Ben-Gurion University of the Negev

The Jacques Loeb Centre
For the History and Philosophy
of the Life Sciences

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International Workshop

From gene to genome as an integrated system. Scientific, historical, and philosophical perspectives

Ben-Gurion University of the Negev, 24-25 November 2014

The idea of what is now called "genomes" and "genomics" goes back to the beginning of modern genetics and cytology in the late nineteenth century. August Weismann's late-nineteenth-century notion of asymmetric cell divisions and unique sets of nuclear determinants that specify the cell type was finally disproved only by the cloning experiments of John Gurdon in 1958. Drosophila geneticists, most notably Sturtevant, demonstrated in 1925 that genes' effects are sometimes influenced by neighboring genes in the chromosome (position effect). Richard Goldschmidt's holistic "germ plasm as a whole" concept of the 1930s did not prove fertile because of its vagueness. However, around the same time, Sewall Wright proposed his farsighted model of hierarchical, integrated genetic systems in the body with evolutionary implications. This is another example of the fact that early on, biologists were aware of the necessity of studying genes as part of the genome.

This workshop focuses on the idea and materialization of the animal genome in the more recent history of biology from the mid-twentieth century. The 1950s and 60s saw the resumption of older disputes on the question of whether or not all cells of an organism have the same genome. Large databases of genome sequences have now become available and have led to new approaches, the fertility of which has been called into question in a number of cases. The new concept of the regulatory genome has become a tool with wide implications. Comparative genomics has had a revolutionary impact on animal phylogeny and systematics with strong implications for evolution.

Generally speaking, two meanings of the concept of the genome should be distinguished. The first meaning is the interaction of genes (via their products). The second meaning relates to the importance of the physical position of the genes on the chromosomes, which

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explains the position effect and has found new interest in many phenomena, such as the complexity of regulatory regions.

With participants coming from a variety of specialties such as molecular biology, developmental genetics, immunology, evolutionary biology, history of biology, molecular biology and embryology, as well as the philosophy of science, the Workshop aims at generating an intellectual discussion about the history and achievements of modern genomic studies, and the challenges they pose to established concepts such as that of the gene. Among the topics are:

- Disputes about the assumption that all cells of an organism have the same genome in the 1950s and 60s; their earlier history and their solution.

- Naturally occurring systems where the genome is not the same in every cell of the animal. Examples are the lamprey, trypanosome, as well as immune systems.

- The rise of research in "discovery science", such as ENCODE, and a discussion of its scientific fruitfulness.

- The revolutionizing of our understanding of animal relationships using comparative genomics, and its consequences for evolution.

- The questions of what the sequences of the genomes really tell us, and whether comparative genomics is just a comparison of ensembles of genes.

- Genome-wide analyses: what is the rationale behind their huge funding? In which cases are these studies scientifically useful?

- The regulatory genome as a conceptual entity and its overall characteristics and properties.

- The genome as a substrate for synthetic and natural change in the properties of animals.

- The relation of genomics studies to the notion of the hierarchy of gene networks.

- The role of the gene in genomic studies.

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