Eugen Steinach (1861–1944) [1]

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Eugen Steinach researched sex hormones [5] and their effects on mammals in the late nineteenth and early twentieth centuries in Europe. He experimented on rats by removing their testicles and implanting them elsewhere in their bodies, and he found that the testes [6] interstitial cells produce male sex hormones [5]. He developed the Steinach Rejuvenation Procedure, which he claimed could rejuvenate men by increasing their production of sex hormones [5]. Steinach's work on female sex hormones [5] and on ovarian extracts led to the development of the first standardized injectable estrogen [7]. Steinach's research on reproductive hormones [8] helped researchers explain the roles of sex hormones [5] and develop hormone [9] drugs.

Eugen Steinach was born on 27 January 1861 in Hohenems, Austria, to Flora Rosenthal and Simon Steinach. Steinach's father and grandfather were physicians. His grandfather also bred cattle. Steinach's experience with cattle breeding and the physical and behavioral consequences of castration later influenced much of his research. Steinach studied natural science at the University of Geneva [10] in Geneva, Switzerland, in preparation to study medicine at the University of Vienna in Vienna, Austria, to graduate in 1886 with a medical degree.

After graduation, Steinach worked as a research assistant at the Physiological Institute in Innsbruck, Austria, until 1898. Then he moved to Prague, Czech Republic, to work at the German University of Prague [11] as an assistant to Karl Ewald Hering, who study physiology. From 1890 to 1910 Steinach spent his time teaching, supervising students, experiments, and conducting research on the physiology of the eye with Hering. Steinach later described this period as unsatisfactory as he did not have a strong interest in eye research. In 1907, he became Professor at Charles University [12] in Prague, and he began his own physiology research laboratory.

In 1912, at the age of fifty-one, Steinach became research director of the Department of Physiology at the Institute for Experimental Biology of the Academy of Sciences, also called the Vivarium, in Vienna, Austria. With that position, Steinach focused on his research, rather than on teaching. The Vivarium was a private research institution that attracted scientists with new technologies available for experiments. At the Vivarium, Steinach worked with Paul Kammerer, who bred salamanders to study how environment affects evolution [13]. While at the Vivarium, Steinach studied the sexual changes that he had first noted in cattle after they experienced castration on his grandfather's farm.

Through centuries of animal domestication and castration, scientists had identified the testes [6] as the source of a substance that affects sexual characteristics in male animals. Several decades before, in 1849, physiologist Arnold Berthold at the University of Göttingen in Göttingen, Germany, had castrated roosters and transplanted their testes [6] onto other parts of their bodies to study the role of the sex organs on sexual characteristics. Berthold noted that when he removed the testes [6], the physical and behavioral sex characteristics of a rooster weakened. However, when Berthold transplanted the testes [6] to another part of the body, the rooster regained normal physical and behavioral characteristics. Berthold concluded that blood circulation provided the link between chemicals secreted from testes [6] and the brain. However, many scientists rejected Berthold's conclusions and stated that the difficulties in complete removal of the testes [6], which had made it unlikely that Berthold could have fully removed their sex organs, invalidated his conclusions.

Steinach recreated Berthold experiments, but with rats between 1894 and 1910. In his experiments, Steinach removed the testes [6] of male rats and then transplanted them onto their abdomens. Steinach noted that when he removed the sex organs, normal male sex characteristics ceased. The sex characteristics he observed were both physical and behavioral traits that distinguish male and female rats. Examples of physical characteristics included prominence and size of sex organs (penises and nipples), body size and shape, and hair quality. Behavioral characteristics included sexual behavior, like pursuing or being pursued, aggression, and nurturing characteristics. Upon successful transplantation of the testes [6] onto the abdomen of the rat [14], this restored the physical and behavioral characteristics of normal male rats. Steinach was one of the earliest scientists who performed and documented a transplantation to another part of the body of testes [6] that vascularized again. Steinach concluded that the sex organs influenced the physical functions and sexual behavior, but he did not indicate complete dependence.

During his studies on rats, Steinach began to study the location of sex hormones [5] in the body. During the early twentieth century, some scientists tried to determine where in the body sex hormones [5] are produced and function. In 1850, Franz Leydig at the University of Tübingen in Tübingen, Germany, had noted the presence of interstitial cells, or cells positioned between two other cell types, in the testes [6]. Leydig found that the interstitial cells located within the testes [6] surrounded several ducts that

produce sperm [15] cells. Leydig hypothesized that interstitial cells of the testes [6] were the source of the male sex hormone [9]. At the time, there was little evidence to support his hypothesis.

