BOOK REVIEW

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NEUROBEHAVIORAL GENETICS: METHODS AND APPLICATIONS

Edited by Byron C. Jones and **Pierre Mormède**

Second Edition. Taylor & Francis Group, 2007, 496 pp. ISBN: 9780849319037; ISBN-10: 0-8493-1903-X.

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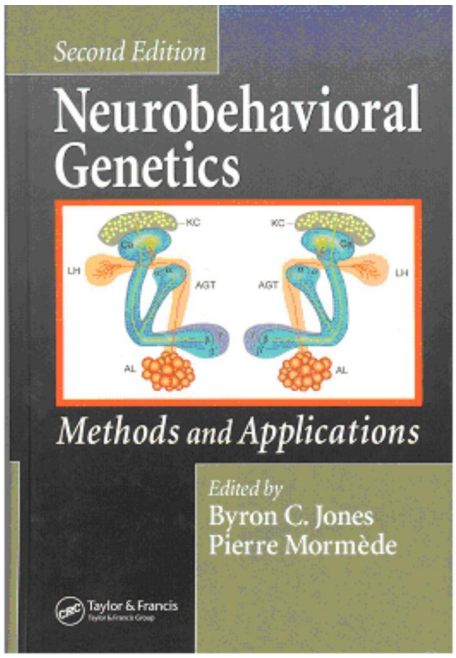
The excellent book ***Neurobehavioral Genetics: Methods and Applications*** was written by 52 contributors on 496 pages and edited by Byron C. Jones (Professor of Behavioral Health and Pharmacology at Pennsylvania State University and a member of the editorial boards of the journals *Pharmacology, Biochemistry, and Behavior* and *Nutritional Neuroscience*) and Pierre Mormède (Director of Research at the French National Institute for Agricultural Research and Director of the Laboratoire de Neurogénétique et Stress). The book is divided into 30 chapters (each with its own literature) and in total includes 91 black and white figures, six color photos, and 20 tables. There is an index at the end (pp. 469 - 496). The book covers a wide spectrum of the most current techniques in neurobehavioral genetics, as well as applications of quantitative and molecular genetics in both basic and clinical research.



Entitled *A History of Behavioral Genetics*, Chapter 1 acquaints us with the history of behavioral genetics, which began long before Darwin's work on evolution and Mendel's work on inheritance. Preliterate and ancient history is followed by the story of two Victorian cousins, Charles Darwin (with his writings on behavioral evolution) and Francis Galton (who initiated three methods of studying behavioral inheritance in humans: family, twin, and adoption studies). Chapter 2 is entitled *Developmental Neurobehavioral Genetics: Development as Explanation* and is devoted to the interaction of genetic activity, neural activity, behavior, and environment, demonstrating all the coacting factors involved in the developmental construction of behavior and showing the interaction among them.

Chapter 3 introduces us to some basic Mendelian traits, acquaints with polygenic, complex traits, and discusses both gene-gene and gene-environment interactions. Both Chapter 4 (*An Introduction to Quantitative Genetics*) and Chapter 5 (*From QTL Detection to Gene Identification*) provide a brief overview of quantitative-genetic theory and link it with behavioral and neural phenotypes. Also discussed are various approaches and difficulties in identifying gene(s) in genetic dissection of complex traits. Gene-gene interactions, why they are important, and how genes and the environment cooperate in both animals and humans are questions that are treated in great detail in Chapters 13 (*Gene-Environment Interactions*) and 14 (*And Now It Starts to Get Interesting: Gene-Gene Interactions*), while the essential "molecular story" from the strucuture of genes up to measuring their expression is given in Chapter 6 (*Gene Expression*).

Planning any (behavioral) experiment involves the choice of an experimental design and sample size for each of the groups in the study. Entitled *Sample Size Requirements for Experiments on Laboratory Animals*, Chapter 10 would be very helpful for any kind of experimental work. When we have an experimental plan, we need animals to work with. The author of Chapter 9 gives a survey of *Animal Resources in Behavioral Neurogenetics* and introduces readers to the requirements for a suitable animal model system, together with various experimental tools and techniques (inbreeding, selection experiments, crossing experiments, etc). Later on in this chapter, we can also learn when and how to use strains that differ only by a known part of their genome (co-isogenic, congenic, consomic and conplastic strains), lines made from (multiple) inbred strains, etc. For example, both congenic and consomic strains have been successful tools for the behavioral geneticist in investigating single gene effects, as well as in mapping genes that influence behavioral traits (Chapter 8 – *Congenic and Consomic Strains*).

A section very useful in elaborating and analyzing behavioral data is Chapter 7 (*Bioinformatics of Behavior*), which is "intended to provide a brief introduction to biological databases for two major purposes - first, to familiarize readers with the structure and design of databases for use in their own laboratories and second, to illustrate examples of public biological databases and approaches that have grown from early bioinformatics methods".

