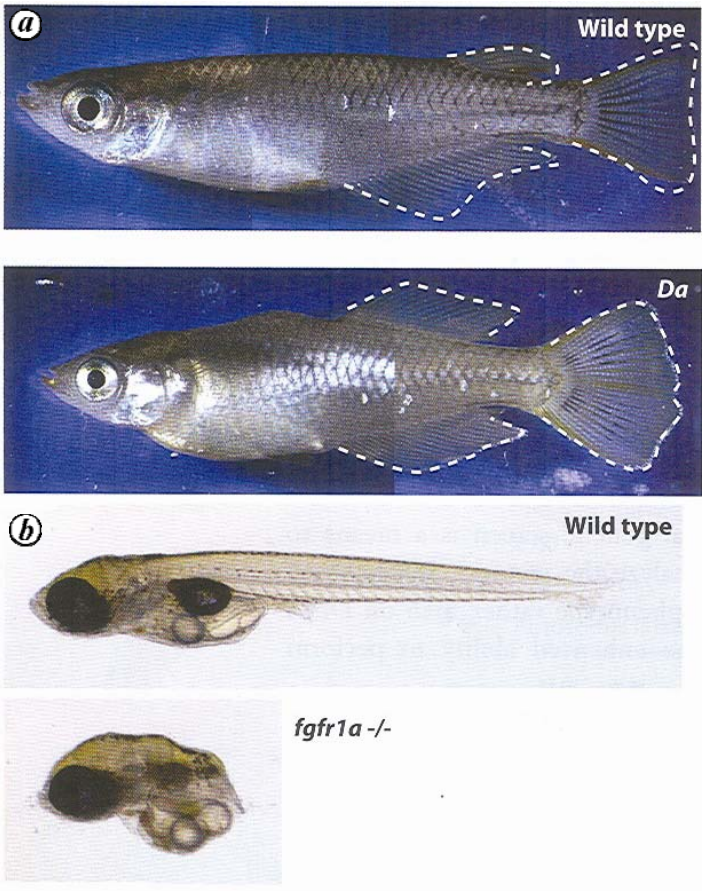

Medaka developmental mutants. ***a***, Wild-type and homozygous *Da* (*double anal fin*) mutant adults. Structures such as the dorsal fin and the dorsal half of the caudal fin are ventralized. ***b***, Wild-type and *fgfr1a-/-* medaka larva. The latter totally lacks the trunk tail structures. Note that a mutation of *fgfr1a* in zebrafish causes impaired scale development.

the evolution of phenotypes such as antibiotic resistance. In this context, the *lexA* gene, which negatively controls SOS response by inhibition of *recA* gene expression, could be an excellent target to develop as an anti-SOS mechanism and pathogenesis. This article is a good example of lucid description of an emerging field. The article on bacterial antisense RNAs examines the role of RNA-mediated regulation of gene expression in bacteria and phages. RNA-mediated transcriptional regulation was discovered in the phages several years ago, and this article on bacterial antisense RNAs reviews succinctly the mechanisms of RNA interference in bacterial systems. The application of this mechanism in biotechnology is evolving at present.

The article by Susan Lindquist and co-workers on protein homeostasis and the phenotypic manifestation of genetic diversity is timely. The stress proteins in general and heat shock proteins in particular are involved in several functions, in addition to their chaperone activity. Hsp90 could potentiate the newly formed mutations by stabilizing the altered protein product of a mutated gene, and helps in the functioning of altered protein which otherwise will fold incorrectly and become nonfunctional. Therefore, in the absence of potentiating Hsp90, the mutant phenotype is not expressed. Hsp90 also could act as a capacitor for latent mutations by buffering the effect of mutations. In this case, the phenotypic effect of a mutation appears only when the quantity of Hsp90 is reduced. This type of canalization, insensitivity of phenotypic trait to mutations and environmental factors have been demonstrated in *Drosophila* and other systems. Therefore, the role of Hsp90 is emerging as an important driver of evolution. This review brings out succinctly the true nature of protein homeostasis in shaping evolution.

All in all, this edition of *ARG* is a treat for every biologist. There are other equally interesting articles on various aspects which are of high standard. Anyone interested in modern molecular biology should make it a point to read this volume.

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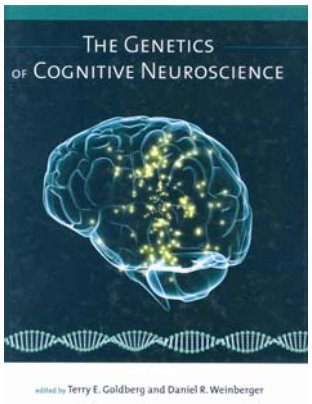

The Genetics of Cognitive Neuroscience. T. E. Goldberg and D. R. Weinberger. The MIT Press, 55 Hayward Street, Cambridge, MA 02142, USA, 2009. xii + 297 pp. Price not mentioned.

