



## BOOK REVIEW

# All you ever wanted to know about pig genetics, but were too busy to look up

The genetics of the pig, 2nd edition. M. F. Rothschild, A. Ruvinsky, eds. CABI, Wallingford, UK, 2011. 496 pp. ISBN 978-1845937560. Hardcover, GBP 115.

Suppose you have been to university, where you got a heavy Master's degree with majors in biology and statistics, combined with minors in economy and information technology. As with most people in this world, you do not know much about pigs. Then for some reason, your main professional goal in life becomes to set up a full-blown state-of-the-art commercial pig breeding programme and to keep it running in a profitable and sustainable state for a few decades. The strange person who gave you this job will supply the required pigs, farms to keep them in, farm staff to run the farms, plus the necessary feed-stuffs, equipment, accountancy and sales and marketing services. What do you do?

A very clever first step would be to read this book a few times. Not from cover to cover, in your particular case. A good place to start would be the chapter on *Genetic improvement of the pig* (by Jack Dekkers, Pramod Mathur and Egbert Knol), which introduces issues such as the current structure of pig breeding in its various forms (breeding organizations, production pyramids, value chains, reproductive technology); breeding goals and how to equip these with weightings for the various traits of interest; selection criteria and breeding value estimation; and the practical use of DNA marker technology. It also gives some useful thought to more specialized things like sire and dam line breeding, genetic dissemination, environmental sensitivity and suchlike. And it supplies 169 references to further literature on all this.

Reading all those 169 papers (including Darwin's *On the origin of species*) would be very useful too (and you will surely come across many of them at a later stage in the job), but it is more convenient to stay with this book for a while and go through the chapters on *Genetics of performance traits* (by Archie Clutter), *Genetics of meat quality and carcass traits* (by Daniel Ciobanu *et al.*), *Biology and genetics of reproduc-*

*tion* (by Jean-Pierre Bidanel), *Genetics of morphological traits and inherited disorders* (by Frank Nicholas) and *Behaviour genetics of the domestic pig* (by Anna Johnson and John McGlone). This will give you a very thorough understanding of most of the traits that you are likely to have to deal with and their genetic aspects. This includes nicely detailed overviews of additive and non-additive genetic variation and covariation and of QTL as reported up to 2009, some very useful biological background information (for example, Archie Clutter manages to seamlessly integrate the 1976 Fowler–Richard–Pease model of the effect of nutrition on selection response into his text, which is not easy at all) and 55 pages of further references and tables with lots of detail. There is also a chapter on *Pigs as a model for biomedical sciences* (by Kristy Kuzmuk and Lawrence Schook), by no means a mainstream issue in most of the sector, but a very interesting niche if the opportunity presents itself – and a fascinating topic.

Approaching the topic from another point of view, some chapters deal with methodology such as *Molecular genetics* (by Chris Moran), *Cytogenetics and chromosome maps* (by Terje Raudsepp and Bhany Chowdhary), *Pig genomics* (by Martien Groenen *et al.*), *Standard genetic nomenclature of the pig with glossaries* (by Zhi-Liang Hu *et al.*), and *Transgenics and modern reproductive technologies* (by Jason Ross and Randall Prather). In this new job, you are very likely to have to communicate with experts in these fields quite a lot, possibly hiring some of them as consultants or in-house colleagues, and these chapters will give you a very broad and up-to-date overview of the matter. Up-to-date until 2010 of course, and this field moves faster than any other in animal breeding, so there will be more reading to do at a later stage. The book's editors write in their Preface that it is 'in no way [...] meant to replace the many fine textbooks devoted to the theory of animal breeding', and indeed, a similar methodological chapter on quantitative genetics and its application to pig breeding is lacking – for that kind of background, those

fine textbooks and a handful of the aforementioned 169 references supplied by Dekkers *et al.* will have to do the job.

Another group of specialists that you will have to consult with quite intensively deal with disease and embryonic development (many of them will be veterinarians), and here, the two chapters on *Immunogenetics* (by Joan Lunney *et al.*) and *Developmental genetics* (by Michael Dyck and Anatoly Ruvinsky) are going to be very useful, especially if those specialists start interfering with your breeding strategies as they often do. Prepare for a staggering amount of detail here, including another 20 pages of references. But for anyone working in a sector where loin chops and teat numbers are important issues, some clue about the genetics of body segmentation and the HOX genes that drive it can only be useful, just to give an example.

