



Dr. Voronoff's curious glandular xenoimplants

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CUPERSCHMID, Ethel Mizrahy; CAMPOS, Tarcisio Passos Ribeiro de. Dr. Voronoff's curious glandular xenoimplants. *História, Ciências, Saúde – Manguinhos*, Rio de Janeiro, v. 14, n. 3, p.1-24, July-Sept. 2007.

Dr. Serge Voronoff visited Brazil during the *Jornadas Médicas* of 1928, where he demonstrated his xenotransplantation technique to the local medical community. The present article uses newspaper clippings from that era to illustrate how this controversial surgery and Voronoff's alleged miraculous preservation of good health and longevity was viewed in the popular imagination. Voronoff's initiative paved the way for other health professionals to report on their surgical experiences with xenotransplantation and also popularized the topic, which became the subject of Carnival songs and sardonic jokes in the press. An analysis is offered, based on current scientific parameters, along with a suggestion concerning the possible involvement of xenotransplantation in HIV epidemiology.

KEYWORDS: xenotransplantation; Serge Samuel Voronoff (1866-1951); gonads; thyroid.

When Voronoff arrived in Brazil for a brief stay to take part in the 1928 Jornadas Médicas, he already had a name in the scientific world linked with a variety of issues (such as futuristic scientific progress) and he was also the frequent object of jest. For the elderly, his name, his person, and his techniques conveyed hope for sure and certain rejuvenation. Among younger people and those who lived in Brazil's larger cities, Voronoff inspired Carnival songs, ridicule, and jokes. He was part of the popular imagination for quite some time, remembered whenever the prospect of further medical progress arose.

But who really was this Serge Voronoff?

His name first appeared in the mass media in the 1920s at the time of the Jornadas Médicas, an international event sponsored by Brazilian medical and surgical associations in mid-1928 in Rio de Janeiro, then Brazil's federal capital. Chaired by the physician Fernando de Magalhães, the meetings took place at the Medical and Surgical Society.

According to a news item published in *Diário de Minas* (July 12, 1928), the Jornadas Médicas were a major scientific event in the life of the country. Physicians from Brazil, Portugal, France, Germany, Uruguay, and Argentina took part. Belo Horizonte's School of Medicine announced name by name the members of the commission who were sent to honor the event, led by professor of psychiatry Lopes Rodrigues.

Serge Samuel Voronoff (1866-1951) was called a sage, scientist, doctor, surgeon, physiologist, and professor. His nationality is uncertain; sometimes he is identified as Russian, other times as a Slav or Frenchman. Indications are that he was Russian born but took French citizenship in 1895, having completed his medical studies in Paris. His name is not to be found in such publications as *Os mil que fizeram o século XX*, *Médicos revolucionários*, or *Memórias do século XX* (Mason, 2003). Nor is he cited by British historian Eric Hobsbawm (1995) or by Edwin Black (2003), whose book explores the birth of eugenics as a practical science in the US.¹

The physician is also not mentioned by Marcelo Lopes Costa (1999) or Pedro Nava (2003), Brazilian authors who have explored the history of medicine. Yet his name is cited in a brief entry in *Enciclopédia judaica*, where he is remembered as a scientist rather than as a Jew: "Working in France, he developed gland transplantation and thus increased the growth of sheep wool. He also stimulated sexual activity by transplanting glands from higher apes to human beings, alleging that this could extend human life to 140 years" (Roth, 1967, p.1199).

According to a biography by Jean Réal (2001), Serge Voronoff was born Samuel Abrahamovitch in a village near Voronej, Russia, in 1866. He became a world-famous surgeon when he performed

¹ One of Voronoff's eugenic affirmations about the benefits of xenotransplantation was: "By grafting young lambs, we have succeeded in developing super-rams. Why not try creating a race of super-men, endowed with physical and intellectual attributes very superior to ours?" (Voronoff, 1928, p.178).

grafts and gland experiments in an effort to improve breeds of sheep and horses. Voronoff argued that transplanting testicles from younger to older animals would restore lost vigor. The surgeon carried out over 500 transplants on sheep, goats, and bulls.