Leydig's results inspired two opposing theories in the early twentieth century. One theory claimed that the interstitial cells within the gonads secreted sex hormones [5], and the competing theory claimed that the interstitial cells were connective tissue and that, in males, the sperm [15] cells produced sex hormones [5]. Steinach in 1910 used infant rodents to investigate both theories. He noted that when he removed the sex organs of infant rodents, the animal remained in an infantile state and did not enter puberty, but if he transplanted the testes [6] to another part of the body, the infant animal developed normally. Steinach used those studies as emphasize that the production of male sex hormones [5] occurs in tactical interstitial cells, called Leydig cells.

In 1912, Steinach began to study age and rejuvenation. André Pol Bouin and Paul Ancel in Nancy, France, also worked to determine which sex hormones [5] control sexual behavior. In 1903, Bouin and Ancel had performed vasectomies, or vasoligation, on male guinea pigs (*Cavia porcellus* [16]) and rabbits to study the function of interstitial cells and the production of sex hormones [5]. In vasoligation, surgeons cut and seal the vas deferens, which are the ducts that pass sperm [15] from the testes [6] to the ejaculatory ducts of the penis. The procedure sterilizes the male by preventing sperm [15] from leaving the testes [6] during ejaculation. Steinach's associate Robert Lichtenstern applied Bouin and Ancel's technique in humans [17]. Men had reported that as they aged, their sex drives waned. Steinach argued that a vasectomy could halt sperm [15] production and induce an increase of sex hormones [5] in men. Steinach postulated that by increasing the sex hormones [5] in men, their sex drives would rebound. He developed the Steinach Rejuvenation procedure, in which a physician performs a vasectomy on a human male patient, to increase the sexual libidos of men that often wane with age.

Also in 1912, Steinach began experimenting with the transplantation of sex organs from the opposite sex in animals. In those experiments, Steinach castrated infant male guinea pigs and implanted ovaries in them. He repeated that process with infant female guinea pigs and implanted testes [6] in them after removing their sex organs. He found that male guinea pigs developed female sex characteristics, like milk-producing nipples, and were pursued by normal male guinea pigs. When he implanted female sex organs onto male guinea pigs, he noted that this impacted behavioral characteristics, including aggression, nurturing, and mating preferences, along with the physical characteristics. That experiment began his work on the relationship between hormones [8], sexual behavior, and mental attributes. Steinach began discussing ideas and theories with Sigmund Freud, who worked in Vienna, Austria, whom he had met while they were both university students. His discussions with Freud stimulated his interest in the role of hormones [8] and mental attributes, specifically in relationship to homosexuality.

In 1918, Steinach began working with Lichtenstern, a urologist in Austria, on the subject of hormones [8] and homosexuality. Steinach and Lichtenstern published the paper "Conversion of Homosexuality through Exchange of Puberty Glands," in which they discuss an experiment where Lichtenstern replaced the testes [6] from homosexual men with those from heterosexual men. The testes [6] transplanted from the heterosexual men were undescended third testes [6] that doctors had removed surgically. After the transplantation, Steinach and Lichtenstern observed the homosexual man's sexual tendencies. They concluded that, after implantation [18], heterosexual tendencies replaced homosexual tendencies.

By the 1920s, the Steinach Rejuvenation procedure had gained popularity across Europe, and Steinach began conducting clinical studies on its success. Steinach never performed Steinach Rejuvenation Procedures, deeming himself clinically incompetent, and chose rather to further research the technique. He recorded the objective and subjective notes that physicians gave about their patients before and after surgeries, and then he used statistical methods to determine the technique's success. Steinach found that the results varied. Many men had invigorated libidos, yet some reported no effects or negative outcomes. Steinach's results caused researchers and doctors to doubt the procedure and its underlying theories. Some scientists said that positive results could relate to autosuggestion or placebo effects. Others claimed that the science behind the procedure was inaccurate, but still said that the procedure had some medical benefits. However, despite the controversy, by the 1920s, rejuvenation procedures were common. In 1920 greater than one-hundred male scientists, physicians, and professors in Vienna underwent the Steinach Rejuvenation surgery in an attempt to improve sexual health.

In 1920, Steinach published a book titled *Rejuvenation Through the Experimental Revitalization of the Aging Puberty Gland*, based on his experiments with vasoligation. In 1922, Universum film, a film company in Berlin, Germany, released two motion pictures one a documentary for professionals and the other a popularized version based on Steinach's experiments for a wider audience. According to historians, the popularized film angered Steinach because he hadn't consented to a popularized version.

In the 1920s, Austria suffered an economic downfall and monetary inflation. As a result, the government cut all funding for research, forcing Steinach to fund his experiments on his own. However, the Steinach Rejuvenation procedure remained popular and brought patients from all over the world, providing Steinach the funds necessary to continue his research. According to historians, by 1926, Steinach was world famous due to his rejuvenation.

