis is covered by three chapters, the first by Branko Kozulic, who provides a very readable account of recent theories which attempt to explain electrophoretic phenomena, including his own 'door-corridor' model. He also provides a tantalising glimpse into the world of new gel matrices and intercalating dyes. The second chapter is devoted to pulsed field gel electrophoresis (PFGE) in which the authors review the various aspects of the technique and provide protocols for the preparation of high molecular weight DNA from soybean leaves and provide physical mapping data from PFGE combined with two dimensional electrophoresis. The other chapter describes capillary electrophoresis (CE) as applied to the isoelectric focusing of proteins and provides an extensive protocol and a troubleshooting chart.

A chapter on subtractive hybridisation describes the use of commercially available multipurpose cloning vectors to perform cDNA subtractive hybridization between biotinylated RNA and single stranded DNA. The unhybridised product is purified by streptavidin and used for transformation. This technique should appeal to researchers involved in gene expression and developmental studies.

The widespread use of PCR in molecular biology has required the simultaneous development of reliable methods for the production of oligo primers. A chapter describes recent developments in the related field of oligoribonucleotide synthesis. The demand for synthesized RNA is likely to increase as interest in antisense RNA and the possible use of ribozymes in gene therapy intensifies.

Finally, there are two interesting chapters on instrumentation. One describes state of the art devices for automated DNA hybridization and detection and the other is devoted to a relatively new technique called matrix assisted laser desorption ionization mass