Voronoff left Russia in 1884 to study medicine in Paris. He credited his mastery of surgical skills to Alexis Carrel (1873-1944), one of his professors and the pioneer of tissue transplantation (Porter, 2004, p.156). According to Adler (2006, p.188), Carrel was responsible for advances that led to modern transplant surgery. He was awarded the Nobel Prize in Physiology or Medicine in 1912 for his work suturing blood vessels and his experiments with organ transplantation. He demonstrated two aspects of transplantation that were essential to advancing the technique: it was technically possible to transplant organs and tissue within the same donor animal; however, when the organ or tissue came from another animal, the graft or transplant would be successful only for a certain time, after which the animal would die. Carrel thus demonstrated the phenomenon of tissue rejection, which was to forestall successful transplants in human beings for many years.

Voronoff began his research in 1889, working with the French physiologist Adolphe Brown-Séguard (1817-1894), who had gained fame that same year for injecting himself with an aqueous testicular extract obtained from dogs and guinea pigs. This was the dawn of treatment using juice from glands, which became known as opotherapy. But Brown-Séguard's experiments soon proved inefficient.

The Californian surgeon L.L. Stanley and the Austrian doctor Eugen Steinach (1861-1944) were likewise followers of Brown-Séguard's opotherapy. Stanley injected cells obtained from animal testicles into more than one thousand patients, while Steinach introduced the pioneer vasectomy technique,² likewise with the aim of delaying the biological clock. Steinach also conducted experiments on rejuvenation through transplantation of the sex glands of certain animals to humans, "but none of these methods managed to demonstrate the desired results" (Burnie, 2005, p.128). Brown-Séguard began his research by trying to replicate the experiments of physician John Hunter (1728-1793), dubbed the "father of scientific surgery" because he had successfully transplanted a rooster's foot to its comb. Séguard expanded on Hunter's work with transplantation between species, grafting a rat's tail onto a rooster's comb (Adler, 2006, p.188).

After his apprenticeship with Brown-Séguard, Voronoff worked at a hospital in Egypt for fourteen years. He lived in Cairo from 1896 to 1910, where he had the opportunity to observe eunuchs. He noted their obesity, lack of body hair, and broad pelvises, as well as their flaccid muscles, lethargic movements, memory

² Known as the Steinach method, in this procedure the vas deferens were cut in order to rejuvenate elderly men. See Eugênio Steinach

problems, and lowered intelligence. He concluded that the absence of testicles was responsible for aging and that their presence should prompt rejuvenation. He believed testicles played not only a genital role but also impacted a person's bone, muscle, nerve, and psychological development. He saw aging as the result of the slower production of endocrine secretions and hormones, especially sex hormones (Deschamps, 2005).

He returned to Paris in 1910, where he devoted himself to transplantations on experimental animals, beginning with muscle and bone grafts and then working with the pancreas, kidneys, and endocrine glands. He tested the hypothesis that higher primates were the perfect donors for humans while also studying red blood cells and ABO antigens in the saliva. Voronoff accompanied Dr. Lansteiner's work closely.

It is equally important to point out that their blood is like ours, and has the same composition, with red globules of the same size; like ours, it differs from the blood of every other animal, even from that of the lower monkeys. It is not astonishing, therefore, that of the lower monkeys, finding in our bodies the same soil, the same blood, may be grafted therein and continue to live in their new host (Voronoff, 1928, p.135).

Let us remember that it was only in 1939 that the Rh factor was described, and that Voronoff was one of the first scientists to believe in a relation between hormonal activity and aging.

There are a number of remarkable stories about the surgeon's accomplishments. Rafael Oriol (May 2001, p.149) writes that Voronoff used fetal membranes in transplantation procedures involving extensive burns. Voronoff stated that bone and skin transplantations were already being performed on human patients but only using donors of one same species (Voronoff, 1928, p.126). One source affirms with certainty that he transplanted thyroid and parathyroid glands from monkeys to humans in an effort to treat patients suffering from cretinism (Voronoff, 1964). In his book, Voronoff explains that he couldn't always find donors; usually the child's mother would offer to donate part of her gland but when this wasn't possible, he would use simian donors.