The book under review is a concise and lucid introduction to the field of genetics of cognition. Animal models, imaging studies and clinical studies are used to illustrate the foundations and findings in this new field of neuroscience. The emphasis of the book is on genetics. How genetic inheritance and gene expression can modify behaviour is the chief message. The editors state in the preface that the aim of the book is to help the reader understand the effect of genetic variants on cognition, affective regulation, personality and CNS disorders. They have set out with two goals. The first is to provide an understanding of basic principles to enable the reader to critically evaluate recent studies. The second is to

provide a glimpse of the recent research in the field. The two goals are laudable as the field is new in the realm of neuroscience. As stated by the editors in their introduction, the book is targeted to a broad audience of postdoctoral fellows, independent researchers and experienced researchers. The book has 11 chapters divided into three sections.

The first section has three chapters on the theme of 'Methodologies for genetic association studies of cognition'. Chapter 1 by Kempf and Weinberger is titled 'Molecular genetics and bioinformatics: an outline for neuropsychological genetics'. The chapter gives the history of medical genetics, concepts of gene structure and function, genetic variation and functional correlation, genetic basis of complex phenotypes, neuropsychological genetics and a step-by-step guide on how to pick genes for studies of cognition. Chapter 2 is on 'Statistical methods in neuropsychiatric genetics' by Nicodemus and Zhang. This chapter explains the statistical methods used in understanding the association of genes with cognition and behaviour. An overview of statistical genetics is followed by sections on determination of genetic component for a trait, the regressive model, marker statistics in population genetics, linkage analysis, candidate gene association analysis, genome-wide association analysis, epistasis and gene–environment interaction, and power and sample size calculation. Basic concepts and methods of statistical genetics are lucidly explained. Chapter 3 is on 'Animal models of genetic effects on cognition' by Papleo, Weinberger and Chen. It describes the methods employed to alter genes in animals, mostly in mice, and the tests to study their behavioural traits. The types of genetic alterations are transgenic mice and targeted gene knockout mice. Tests to measure declarative memory, working memory, recognition memory, instrumental learning, attention, extinction, habit reversals, shifting and flexibility. The chapter highlights the genetic effects on cognition through proteins, neurotransmitter, endocrine and opiod pathways. The candidate genes which impact cognition of mice are also mentioned. The authors caution that the simple gene knockout model may not be appropriate to understand psychiatric disorders, as these are polygenic conditions with gene–gene interactions as well as gene–environment interactions.

The second section titled 'Genetic approaches to individual differences in cognition and affective regulation' contains four chapters. Chapter 4 by Posthuma, de Ceus and Deary on 'The genetics of intelligence' notes that intelligence is predominantly heritable as seen from twin studies, adoption studies, and twin–singleton comparisons. The genetic effects on intelligence are multivariate, as seen from the associations between IQ and brain volume, and parameters of brain functioning such as speed of information processing. The increase of heritability in IQ in late adulthood is explained by gene × environment interaction. Using the whole genome approach specific chromosomal sites are linked to intelligence. The candidate gene approach has shown that the catechol-O-methyltranferase (*COMT*), cholinergic muscarin receptor 2 (*CHRM2*), *SNAP-25*, and Dysbindin 1 (*DTNBP1*) genes influence intelligence. The authors highlight the multigenetic effect on intelligence and on the challenge of understanding the effect of genetic variation on brain functioning related to cognition. Chapter 5 by Fossella, Fan and Posner is entitled 'Candidate genes associated with attention and cognitive control'. It describes the tripartite division of attention by Posner and colleagues into alertness, orienting and executive attention. The ANT test of Fan and colleagues is a reliable measure of heritability of attention. Using candidate gene association approach, studies found a modest relationship between the dopaminergic genes *DRD4* and *MAOA* with executive attention; *COMT* gene with fluid intelligence and *CHRNAL* with orienting. Studies on fMRI imaging and genetic associations are also described. The association is influenced by the multiple brain areas in which the gene is expressed, the timing of gene action in development of the child's brain and gene × environment interaction. The authors explain their studies on genetic effects on anterior cingulate cortex and the possibility of using gene expression profiling to examine these genetic effects. Chapter 6 is on 'Genetics of corticolimbic function and emotional reactivity' by Hariri, Forbes and Bigos. Structural and functional integrity of neural circuits, particularly the cortico limbic circuit assessed through MRI and fMRI is the datum on which genetic basis of individual differences in emotional reactivity and vulnerability to mood disorders is established. The genetic effects on personality and affective disorders are described. Personality genetics has dealt with the effect of dopamine and serotonin on emotional regulation. In normal persons the personality constructs of extraversion are used as a measure of emotional regulation. Failure of emotional regulation is observed in affective disorders. However, the genetic association studies in personality and affective disorders are inconclusive about the association between genes and mood regulation. The reason for the lack of a firm association is attributed to the complex set of factors impacting these mood variables. There is a section on polymorphisms which have an effect on serotonin function impacting amygdala and temperamental anxiety. This is an emerging area with promise, but the findings are not conclusive yet. Chapter 7 is entitled 'Genes associated with individual differences in cognitive aging' by Goldberg and Mattay. It has sections on cognitive aging, its association with genes and longevity. Age adversely impacts processing speed, episodic memory and reasoning. The authors have given a comprehensive table containing the list of genes that have a potential impact on cognitive aging with their cytogenetic location and findings, which would be useful for researchers. Effects of specific genes such as *COMT*, *DISC1*, *WRN*, *SLC64A* and *BDNF* on aging are briefly described.

