Preface

The existence of mouse chromosomal variants in the tobacco mouse, first discovered in the Poschiavo valley by Alfred Gropp, was a breakthrough for the study of speciation and even more so, for reinforcing the establishment of new mouse models for research on developmental processes.

The completion of a draft sequence of the mouse genome in December 2002 was a major landmark in biology, opening new research opportunities that will provide insights into the human genetic code and will make the mouse an even better tool for biomedical research.

When I was asked by Michael Schmid to edit a special issue of *Cytogenetic and Genome Research* devoted to our favourite experimental model, I immediately thought of two earlier books, the *Biology of the House Mouse*, edited by R.J. Berry (1981) and the *Genetic variants and strains of the laboratory mouse*, edited by Antony G. Searle and Mary F. Lyon (1981). These books, that encompassed nearly all the possible topics on mouse research, have been excellent companions during all my studies anticipating areas of interest which are still very important. Following these editors' example, I have tried to collect a wide-ranging overview of all current aspects of mouse genetics, with the aim of making the book a suitable tool of investigation for the wide population of researchers that use this model animal.

The house mouse holds a unique place among model organisms, representing an indispensable tool for most investigators in many areas, particularly biomedical research. The amount of information on the physiology, reproduction and development of the mouse is greater than that for any other mammal, with the possible exception of man. High fertility, short gestation, genetic variations, susceptibility to diseases and genetic tractability, are just a few of the reasons that have led researchers to exploit the mouse. Comparative genomics analyses showed that less than 1% of genes have no detectable homologs in humans even though mice diverged from the human lineage about 75 million years ago. Thus, it is not a surprise that mice are involved in about 90% of all experiments carried out in USA and represent a USD 200 million business per year.

Mouse genetics encompasses nearly 100 years of research, from William Castle's studies of Granby mice (1901–1908) and the establishment of the first inbred strain (DBA, 1909) to the publication of the mouse genome sequence (2002). In between there have been milestone achievements which have revolutionized biomedical science leading the mouse to be *the* experimental model for human biology: 1915, first linkage study;

1937, Peter Gorer's description of the H-2 locus; late 1940s, George Snell bred the first congenic strains; 1961, Mary Lyon's X-inactivation hypothesis; during the 1960s the lack of thymus was discovered and nude mouse strains were established. The golden achievements of the 1980s are: 1980, first transgenic mouse created by pronuclear injection of fertilized eggs; 1981, first murine embryonic stem cell line; 1983, a SCID mouse strain established; 1987, site-directed mutagenesis by gene targeting in embryonic stem cells; 1987, first knockout mouse; 1992, a p53 knockout mouse; 1998, Ryuzo Yanagimachi's mouse clones.

Genomics is a new and fascinating area of biology that takes a broad approach to molecular biology and evolution by studying the complete genome functioning. Now that the mouse genome sequence has been published, the "mouse community" has a powerful tool for dissecting the complexity of biological processes which require to be tackled at both molecular and organism level. For many researchers the availability of the full mouse genome sequence is really exciting; for all scientists it is a watershed that forces us to re-consider our conceptual tools and the way we do research. From now on, we all need to frame our research topics within genomics and be familiar with genome sequences, transcriptome profiling data and high-throughput technologies.

This issue features 37 peer-reviewed articles and brings together contributions that cover all major aspects of mouse genetics. The guest editor's preface usually offers a very short presentation of the articles, a truly impossible task when dealing with such a large number of articles on topics ranging from nuclear transfer and embryonic development to cancer, from reproduction to speciation and to functional genomics technologies. I shall let the articles speak for themselves!

I hope the readers will share my excitement for the huge impact that the knowledge of the mouse genome already has on all fields of biological research and human health, since the mouse genome encodes an experimentally tractable organism, a feature that has been uniquely exploited in this small mammal.

My warmest thanks to all the authors, the reviewers and the editors who have devoted their time and enthusiasm to explain current knowledge on the mouse genetics and offer glimpses of the exciting future.

Silvia Garagna
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