On December 5, 1913, according to his own report, Voronoff implanted the thyroid gland of a chimpanzee in a boy by the name of Jean B. Dr. Montalti, of Nice, then observed the lad for fourteen months. After discharge, Jean B. regained his color, weight, and height. His intelligence also rose substantially and he was able to go to school. The operation was reported to the Academy of Medicine on June 30, 1914, in an article accompanied by photographs taken before and after surgery. In early 1917, Voronoff learned the boy had been drafted and was to serve on the front

lines in World War I. Voronoff's conclusion: "Thus the boy whom I had known in 1913 as a pitiful imbecile, with the body of an eight-year-old child, had, four years later, been passed by the army doctors as fit for active service and was doing a man's duty" (Voronoff, 1928, p.136).

During the First World War, Voronoff took care of wounded French soldiers. Some sources suggest he became well known when he performed bone transplants using material from combat amputees, as head surgeon of Russian and French hospitals (Voronoff, 1964). Rafael Oriol (May 2001, p.149) writes that Voronoff transplanted a chimpanzee bone on a wounded soldier in 1915 and that this operation gave the doctor the idea of transplanting a monkey testicle to a man.

According to Voronoff, the glandular transplants would allow the organism to produce hormones on a regular basis, eliminating the need for the constant injections required by opotherapy. He also claimed that a graft from a monkey's thyroid gland worked better than grafts involving human glands. Voronoff claimed he had grafted simian glands in humans for the first time in 1913, but other sources say the date was 1917 or 1920. Whatever the case, there is no question that Voronoff was the first to conduct xenotransplantation using primate organs (Gordon, 2004, p.385).

Cynocephalus glands were employed in a transplantation procedure on November 16, 1916. Using a local anesthetic, Voronoff grafted sex glands in a 74-year-old man who displayed classic signs of senility. The monkey gland was cut into pieces of about 2 cm by 0.5 cm and a few millimeters deep. Voronoff then introduced two grafts in the scrotum, attaching them with stitches for eight days. Given the success of this xenotransplantation, he began using *Cynocephalus* glands instead of chimpanzee glands.

Voronoff states that by 1919 he had already carried out 120 experiments grafting animal organs into other animals, including goats, rams, ewes, horses, and bulls. He conducted these studies under the auspices of the Collège de France, a progressive institution that invested in research with an eye on the future and the advancement of science. Its members were not professors but researchers who worked in the interest of man (Voronoff, 1928, p.123).

According to Voronoff, the use of experimental animals was justified by the value of human life. Voronoff asked himself: Why not do the testing on animals first? No patient should be sacrificed in the name of science so that others may later be saved. Animals could be used instead (but he did perform vivisections under anesthesia). Animal donors were much easier to find than human ones (Voronoff, 1928). In his reports, Voronoff affirmed that the evolution of science would be followed by the evolution of

mentalities and laws, since the former was more advanced than the latter. We believe his goal was to promote a system for rapidly developing transplantation procedures, even if he had to resort to animal experimentation. He wrote, for example, of the various moral complications he encountered when trying to get donor organs from a prisoner who was going to be executed: would the recipient acquire the donor's perverse characteristics? Furthermore, French law was clear: the State was responsible for the bodies of its citizens and no Frenchman had the right to do as he wished with his. It was also necessary to take into consideration that no citizen could enlist in the military unless he enjoyed perfect health and all his organs were functioning properly.³

³ In 1790, France instituted mandatory, personal military service and launched a new type of recruitment, with all citizens spending some time training at the barracks. Physical selection followed strict criteria. The French colonies in northern Africa sponsored conscription campaigns, and during World War I, France had the help of 600,000 colonial soldiers.

There were other practical questions as well. It would be even harder to find human donors of sex glands, and there was the danger of encouraging a 'black market' of organs, which would make grafting dependent upon financial wealth. Transplantations could rely on organs from young donors who had died – in accidents, for example – but Voronoff felt that even though death may not be an instantaneous process, our body organs become useless within minutes or hours:

Each organ continues to live for a shorter or longer time according to the delicateness of its composition. The bones survive for eighteen hours; the kidneys, the liver and the glands for from six to eight hours. If they are removed in time, these organs retain all their vital properties and, if transplanted in another body they are capable of again accomplishing their former functions (Voronoff, 1928, p.127-128).

