Jacques Loeb (1859-1924) [1]

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Jacques Loeb experimented on embryos in Europe and the United States at the end of the nineteenth and beginning of the twentieth centuries. Among the first to study embryos through experimentation, Loeb helped found the new field of experimental embryology. Notably, Loeb showed scientists how to induce artificial parthenogenesis, thus refuting the idea that spermatozoa alone were necessary to develop eggs into embryos and confirming the idea that the chemical constitution of embryos? environment affected their development. Furthermore, Loeb?s work showed that scientists could manipulate materials in a laboratory to create, as he called the process, the beginning stages of life.

Jacques Loeb was born in the Prussian town of Mayen to Barbara and Benedict Loeb in 1859. Named ?Isaak,? he changed his name to ?Jacques? just prior to entering the University of Strassburg in 1880. At Strassburg Loeb studied with the physiologist Friedrich Goltz and there he earned his MD in 1884.

Until 1891 Loeb taught and researched at various institutions, including the Naples Zoological Station in the winters of 1889 and 1890. In 1890 he met and married Anne Leonard, an American philologist. Moving to the United States, Loeb taught at Bryn Mawr College for a year prior to accepting an assistant professorship with the University of Chicago in 1892. While at Bryn Mawr Loeb met and initially disliked the young Thomas Hunt Morgan. At Chicago Loeb struggled to get along with Charles Otis Whitman, and to tolerate what Loeb termed the ?romantic evolutionism? espoused most prominently by Chicago?s John Dewey.

After a decade at Chicago, Loeb moved to the University of California at Berkeley for eight years. In California he experimented at Stanford University?s Hopkins Marine Station in Pacific Grove. He then returned east to New York?s Rockefeller Institute for Medical Research in 1910, working there until he died in 1924. During his career, he conducted many of his experiments at Bryn Mawr, Chicago, Rockefeller, and at the Marine Biological Laboratory in Woods Hole, Massachusetts.

Loeb?s early work at Strassburg was on brain physiology. Having judged the field?s dominant theory misguided, he decided to instead study traditional issues in biology such as embryology. He used experiments to answer questions about development and embryology rather than observation alone, which was the common method of biological inquiry. Loeb looked to the scientific practices of physiologists Goltz, Eduard Pflüger, and the eminent plant physiologist Julius Sachs for methodological inspiration.

Loeb worked with Sachs extensively while the former worked at the University of Würzburg for two years starting in 1886. Loeb then developed a correspondence and friendship with the Austrian physicist and philosopher Ernst Mach, whose writings provided the theoretical foundation for Loeb?s work. For Loeb, any explanation of phenomena could come only from manipulating the physical structures of things and their chemical makeup. That conception of

scientific knowledge, based on physicochemical manipulations, paralleled Wilhelm Roux?s mechanistic conception of science encapsulated in *Entwicklungsmechanik*.

Like Mach, Loeb thought science was not a mere description of nature but was instead a tool for humans to interact with nature. To him, a biologist was like an engineer and organisms were biologists? material. Loeb earned his reputation as a biologist-engineer in 1899 when he published experimental results showing artificial parthenogenesis in sea urchins, in ? On the Nature of the Process of Fertilization and the Artificial Production of Normal Larvae (Plutei) from the Unfertilized Eggs of the Sea Urchin?.

Artificial parthenogenesis is the human manipulation of egg cells causing embryonic development without spermatozoa. Loeb manipulated unfertilized sea urchin eggs with inorganic solutions of salt water. The result was eggs developing into larvae, or early stage embryos, which he later reproduced using frog eggs. Loeb elaborated on his results in 1913?s *Artificial Parthenogenesis and Fertilization*.

Loeb?s 1899 results stirred the popular presses, and many viewed him as a creator of life, perhaps with the ability to engineer new types of organisms. Loeb was never able to create new forms of life, as he intended, but he inspired scientists such as John Howard Northrop, John Broadus Watson, Hermann Joseph Müller, Burrhus Frederic (B. F.) Skinner, and Gregory Pincus. Loeb also contributed to the study of animal tropisms (environment-caused orientation).

Loeb helped transform biology into a largely experimental science. His 1912 *The Mechanistic Conception of Life* established his reputation as a researcher who treated organisms as machines. In that work, he stated that biologists explain organic phenomena only when they could control those phenomena. Loeb later believed that biologists explain phenomena by detailing the mechanisms, the step-by-step processes, by which a component of an organism achieves its function in physical and chemical terms. In *The Organism as a Whole* (1916), Loeb discussed how a mechanist could investigate organisms considered as wholes. His commitment to physicochemical explanations led him to study protein chemistry for the last few years of his life. Loeb died in 1924.

Sources

1. Loeb, Jacques. *Artificial Parthenogenesis and Fertilization*. Chicago: University of Chicago Press, 1913.
2. Loeb, Jacques. ?Mechanistic Science and Metaphysical Romance.? *Yale Review* 4 (1915): 766?85.
3. Loeb, Jacques. ?On the Nature of the Process of Fertilization and the Artificial Production of Normal Larvae (Plutei) from the Unfertilized Eggs of Sea Urchins.? *The American Journal of Physiology* 3 (1899): 135?38.
4. Loeb, Jacques. *The Organism as a Whole: From a Physicochemical Viewpoint*. New York: G.P. Putnam?s Sons, 1916.
5. Loeb, Jacques. *The Mechanistic Conception of Life*. Ed. Donald Fleming. Cambridge, Mass.: Harvard University Press, 1964.
6. Pauly, Philip. *Controlling Life: Jacques Loeb and the Engineering Ideal in Biology*. New York: Oxford University Press, 1987.

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