

Boris Ephrussi (1901-1979) ^[1]

By: Chhetri, Divyash Keywords: one-gene-one-enzyme hypothesis ^[2]

Boris Ephrussi studied fruit flies, yeast, and [mouse](#) ^[3] genetics and development while working in France and the US during the twentieth century. In yeast, Ephrussi studied how mutations in the cytoplasm persisted across generations. In mice he studied the genetics of hybrids and the development of cancer. Working with [George Wells Beadle](#) ^[4] on the causes of different eye colors in fruit flies, Ephrussi's research helped establish the one-gene-one-enzyme hypothesis. Ephrussi helped create new embryological techniques and contributed the theories of genetics and development.

Ephrussi was born on 9 May 1901 in Moscow, Russia. After completing high school, Ephrussi spent a year at a school of fine arts. Rather than studying the arts, he studied biology, but due to the Russian revolution, he left Russia and moved to Paris, France, in 1920.

Ephrussi studied tissue culture techniques and [embryology](#) ^[5] in the 1920s, but he later focused on the relationships between [embryology](#) ^[5] and genetics. In 1922, Ephrussi obtained a certificate in zoology at the Sorbonne in Paris and later completed a doctorate there in 1932. Ephrussi's biographers note the influence of two scientists on Ephrussi's early career: Louis Rapkine and Emmanuel Fauré-Fremiet. Ephrussi worked with Rapkine at the Collège de France and the *Station biologique de Roscoff* (Roscoff Marine Biological Station), where they used biochemical methods to study the embryological development of sea urchins. Fauré-Fremiet mentored Ephrussi at the Collège de France on techniques of tissue culture.

Soon after graduating, Ephrussi received a [Rockefeller Foundation](#) ^[6] fellowship to go to the [California Institute of Technology](#) ^[7] (Caltech) in Pasadena, California in 1934. At Caltech Ephrussi met [George Wells Beadle](#) ^[4], with whom he collaborated to study the genetic factors of eye pigmentation in *Drosophila* ^[8]. Ephrussi returned to France along with Beadle to continue their work in 1935. Beadle stayed in France for a short period before moving to [Harvard University](#) ^[9] in Cambridge, Massachusetts.

With the aim to study how tissue development affected [genes](#) ^[10] and vice versa, the pair transplanted imaginal discs that develop into eyes from one *Drosophila* ^[11] embryo to another. Using imaginal discs and embryos with different mutations for eye color, they observed how the eye pigment developed. Ephrussi suggested that [genes](#) ^[10] operated through the action of [hormones](#) ^[12]. From Ephrussi and Beadle's work on *Drosophila* ^[11] embryos, they hypothesized that [genes](#) ^[10] controlled the order of chemical reactions in the cell. Ephrussi and Beadle ended their collaboration in the late 1930s, but in 1941, Beadle and Edward Tatum at [Stanford University](#) ^[13], California, proposed the one-gene-one-enzyme hypothesis that each gene codes for one enzyme.

Ephrussi left France in 1941 after Germany invaded, and he took a position at [Johns Hopkins University](#) ^[14] until 1944 in Baltimore, Maryland. He returned to Paris in 1945 and served as a professor of genetics at the Sorbonne. In 1949, he married the geneticist Harriett Taylor and

the couple had a daughter, Anne, in 1955. Anne went on to become a molecular biologist. Ephrussi and Ephrussi-Taylor collaborated to study genetic transformations in bacteria. In the post-war period, Ephrussi used yeast (*Saccharomyces cerevisiae* [15]) to study genetics and development of somatic cells. He created a strain of yeast that did not metabolize oxygen, and then he mated them with non-mutated yeast. He discovered that mutations, which caused the yeast to fail to metabolize oxygen, occurred in the yeast's cytoplasm, rather than in the nuclear DNA. Scientists later determined that mutations in the mitochondrial DNA, located in the cytoplasm, caused them to not metabolize oxygen.

Ephrussi worked at Case Western Reserve University in Cleveland, Ohio, from 1962 to 1967. While in Cleveland Ephrussi worked with his graduate student Mary Weiss on [mouse](#) [3] cell hybridization, fusing cells of different types and species. Previously, researchers Georges Barski, Serge Sorieul, and Francine Cornefert at the Institut Gustave Roussy at Villejuif in Paris, designed an experiment to combine two [mouse](#) [3] cell lines, and they published their results in 1960. Building on that work, Ephrussi's hybridization studies led scientists to discover a phenomenon called extinction in hybrid cells, which caused some [genes](#) [10] to not produce RNA or proteins.

Building from his work on [mouse](#) [3] hybrid cells, Ephrussi also studied cancer cells in mice starting in the late 1960s. He took tissue samples of teratocarcinomas, a type of germ cell cancer, and maintained them in long-term cell cultures. Ephrussi found that when he hybridized cells grown from a teratocarcinoma with normal cells, they lost their potential to differentiate into different cell types.