The most often used animal model systems and other animal species of interest for behavioral neurogenetics research are described in several book chapters, and the most useful web sites

treating them are given. For example, a simple organism like the nematode *Caenorhabditis elegans* can be used in analyses of various behaviors such as chaemosensory behavior, egg laying, regulation of locomotion in response to food, social feeding behavior, etc. (Chapter 24, *Behavioral Genetics in the Nematode Caenorhabditis elegans*). The most popular model-organism in genetics, the fruit fly, was the model system for genetic dissection of the components of food search behavior [(Chapter 21, *Genetic Analysis of Food Search Behavior in the Fruit Fly (Drosophila melanogaster*)] and for studying the cascade of genes involved in mating behavior (Chapter 22, *Genetic and Molecular Analyses of Drosophila Courtship Behavior*). Small *Drosophila* flies can learn and memorize very different types of stimuli (Chapter 23, *A New Era for Drosophila Learning and Memory Studies*); they can use such information, among other things, in the aforementioned mating and food search behavior. However, this chapter pays special attention mostly to *Drosophila* learning and memory mutants, and to localization and dynamics of olfactory memory phases.

Information about genes and development, brain and behavior, complex trait analyses, and mapping QTL loci can be found in Chapter 27, entitled *Expression and Brain Structure: Black Boxes Between Genes and Behaviors*. Chapter 25 (*Genetics, Behavior, and Brain Dopamine Systems*) also links the topics of genes, behavior, and brain (dopamine) systems, and is presented to the reader with examples largely extracted from work in the authors' own laboratories; this chapter is mostly focused on D_2 dopamine receptors, which are involved in the etiology and/or expression of a variety of behaviors. Potential correlates between behavioral and brain traits are also presented in Chapter 26, entitled *Natural Genetic Variation of Hippocampal Structures and Behavior – an Update,* which analyzes the genetic variability of the so called intra/infrapyramidal mossy fiber projection in mice and rats, and its relation to behavior.

Human behavior is one of the most interesting topics, especially nowadays, when we know that genes play a role in the etiology of a wide spectrum of behaviors, from personality traits up to psychiatric disorders. Chapter 12 (*Family and Twin Methods*) provides an introduction to the concepts and statistical techniques used in various human behavioral genetic researches. What is personality and how it is measured, and what is known about heritability of personal dimensions and their molecular genetics are questions that are treated in detail in Chapter 18 (*The Elusive World of Personality Genes: Cherchez le Phenotype*). Chapter 17 is also devoted to researches on the behavior genetics of personality, but in our chimpanzee cousins [*Pedigree Analyses and the Study of Chimpanzee (Pan troglodytes). Personality and Subjective Well-Being*]. Apart from personality, study of genetic aspects of human emotions is a very challenging task because "emotions are difficult to define, measure, and genetically analyze". Experimental approaches available for the genetic study of emotionality in animals are described in Chapter 20 (*Genetic Analysis of Emotional Behaviors Using Animal Models*).

In addition to chapters devoted to variability in personal or emotional traits, several chapters pay special attention to psychiatric disorders, mental retardation, aggressive behavior, and alcoholism. For example, the intent of Chapter 11 (*The Role of Association Studies in Psychiatric Disorders*) is to familiarize readers with association studies, which are widely used in genetics to search for the involvement and/or the localization of a gene in the risk of certain disorders, and point out all the advantages and limitations of their use. Anyone interested in knowing how genetic variation contributes to their etiology of complex dysfunctional human psychopathological phenotypes, what are the incidences in family, twin, or adoption studies, or what is the nature of genetic effects (how many and which genes contribute to their liablilty) will find many answers in Chapters 15 (*Schizophrenia: Study of a Genetically Complex Phenotype*) and 16 (*Genetics of Major Affective Disorders*).

The causes of mental retardation (MR) include different factors, environmental ones, teratogenes, numerical and structural abberations of chromosomes, gene defects, etc. Chapter 28, *Synaptic Mechanisms Involved in Cognitive Function: Cues from Mental Retardation Genes,* covers a broad scope of topics related to MR, especially MR genes and cellular mechanisms important for cognitive functions.

Genetic influence on developing alcoholism has been demonstrated by animal pharmacogenetic studies (studies with inbred strains and with selectively bred lines) and many controlled human studies using twins and adoptees. Modern molecular biological methods now make possible studies of candidate genes and identification of risk markers and QTLs (Chapter 30, *Alcohol Psychopharmacogenetics*).

Evidence that "individual differences in personality traits associated with aggressiveness are due to genetic variants", types of aggression, and some conceptual and methodological issues relevant to genetic analyses of aggression in mice and humans are considered in Chapter 19 (*Aggression: Concepts and Methods Relevant to Genetic Analyses in Mice and Humans*).

Finally, because it treats an area of research with great impact on human health, Chapter 29 (entitled simply *Pharmacogenetics*) is very important for future neurobehavioral researches. It is devoted to genetic bases of individual differences in drug actions and discusses relationships between single genes as well as QTLs and pharmacogenetics. Readers interested in the next step – *pharmacogenomics* – are also directed to http://www.genenetwork.org

In our opinion, this book represents an important contribution to neurobehavioral literature. It will be of great assistance to any behavioral scientist interested in a broad range of topics and to specialists using a wide spectrum of modern techniques to study behavior in both animals and humans. It will also be useful to students taking courses like *Animal Behavior, Behavioral Genetics, Neurobiology*, etc.

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