adding albinism and cystinuria as examples) seems to have fallen on unreceptive ears.

In his study of alkaptonuria Garrod had noticed an increase in consanguinity amongst the parents of affected cases. This fact was picked up by the botanist Bateson, one of the early advocates of the recently rediscovered Mendelian principles, who pointed out that 'the mating of first cousins gives exactly the conditions most likely to enable a rare and usually recessive character to show itself'. A rapid exchange of correspondence between the physician and botanist followed, and in a *Lancet* paper in 1902 Garrod stated that Mendel's law of heredity offered the best possible explanation for a condition such as alkaptonuria.

In the first decade of the twentieth century a furious debate raged between the Mendelians and the biometricians. Garrod took no part. He continued to study his 'metabolic sports' and the detailed chemistry of the urinary pigments. Once he had satisfied himself that consanguinity was involved in inborn errors of metabolism, he seemed to have had little further interest in the genetic mechanisms that might be responsible. In 1914 the German biochemist, Oscar Gross, reported that an enzyme capable of oxidizing homogentisic acid was deficient in patients with alkaptonuria. The vital connection between gene and enzyme was tantalizingly near. But not until Beadle's paper in *Chemical Reviews* in 1945 was it explicitly stated.

It is easy with hindsight to see what others missed. Perhaps the intellectual climate in 1914, with the Great War looming, was not right for making theoretical deductions. By the end of the war, Garrod had lost two of his three sons, while the third died in the flu epidemic of 1919. As befitted an English gentleman of the time, his grief was private and he talked little to friends about his loss. But is hardly surprising that at 62 years of age some of the fire went out of his work. One can only speculate on how the development of genetics might have changed had Garrod been able to deduce from the evidence before him in 1914 that the function of genes was to make proteins.

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Preimplantation Diagnosis of Genetic Diseases: A New Technique in Assisted Reproduction. Edited by Y. VERLINSKY and A. M. KULIEV. Wiley–Liss. 1993. 144 pages. Price $59.95. ISBN 0 471 58824 5.

'Genetically disadvantaged' is the new political correctspeak for couples where both partners are heterozygous for the same rare recessive mutant gene. If such couples wish to have unaffected children they must resort to prenatal diagnosis and the 1 in 4 possibility of a termination of pregnancy. For some, though in actual practice a total minority, abortion is morally unacceptable, and their options are to forgo reproduction or to take a chance. In theory the development of methods of preimplantation diagnosis overcomes this problem by permitting selection of unaffected gametes prior to fertilization or unaffected pre-embryos before implantation. These two techniques, of which the latter is the better established, have been collectively termed preimplantation diagnosis.

The most serious drawback to making genetic diagnoses on gametes or pre-embryos is that the high failure rate of the subsequent fertilization and implantation processes usually renders the findings void. In fact the 'take home baby' rate of in vitro fertilization centres, from which the success rates must be derived, is usually below 15%. This means that a preimplantation diagnosis may have to be repeated up to 10 times before the couple achieve their goal of an unaffected child. Couples need to be absolutely sure that termination of pregnancy is outside their moral framework and equally determined that they want to have a child before they go through this long-drawn-out and emotionally draining experience.

Many of us suspect that preimplantation diagnosis will never become a mainstream part of antenatal care. None the less, it attracts a great deal of attention in both the lay and medical presses. The professional publications, like this one, all suffer from the same disadvantages in that they are written by aficionados for aficionados, and give completely unbalanced accounts of the reality of the subject. Lavish chapters on the technical minutiae of making cytogenetic or molecular genetic tests on single cells are usually followed by an apologetic few paragraphs on the fact that the whole science is undermined by the failure rates of artificial implantation. This book is no exception; furthermore it is compiled by the staff of the Reproductive Genetics Institute and Illinois Masonic Medical Center, which I understand to be a private organization selling preimplantation diagnosis. Perhaps it should be labelled 'advertisement'.

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Handbook of Quantitative Forest Genetics. Edited by L. FINS, S. T. FRIEDMAN and J. V. BROTSHOL. Kluwer Academic Publishers. 1992. 398 pages. Hardback £54.00. ISBN 0 792 31568 5.