Ephrussi returned to France in 1967 to direct the Center of Molecular Genetics near Paris. He retired in 1972. In addition to receiving honors such as the Gold Medal of the Emil Christian Hansen Foundation in Copenhagen and membership in numerous science academies, he became a member into the French Academy of Sciences in 1978. Ephrussi died in Paris on 2 May 1979.

Sources

1. Barski, Georges, Serge Sorieul, and Francine Cornefert. "Production dans des cultures [in vitro](#) [16] de deux souches cellulaires en association, de cellules de caractère hybride" [Production of cells of a hybrid nature [in culture [in vitro](#) [16] of two cellular strains in combination]. *Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences* [Proceedings of the Weekly Sessions of the [National Academy of Sciences](#) [17]] 251 (1960): 1825?7.
2. Beadle, George Wells, and Edward Lawrie Tatum. "Genetic Control of Biochemical Reactions in Neurospora." *Proceedings of the [National Academy of Sciences](#) [17] of the United States of America* 27 (1941): 499?505.
<http://www.pnas.org/content/27/11/499.full.pdf+html> [18] (Accessed August 7, 2014).
3. Burian, Richard M., Jean Gayon, and Doris T. Zallen. "Boris Ephrussi and the synthesis of genetics and [embryology](#) [5]." In *A Conceptual History of Modern Embryology*, ed. [Scott Gilbert](#) [19], 207?27. New York: Springer, 1991.
4. Ephrussi, Boris. *Nucleo-cytoplasmic Relations in Micro-organisms: Their Bearing on Cell [Heredity](#) [20] and Differentiation*. Oxford: Clarendon Press, 1953.
5. Ephrussi, Boris, and [George Wells Beadle](#) [4]. "A technique of transplantation for [Drosophila](#)

- [11]. " *The American Naturalist* 70 (1936): 218-225.
6. Ephrussi, Boris, and Serge Sorieul. "Mating of somatic cells *in vitro* [16]." In *Approaches to the Genetic Analysis of Mammalian Cells*, eds. D.J. Merchant and J.V. Neel, 81-97. Ann Arbor: [University of Michigan](#) [21] Press, 1962.
 7. Ephrussi, Boris and Mary Weiss. "Interspecific hybridization of somatic cells." *Proceedings of the National Academy of Sciences* [17] of the United States of America 53 (1965): 1040-2. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC301369/> [22] (Accessed August 7, 2014).
 8. Ephrussi-Taylor, Harriett, A. Michel Sicard, and Robert Kamen. "Genetic recombination in DNA-induced transformation of pneumococcus. I. The problem of relative efficiency of transforming factors." *Genetics* 51 (1965): 455-475. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1210798/> [23] (Accessed September 12, 2014).
 9. Finch, Brenda W., and Boris Ephrussi. "Retention of multiple developmental potentialities by cells of a [mouse](#) [3] testicular teratocarcinoma during prolonged culture *in vitro* [16] and their extinction upon hybridization with cells of permanent lines." *Proceedings of the National Academy of Sciences* [17] of the United States of America 57 (1967): 615. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC335553/> [24] (Accessed August 7, 2014).
 10. Horowitz, Norman H. "[George Wells Beadle](#) [4] (1903-1989)." *Genetics* 124 (1990): 1-6. <http://www.genetics.org/content/124/1/1.full.pdf> [25] (Accessed August 7, 2014).
 11. Lerner, K. Lee, and Brenda Wilmoth Lerner. *World of Genetics*. Detroit: Gale Group, 2002.
 12. Morange, Michel. "What history tells us XII. Boris Ephrussi's continuing efforts to create a 'genetics of [differentiation](#) [26].'" *Journal of Biosciences* 33 (2008): 21-5. <http://www.ias.ac.in/jbiosci/mar2008/21.pdf> [27] (Accessed August 7, 2014).
 13. Ravin, Arnold W. "Harriett Ephrussi-Taylor." *Genetics* 60 (1968): S24. <http://profiles.nlm.nih.gov/ps/access/BBGBDU.pdf> [28] (Accessed September 3, 2014).
 14. Richardson, Robert C. "Ephrussi, Boris." *Dictionary of Scientific Biography* 20: 398-403.
 15. Roman, Herschel. "Boris Ephrussi." *Annual Review Genetics* 14 (1980): 447-50. <http://www.annualreviews.org/doi/abs/10.1146/annurev.ge.14.120180.002311> [29] (Accessed August 7, 2014).
 16. Zallen, Doris T., and Richard M. Burian. "On the Beginnings of Somatic Cell Hybridization: Boris Ephrussi and Chromosome Transplantation." *Genetics* 132 (1992): 1-8. <http://www.genetics.org/content/132/1/1.full.pdf> [30] (Accessed August 7, 2014).

Boris Ephrussi studied fruit flies, yeast, and mouse genetics and development while working in France and the US during the twentieth century. In yeast, Ephrussi studied how mutations in the cytoplasm persisted across generations. In mice he studied the genetics of hybrids and the development of cancer. Working with George Wells Beadle on the causes of different eye colors in fruit flies, Ephrussi's research helped establish the one-gene-one-enzyme hypothesis. Ephrussi helped create new embryological techniques and contributed the theories of genetics and development.

