in many species, scientists considered sex to be dependent on environmental factors. Indeed, until the development of *Drosophila* genetics from the 1910s onwards, a wide variety of other species were investigated and provided a diverse array concerning how and by what biological processes sex was determined.

Delgado argues that it was the innocuous fruit fly that became the experimental system in T. H. Morgan's laboratory and, subsequently, in developmental biology that has led to the current concept of sex determination. This was because *Drosophila* appeared to have the same mechanism of sex determination as the human species had. Although it became a useful experimental system for genetic research, the fact that biological research has constrained its focus on the pattern of XX females and XY males is regarded as limiting by the author. Many other patterns emerged through the history of chromosome research that deserve to be considered in terms of sex determination. However, sexual stereotypes remained through patterns provided by *Drosophila*'s biology, the author suggests.

As a complex historical reconstruction of knowledge production, Delgado's book does not examine just the ideas, but the researchers as well. Importantly, her study brings women's contributions to the fore. By recovering these contributions, she assumes a part in creating a more complex landscape of human actors, rejecting the classic heroic reconstructions. She also includes the participation of Spanish scientists to the project.

Along with the genealogy of the concepts of sex chromosomes and their determination Delgado traces, she also examines conflicting ideas as well as the carefully designed and executed that were performed. For her, these help to constitute the origins of an anthropocentric knowledge about sex determination. Her meticulous and detailed manner of referring to published resources of the period she examines, provides evidence of a dichotomized culture that has tended to classify in pairs, male and female. Thus, she supports the claim that, as Evelyn Fox Keller suggested, culture may be more difficult to change than biology.

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MICHAEL LYNCH, *The Origin of Genome Architecture*, Sunderland, MA: Sinauer Associates, Inc., 2007, xvi + 389 pp, illus., $62.95/£39.99.

"Nothing in Biology Makes Sense Except in the Light of Evolution," this often cited dictum by Theodosius Dobzhansky has mostly been interpreted to mean that biology only makes sense in the light of adaptation by natural selection. Michael Lynch argues against the blind acceptance of natural selection as the only evolutionary force. According to him, other forces relevant to evolution, the nonadaptive forces of mutation, recombination, and random drift, dictate what natural selection can and cannot do. Lynch central goal is "to demonstrate that there are very few, if any aspects of genomic evolution that cannot be explained with well-accepted population genetic mechanisms" (34). For Lynch, in other words, "nothing in evolution makes sense except in the light of population genetics."

His central aim is to provide a synthesis of our understanding of genomic evolution from the standpoint of population genetics and molecular biology, and to transform the descriptive field of comparative genomics into a more explanatory enterprise. He uses population- and quantitative genetic principles as a guide to understanding the origin of eukaryotes and the evolution of their genomic embellishments, such as genome size and architectural complexity, chromosomal integrity, genome expansion by gene duplication and mobile genetic elements, spiceosomal introns, the transcriptional process, organelle genomes, and sex chromosomes. It provides an excellent summary of what genomics has revealed about genome architecture in the last decade and is therefore a must-read for every student of molecular, developmental and evolutionary biology.

As a die-hard population geneticist Lynch thinks little of developmental challenges against the modern synthesis: "Nothing of a productive nature has yet to come from such posturing." However, to reduce more than three decades of critical and constructive discussion of the adequacy of mainstream evolutionary theory to "vague references to molecular and developmental constraints" is an outrageous polemic. Interpreting them "as largely a consequence of our rudimentary understanding of the genetic architecture of complex traits" (xiv) speaks of his believe that phenotypic evolution derives from change at the molecular level which produces the only raw material upon which evolutionary forces operate. According to Lynch the statistics of quantitative, multivariate genetics, albeit not fully satisfactory until supplemented with molecular data of single genes, substantially contributes to our understanding of the evolution of form. Such a limited view of evolution as changes in gene frequency, however, is exactly the focus of critique from evolutionary developmental biology and developmental systems theory. Lynch completely fails to grasp that the lack of a theory of form, as denounced by evo-devo advocats, lies to a large extend in the Modern Synthesis" single concern with genetic and genomic data, not the lack of it. It is quite puzzling how Lynch describes evolutionary developmental biology as almost entirely based on the paradigm of natural selection. One of the main concerns at the centre of evo-devo research is the origination of organismal form, of evolutionary novelty and innovation. Selection only works on what already exist; it is concerned with the survival, not the arrival of the fittest.

My main critique of the book is its genetic chauvinism that asserts genetic primacy both with respect to the origin of life and organic features, and cellular/developmental causation. The book presents this as a scientific fact (just like the author understands himself as a scientist who deals in facts; as a philosopher I maintain that we all deal with theories and evidence). Lets look at this "fact": The two serious contenders for the origin of life scenario are a RNA world or the spontaneous creation of self-sustained metabolic cycles, with DNA being a later invention. To explain that origin of the rather complex genomic architecture of eukaryotes the author needs to assume the origin of eukaryotes through a serious of prokaryote hybridization events that led to an increase in cell size and consequently a decreased population size. Only these more or less nongenetic events then provided the necessary permissive nature of population genetic environment for eukaryotic DNA embellishment to evolve. Why should we then deduce that "the prior establishment of the genomic material" (379) makes the evolution of cellular complexity possible? Only "because cellular and developmental features reflect the transformation of gene-level information into gene expression, the potential directions of phenotypic evolution must ultimately be defined by the physical materials existing at the genomic level" (379)? First, the phenotype is the result of the interaction of genetic *and* environmental resources, and secondly, gene expression if a highly systemic process with a network of bottom up, top down and circular causal pathways. Reliable gene expression that underpins development depends on a rich ontogenetic niche which coevolves with the genome, and is to a large extend constructed anew in each generation. You cannot grasp this without having a concept of *extended inheritance*, which includes epigenetic programming, cellular/architectural, ecological and behavioural inheritance, genetic and non-genetic parental effect. Organisms inherit the world.

Lynch's many nonadaptive evolutionary scenarios have the advantage that they need not assume an immediate adaptive effect of many novel features (and therefore undermines the argument of "irreducible complexity" used by intelligent design against Darwinism). Similar to adaptationists, however, neutralists like Lynch neglects systems and their unique features of feedback and feed forward causality, systems-level interaction, and character integration. Both adaptive and non-adaptive evolutionary forces produce evolutionary change precisely because they work on self-organized systems subject to non-linear changes. Without such a theory of complex systems dynamics and their actions and interactions we cannot have a theory of development or a theory of evolution.

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