Sooner or later, you will have to make decisions about the pig breeds in your system and find out how these relate to other breeds. Here, we have chapters on *Breeds of pigs* (by David Buchanan and Ken Stalder) and *Pig genetic resources* (by Louis Ollivier and Jean-Louis Foulley), two very different approaches that together cover much of the status quo of genetic diversity and of the strategies employed to quantify and conserve it. One of the most conspicuous pig breed characteristics is colour, and the chapter on *Molecular genetics of coat colour variation* (by Leif Andersson and Graham Plastow) deals with the (surprisingly few) genes behind this trait. The chapters on *Genetic aspects of pig domestication* (by Greger Larson *et al.*) and *Systematics and evolution of the pig* (by the editors *et al.*) give some fascinating background information to all this, including, for instance, the notion that the domestic pig genotypes of the Middle East were replaced, in the Late Stone Age, by European ones which had been developed (from European wild boar) following the example of domestic pigs that had previously been brought into Europe from the Middle East, but not further explored for whatever reason. Such scenarios are the topic of intensive study, debate and policy-making in the genetic resources sector right now, and it can be very sobering to realize that there has been nothing new going on for 7000 years.

Of course, if you are not in the rather awkward job situation that I first described, you still have to read this book, maybe starting from a different chapter and probably not covering all the chapters. Two examples are as follows: (i) In 2010, when this book was still under development, I was preparing for a talk at the annual meeting of the European breeders

of saddled pig breeds (one of them is a neighbour of mine), covering the genetic aspects of that coat colour pattern. This was a nice topic to research, and I spent some interesting evenings pulling all the information together, but it would have been very convenient if the Andersson & Plastow chapter of this book (with, incidentally, exactly the information that I had found – that was a good thing to discover) had been available then. (ii) Also in 2010, I was writing some texts on *Pig breeding for increased sustainability*, part of which is about global genetic resource management. Again, if the Ollivier & Foulley chapter of this book had been available then, my life would have been quite a bit easier.

So, is this second edition a good textbook? Yes, I think it is a very good textbook. It is more complete and much more balanced than its first edition of 13 years earlier, and its third edition has all the potential to become a classic. Practically every chapter of the book ends with the message that its topic is going to be much better documented and accessible in the near future, as a consequence of the molecular genetics technology currently in the pipeline. Given the speed of development in that field, it would then be a good idea to have the third edition published considerably sooner than 13 years from now. I also feel that edition 3 would benefit from additional chapters such as *The genetics of feed efficiency*, *The genetics of robustness*, *Genotype–environment interactions in pig breeding* and *Genetic strategies to mitigate pollution*. And it would be useful to expand the chapter on behaviour with a substantial section on behavioural deprivation in intensive housing and what could be done about it through selective breeding, and to add a chapter on the associative-effects BLUP models that right now are fully under development to give us control of the way pigs in the same pen influence each other's performance – a useful alternative way to look at social behaviour. And of course, edition 3 should be available on DVD, with lots of hyperlinks and colour.

Editing a book like this is a very demanding task, and most of us would prefer somebody else to do it. Rothschild & Ruvinsky have done it extremely well. Two points that might have been done even better: (i) As far as the literature is in English, this book documents it admirably extensively (both European and American, and that is not self-evident), and in the long term that may be one of its strongest points, even when the Preface notices that it is 'impossible to cover all new and relevant literature'. But very little reference is made to publications in other languages and that is a bit of a pity. (ii) The

individual chapters are very variable in style. At the extremes, we have the Johnson & McGlone chapter that cites 17 literature sources in much experimental detail versus the Nicholas chapter that essentially consists of a 14-page table with 2½ pages of introductory text. Both these styles actually work well for their respective topics, but some more harmonization would make the book feel more coherent. Something similar holds for directly comparable elements across chapters, for example, the phylogenetic breed trees in Figures 13.3 and 18.1, which differ

considerably from each other, quite apart from the fact that Angeln Saddleback (bred by my aforementioned neighbour: I live in Angeln) and Meishan seem to have been swapped in Figure 18.1, and consequently, the text about Meishan in that chapter is confusing. But I am coming close to nit-picking here.

Highly recommended.

Pieter W. Knap  
*PIC International Group, Schleswig,  
Germany*  
*E-mail: pieter.knap@genusplc.com*