Subject

Ephrussi, Boris, 1901-1979 [31] California Institute of Technology [32] Transplantation of organs, tissues, etc. [33] Beadle, George Wells, 1903-1989 [34] Rapkine, Louis, 1904-1948 [35] Faure-Fremiet, E. (Emmanuel), 1883-

[36] Mutation [37] Tissue culture [38] Drosophila [39] Tissue Transplantation [40] Teratocarcinoma [41] Imaginal Discs [42]

Topic

People [43]

Publisher

Arizona State University. School of Life Sciences. Center for Biology and Society. Embryo Project Encyclopedia.

Rights

Copyright Arizona Board of Regents Licensed as Creative Commons Attribution-NonCommercial-Share Alike 3.0 Unported (CC BY-NC-SA 3.0)
<http://creativecommons.org/licenses/by-nc-sa/3.0/>

Format

Articles [44]

Last Modified

Wednesday, July 4, 2018 - 04:40

DC Date Accessioned

Monday, September 15, 2014 - 23:06

DC Date Available

Monday, September 15, 2014 - 23:06

DC Date Created

2014-09-15

- [Contact Us](#)

© 2018 Arizona Board of Regents

- The Embryo Project at Arizona State University, 1711 South Rural Road, Tempe
Arizona 85287, United States

Source URL: <https://embryo.asu.edu/pages/boris-ephussi-1901-1979>

Links:

[1] <https://embryo.asu.edu/pages/boris-ephussi-1901-1979>

[2] <https://embryo.asu.edu/keywords/one-gene-one-enzyme-hypothesis>

[3] <https://embryo.asu.edu/search?text=mouse>

- [4] <https://embryo.asu.edu/search?text=George%20Wells%20Beadle>
- [5] <https://embryo.asu.edu/search?text=embryology>
- [6] <https://embryo.asu.edu/search?text=Rockefeller%20Foundation>
- [7] <https://embryo.asu.edu/search?text=California%20Institute%20of%20Technology>
- [8] <http://eol.org/pages/733739/overview>
- [9] <https://embryo.asu.edu/search?text=Harvard%20University>
- [10] <https://embryo.asu.edu/search?text=genes>
- [11] <https://embryo.asu.edu/search?text=Drosophila>
- [12] <https://embryo.asu.edu/search?text=hormones>
- [13] <https://embryo.asu.edu/search?text=Stanford%20University>
- [14] <https://embryo.asu.edu/search?text=Johns%20Hopkins%20University>
- [15] <http://eol.org/pages/1029744/overview>
- [16] <https://embryo.asu.edu/search?text=in%20vitro>
- [17] <https://embryo.asu.edu/search?text=National%20Academy%20of%20Sciences>
- [18] <http://www.pnas.org/content/27/11/499.full.pdf+html>
- [19] <https://embryo.asu.edu/search?text=Scott%20Gilbert>
- [20] <https://embryo.asu.edu/search?text=Heredity>
- [21] <https://embryo.asu.edu/search?text=University%20of%20Michigan>
- [22] <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC301369/>
- [23] <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1210798/>
- [24] <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC335553/>
- [25] <http://www.genetics.org/content/124/1/1.full.pdf>
- [26] <https://embryo.asu.edu/search?text=differentiation>
- [27] <http://www.ias.ac.in/jbiosci/mar2008/21.pdf>
- [28] <http://profiles.nlm.nih.gov/ps/access/BBGBDU.pdf>
- [29] <http://www.annualreviews.org/doi/abs/10.1146/annurev.ge.14.120180.002311>
- [30] <http://www.genetics.org/content/132/1/1.full.pdf>
- [31] <https://embryo.asu.edu/library-congress-subject-headings/ephrussi-boris-1901-1979>
- [32] <https://embryo.asu.edu/library-congress-subject-headings/california-institute-technology>
- [33] <https://embryo.asu.edu/library-congress-subject-headings/transplantation-organs-tissues-etc>
- [34] <https://embryo.asu.edu/library-congress-subject-headings/beadle-george-wells-1903-1989>
- [35] <https://embryo.asu.edu/library-congress-subject-headings/rapkine-louis-1904-1948>
- [36] <https://embryo.asu.edu/library-congress-subject-headings/faure-fremiet-e-emmanuel-1883>
- [37] <https://embryo.asu.edu/library-congress-subject-headings/mutation>
- [38] <https://embryo.asu.edu/library-congress-subject-headings/tissue-culture>
- [39] <https://embryo.asu.edu/library-congress-subject-headings/drosophila>
- [40] <https://embryo.asu.edu/medical-subject-headings/tissue-transplantation>
- [41] <https://embryo.asu.edu/medical-subject-headings/teratocarcinoma>
- [42] <https://embryo.asu.edu/medical-subject-headings/imaginal-discs>
- [43] <https://embryo.asu.edu/topics/people>
- [44] <https://embryo.asu.edu/formats/articles>