In 1925, Steinach began to study female hormones [8] and sexual behaviors. By the 1930s, researchers had isolated and sold a

somewhat effective natural female hormone [9], called Emmenin. However, there was still a need for a more potent, and cost-effective oral estrogen [7]. Steinach experimented on female rats by injecting them with extracts from ovaries and placentas. He aimed to assess how increased amounts of hormones [8] affected aging female rats. Steinach's work caught the attention of the chemical industry, and with the help of the Schering-Kahlbaun Corporation in Berlin, Germany, Steinach helped create an early standardized, purified, and concentrated solution of female hormones [8] for hormone therapy [19] in women. The product, later remarketed as Progynon-B, an injectable and oral estrogen [7] widely used into the twenty-first century.

After a period during which Steinach studied the pituitary gland [20] with Heinrich Kun, Steinach returned to studying female hormones [8] in 1931. Steinach experimented with the corpus luteum [21], a hormone [9] secreting structure produced in the ovary [22] after discharge of the ovum [23] in female mammals. The corpus luteum [21] is involved in producing hormones [8] during the menstrual cycle, the luteal hormones [8], and disappears in a few days unless fertilization [24] occurs. He found there were two luteal hormones [8], one that was female-specific, which affected the uterus [25], and the second present in both sexes and affected masculine characteristics.

In March 1938, Steinach's scientific career ended when Germany overtook Austria. His library was confiscated and his research materials destroyed. Steinach and his wife, who were both Jewish, were on vacation and a lecture tour in Switzerland when Adolf Hitler marched into Austria. The Swiss government granted Steinach and his wife permanent residence, and they never returned home. In September 1938 in Zurich, Switzerland, Steinach's wife committed suicide. After his wife's death, Steinach planned to go to the US. However, despite promises from US institutions, Steinach never made it to the US. Steinach died alone in May of 1944 in Montreux, Switzerland, at the age of eighty-four.

Sources

1. Berenbaum, Michael, and Fred Skolnik. "Steinach, Eugen." *Encyclopaedia Judaica* 19 (2007): 182–3.
2. Berthold, Arnold Adolph. "Transplantation der Hoden (Transplantation of Testacies)." *Archiv für Anatomie, Physiologie und Wissenschaftliche Medicin (Archive of Anatomy Physiology and Scientific Medicine).* (1849): 42–46.
3. Berthold, Arnold Adolph. "The Transplantation of Testes." Trans. Daniel P. Quiring *Bulletin of the History of Medicine* 16 (1944): 399.
4. Benjamin, Harry. "Eugen Steinach 1861–1944: A life of Research." *The Scientific Monthly* 61 (1945): 427–42.
5. Bouin, André Pol, and Paul Ancel. "Recherches sur les Cellules Interstitielles du Testicule des Mammiferes (Studies on the Interstitial Cells of Mammalian Testes)." *Archives de Zoologie Expérimentale et Générale (The Archives of Zoology Experimental and General).* 1 (1903): 437–523.
6. Freud, Sigmund. *Drei Abhandlungen Zur Sexualtheorie (Three Essays on the Theory of Sexuality).* Leipzig [26] und Wien (Leipzig [26] and Vienna), Germany and Austria: Franz Deuticke, 1905.
7. Harms, Ernest. "Forty-Four Years of Correspondence between Eugene Steinach and Harry Benjamin." *Bulletin of the New York Academy of Medicine*. 45 (1969): 761–6.
8. Hering, Karl Ewald Konstanntin. *Die Lehre vom Binokularen Sehen. (The Theory of Binocular Vision)*, Leipsig, Germany: Wilhelm Engelmann, 1869.
9. Kammerer, Paul. "Breeding Experiments on the Inheritance of the Acquired Characters." *Nature* (1923): 637–40.
10. Leydig, Franz. "Zur Anatomie der Mannlichen Geschlechtsorgane und Analdrusen der Saugethiere (The Anatomy of the Male Sex Organs and Glands of the Anal Sucking Beasts)." *Zeitschrift für wissenschaftliche Zoologie (Journal of Scientific Zoology).* 2 (1850): 1–57.
11. Logan, Cheryl A. *Hormones, Heredity [27], and Race: Spectacular Failure in Interwar Vienna.* New Brunswick: Rutgers University Press, 2013.
12. Nobel Prize Official Website. "Nobel Prize Nomination Database: Eugen Steinach" http://www.nobelprize.org/nomination/archive/show_people.php?id=8765 [28] (Accessed February 9, 2015).
13. Sengoopta, Chandak. "´Dr Steinach Coming to Make Old Young!´ Sex Glands, Vasectomy [29] and the Quest for Rejuvenation in the Roaring Twenties." *Endeavour* 27 (2003): 122–6.
14. Södersten Per, David Crews, Cheryl Logan, and Rudolf Soukup. "Eugen Steinach: The First Neuroendocrinologist." *Endocrinology* 155 (2014): 688–702.
15. Steinach, Eugen. "Untersuchungen zur vergleichenden Physiologie der männlichen Geschlechtsorgane insbesondere der accessorischen Geschlechtsdrüsen.(Studies on the Comparative Physiology of Male Sexual Organs, in Particular the Accessory Sex Glands)." *Pflügers Archiv European Journal of Physiology* 56 (1894): 304–338.
16. Steinach, Eugen. "Geschlechtstrieb und echt sekundäre Geschlechtsmerkmale als Folge der innersekretorischen Funktion der Keimdrüsen (Sexual Desire and Genuine Secondary Sexual Characteristics as a Result of the Endocrine Function of the Gonads)." *Zentralblatt für Physiologie (Zentralblatt of Physiology)* 24 (1910): 551–66.