This book is Volume 39 in the excellent 'Forestry Sciences' series published by Kluwer Academic. It has brought together 10 of north America's most respected quantitative tree breeders to present a chapter each on different aspects of quantitative tree breeding. The book grew out of a meeting of the Western Forest Genetics Association (WFGA) back in 1987, when it

was suggested that the WFGA sponsor a short course in quantitative methods. During planning meetings prior to holding the course it became clear to the organizers that no definitive text existed that covered all the ground of quantitative genetics as it applies to tree breeding. The various instructors therefore decided to adapt their course notes into a handbook that would serve as a text for current and future students and as an important reference tool for professional forest geneticists and tree breeders.

The actual short course took place in March 1989 and the editors worked hard for the next 3 years to make sure the style of each chapter was similar and without to much overlap. And what a good job they have done. It is certainly destined to be a new text-book classic for tree breeders. Every aspect of quantitative tree breeding is covered by one author or another.

Cheryl Talbert gives a good introductory chapter on 'Why bother?' and explains how quantitative genetics assists with decision making in a far from ideal world. After that it's down to the nitty-gritty. Hans van Buijtenen delivers a chapter on 'Fundamental Genetic Principles', which clearly sets out genetic principles and acts as a good reference for essential equations regarding predicted gain and correlated response. Floyd Bridgewater gives a rather 'dry' chapter on mating designs which just reels off all the design types without much comment on their use in actual programmes throughout the world. There is only passing mention of 'nucleus breeding', although admittedly this was little heard of in tree-breeding circles when the chapter would have been initially drafted. The chapter by Judy Loo-Dinkins on 'Field Test Design' is comprehensive and comes complete with suggested computer programs to tackle certain analysis problems. Gary Hodge and Tim White present an excellent chapter on breeding value calculation for single and multiple traits, which is effectively a condensed version of their recent book on the topic.

Other chapters cover 'Computation Methods' by Roy Stonecypher and 'Estimating Yield' of actual forest plantations by Sam Foster. The subject of how quantitative genetics can be used to assist decision making by evaluating alternative strategies is tackled in a most interesting and thought-provoking chapter by Sharon Friedman (also one of the editors), whilst Bob Westfall closes the book with a rather complex, sophisticated look at how analysis of provenance tests can lead to decisions regarding breeding zones.

The book really brings together a rich collection of experts. Of course it is highly north America-orientated. The work of Paul Cotterill and Christine Dean (Australia) is barely considered in multi-trait analysis, whilst good work from New Zealand on the practical implication of genotype environment interaction is not mentioned at all. But that does not detract from the fact that each chapter is a marvellous overview of its particular topic; a (fairly) comprehensive cover of the subject with a good collection of references to take it further if the student or tree breeder wants to.

At £54 it doesn't come cheap. There are no photographs and some pretty ropy diagrams and graphs, as well as some obvious typing errors and in one case errors in a table of presented data which is confusing if you are trying to follow the example through. I would certainly want it on my shelf, however, and if you are a tree breeder or student of tree breeding, you need it to.

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Mutants at xantha *and* albina *Loci in Relation to Chloroplast Biogenesis in Barley* (Hordeum vulgare *L.*). By KNUD W. HENNINGSEN, JOHN E. BOYNTON and DITER VON WETTSTEIN. *Biologiske Skrifter* 42. The Royal Danish Academy of Sciences and Letters. 1993.

A large number of barley mutants which affect chloroplast developments have been collected over the years in the hope that they would help to identify the primary products of the genes affected and, by causing blocks in chloroplast biogenesis, help dissect the structural and functional development of these organelles. This issue of the *Biologiske Skrifter* specifically describes over a hundred mutants at *xantha* and *albina* loci which were collected by Diter von Wettstein over the period 1954–1962. Other similar monographs have appeared before describing *tigrina*, *viridis* and *chlorina* mutants of barley. The authors express the belief that the mutants will be increasingly useful in the elucidation of the mechanism of chloroplast biogenesis as more information is obtained on the macromolecules of the chloroplast and their physiology. If this does prove to be correct this issue of the *Biologiske Skrifter* will indeed be very useful, provided that stocks of the mutants are freely available.

The main feature of the book is the presentation of 115 electron micrographs to illustrate the effects of the *xantha* and *albina* mutants on chloroplast morphology. These are of superb quality and worth having just for their aesthetic appeal. As far as the text is concerned, the genetic analysis of the mutants is described first, then there is a brief introduction to the processes of chlorophyll synthesis and of chloroplast biogenesis, followed by an assessment of how these processes are affected by the mutants. Finally there is a more detailed general discussion of chloroplast biogenesis with particular reference to the mutants, and there are tables listing how the mutants were made, how they segregate and what their properties are. One gets the impression that an enormous amount