The third section entitled 'Genetic studies of cognition and treatment response in neuropsychiatric disease' has four chapters. Chapter 8 is on 'Genetics of dyslexia: cognitive analysis, candidate genes, comorbidities and etiologic interactions' by Pennington, McGrath and Smith. The method of cognitive dissection of dyslexia is described as a precursor for identifying genes for dyslexia. Candidate genes of dyslexia, some of which also impact development are described. The comorbidities of dyslexia such as speech–sound disorder, language impairment and attention-deficit/hyperactivity disorder are examined through overlapping genetic vulnerabilities. According to the authors, a valuable insight from this work is the multiple deficit models with partial genetic and partial cognitive overlap applicable to dyslexia and psychopathologies in general. Chapter 9 is on 'Cognitive intermediate phenotypes in schizophrenia genetics' by Donohue,

Goldberg and Corvin. The genetic contribution to schizophrenia is established. Cognitive phenotypes known as intermediate phenotypes are described as probes that explain how genes translate into the complex phenotype of schizophrenia. The research on deficits of working memory, attention, episodic memory in schizophrenia and their association with genes such as *COMT*, *DISC1*, *GRM3*, *BDNF*, *DAOA* is described. The authors caution that a one-to-one correspondence between the gene and cognitive deficit is unlikely. However, a multi-factorial genetic effect on cognitive deficits in schizophrenia is clear. Chapter 10 by Ringman and Cummings is entitled 'The genetic basis for the cognitive deterioration of Alzheimer's disease'. The authors have given a succinct description of path physiology of this illness. A table containing the nature of products of causative genes associated with dementing diseases is a useful reference material. The roles of amyloid precursor protein (chromosome 21), Down's syndrome, presenilins, apolipoprotein E and putative susceptibility genes in causing Alzheimer's disease (AD) and its variants are discussed. Based on the polygenetic causative pathways and variations in phenotypical manifestations, the authors favour terming the disease in the plural as Alzheimer's diseases. Importantly, the polygenetic etiological pathway to AD is a model for other clinical conditions in their opinion. The utility of understanding the genetic etiology for clinical care of patients with AD and their asymptomatic family members is discussed from the perspectives of genetic screening and genetic counselling. Chapter 11 is on 'Pharmacogenetic approaches to neurocognition in schizophrenia', by Burdick and Malhotra. Incomplete symptom relief even after adequate doses of medication is often seen in schizophrenia. The authors describe pharmacogenetics as a new field which identifies the biological predictors and genetic markers of treatment response. This field has got a boost with the availability of cost-effective, rapid and accurate genotyping spanning the entire human genome. The stability of genes to clinical symptoms and environmental factors as well as the ease of collecting DNA samples from patients have further facilitated the growth of this field. Despite the diversity of clinical manifestation, the genetic basis of cognitive deficits enables pharmacogenetic treatment for neurocognition in schizophrenia. The role of dopaminergic, glutamergic agents in the pharmacogenetics of cognitive deficits in the light of disturbances in the transmission of these two neurotransmitters by schizophrenia-associated genes is discussed. The challenges in this endeavour posed by epistasis, gene–environment interaction, multiplicity of genes, heterogeneity of the disorder are critically discussed by the authors.

The book is lucidly written in a crisp and succinct style. Each chapter describes and critically evaluates a field of study in the genetics of cognition. The first section on methodology is a must read for researchers and students entering the field. The diversity of topics spanning genetics of normal cognition and affect; genetics and cognitive deficits in neurological and psychiatric conditions offers a rich fare valuable to the researcher and clinician alike. The contributing authors are pioneers/experts in their field and their mastery is evident in the chapters. The editors have done an admirable job of bringing out a book which is an introductory text, yet a reference book.

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