17. Steinach, Eugen. "Willkürliche Umwandlung von Säugetier-Männchen in Tiere mit ausgeprägt weiblichen Geschlechtscharakteren und weiblicher Psyche. (Arbitrary Transformation of Mammalian Males in Animals with Pronounced Female Sexual Characteristics and Female Psyche)." Pflügers Archiv European Journal of Physiology 144 (1912): 71–108.
18. Steinach, Eugen. "Pubertätsdrüsen und Zwitterbildung (Puberty Glands and Hermaphroditism)." *Archiv für Entwicklungsmechanik der Organismen* [30] *(Archive for Development Mechanics of Organisms)* 42 (1916): 307–32.
19. Steinach, Eugen. "Histologische Beschaffenheit der Keimdrüse bei Homosexuellen Männern (Histological Characteristics of the Gonad in Homosexual Men)." *Archiv für Entwicklungsmechanik der Organismen* [30] *(Archive for Development Mechanics of Organisms)* 46 (1920): 29–37.
20. Steinach, Eugen. *Verjüngung durch experimentelle Neubelubung der alternden Pubertätsdrüse (Rejuvenation through Experimental Revitalization of the Aging Puberty-gland).* Berlin: Springer, 1920.
21. Steinach, Eugen. "Der Steinach-Film: Kulturabteilung der Universum-Film A.-G. (The Steinach movie: Cultural Department of Universe-Film A. G.)." Berlin: Universum Film, Film-Prüfstelle (Universal Films, Film Testing), 1922.
22. Steinach, Eugen. "Rejuvenation: populäre Fassung des von Professor Steinach autorisierten wissenschaftlichen Films (Rejuvenation: Popular Version of the Authorized Professor Steinach Scientific Films)." Berlin: Universal Film, Film-Prüfstelle (Universal Films, Film Testing), 1922.
23. Steinach, Eugen. *Sex and Life.* New York: Viking Press, 1940.
24. Steinach, Eugen, and Heinrich Kun. "Luteingewebe und männliche Greschlechtscharaktere (Luteal tissues and male sexual characteristics)." *Pflügers Archiv European Journal of Physiology* 227 (1931): 266–278.
25. Steinach, Eugen, and Heinrich Kun. "Transformation of male sex hormones [5] into a substance with the action of a female hormone [9]." *Lancet* 230 (1937): 845.
26. Steinach, Eugen, and Robert Lichtenstern. "Umstimmung der Homosexualität durch Austausch der Pubertätsdrüsen (Conversion of Homosexuality through Exchange of Puberty Glands)." *Münchener Medizinische Wochenschrift (Munich Medicine Weekly)* 65 (1918): 145–8.
27. Steinach, Eugen, Heinrich Heinlein, and Berthold P. Wiesner. "Auslösung des Sexualzyklus, Entwicklung der Geschlechtsmerkmale, reaktivierende Wirkung auf den senilen weiblichen Organismus durch Ovar-und Placentaextrakt (Triggering of the Sexual Cycle, Development of Sexual Characteristics, and Reactivating Effect on the Female Organism Senile by Ovary and Placenta)." *Pflügers Archiv European Journal of Physiology* 210 (1925): 598–611.

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Subject

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Topic

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Publisher

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

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Last Modified

Wednesday, July 4, 2018 - 04:40

DC Date Accessioned
Thursday, February 16, 2017 - 21:54

DC Date Available
Thursday, February 16, 2017 - 21:54

DC Date Created
2017-02-16

DC Date Created Standard
Thursday, February 16, 2017 - 07:00

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