But the infrastructure needed to transport these organs, and the hospitals and specialized professionals required as well, were still things of the future. Voronoff's hope was that the advancement of mentalities and of laws would catch up with the evolution of science. People needed to understand that they could serve humanity even after their death (Voronoff, 1928, p.128).

According to Thierry Gillyboeuf (2000, p.44), between 1920 and 1930, Voronoff operated on forty men at his private clinics (vila Molière, in Auteil; Ambroise Paré, in Neully; and on Montaigne street in Paris). According to the scant documentation available, Voronoff performed xenotransplantation on nine employees, seven doctors, four engineers, four men of letters, three architects, three manufacturers, two lawyers, two university professors, a millionaire, an agronomist, a painter, and a laborer. Three were foreigners, nine were between the ages of 20 and 40, eighteen between 41 and 60, and seventeen between 61 and 80.

Many such operations were conducted later, with a number of failures. However, Voronoff's enthusiasm did not wane, nor did

the ranks of his admirers decline. He stressed that the purpose of xenotransplanting monkey sex glands in men was much less aphrodisiac in nature than it was meant to restore lost youth and physical and intellectual well-being: "Grafting is in no way an aphrodisiac remedy, but acts on the whole organism by stimulating its activity" (Voronoff, 1928, p.150).

Embracing the eugenic medicine in fashion during the 1920s and 1930s, Voronoff wanted to rejuvenate human organisms by transplanting chimpanzee and baboon glands, thus essentially elevating these to the rank of brotherly species of the human genus. Since monkeys bore a resemblance to man and shared kinship on the evolutionary chain, and since its body was strong and its organs and health of good quality, the scientist thought this animal should be used to improve the lives of human beings. Voronoff pointed out that he did a pre-selection based on a thorough study of the donor's and host's blood, although he did not provide any details (1928).

Between 1920 and 1940, more than 45 surgeons used Voronoff's techniques and some 2,000 xenotransplants from non-human to human primates took place. In the 1930s, more than 500 men were operated on in France while others underwent surgery in the US, Italy, Russia, Brazil, Chile, and India. Positive, encouraging results were reported from around the world, but over time a kind of retransplantation became common. Voronoff argued that this second graft, which in half the cases was done five or six years after the first, achieved positive results similar to those observed in the original surgery (1928, p.175).

Voronoff could not demonstrate his rejuvenating surgical technique in England because the removal of sex glands from monkeys was prohibited by law there, even when done under anesthesia. Vivisection was strictly banned as well. The debate on the use of animals for experimental purposes had begun decades earlier in England, prompting the first law regulating animal experimentation: the Cruelty to Animals Act, passed in 1876 (Pai-xão, 2001). From that point on, surgeons found it very difficult to perform transplants. Concern over animal protection had come into law as early as 1822, when legislation proposed by Richard Martin to ban improper treatment of cattle was passed. Two years later, the Society for the Prevention of Cruelty to Animals was founded, and thanks to its efforts the brutal slaughter of animals and hunting for sport became subject to legal regulation in an effort to save these 'targets' from unusual suffering.

England's anti-vivisection movements date back to the mid-nineteenth century. The militant organization Society for the Protection of Animals Liable to Vivisection was founded in 1875, and in 1887 the National Anti-Vivisection Society was born. All

indications are that the emergence of many anti-vivisection societies was a consequence of the 1876 Cruelty to Animals Act, which regulated the practice in England. These bodies pressured authorities to abolish animal experimentation altogether. Starting in 1906, the old law was more strictly enforced and animals enjoyed more efficacious protection against any act described or interpreted as cruel.

Voronoff did not limit his xenotransplantation to men. He also engaged in research to transplant monkey ovaries to women in hopes of mitigating the effects of menopause. It is also said that he did a surprising experiment: he transplanted a woman's ovary to a monkey named Nora. The ensuing artificial insemination was described by the writer Félicien Champsaur (1859-1934) in his book on the monkey who became a woman – a publication that further boosted Voronoff's notoriety (Champsaur, 1929). According to the scientist, his first ovary xenotransplantation took place in 1924. He was assisted by his brother, Georges Voronoff, and by Dr.



Figure 1: Simian used in Voronoff's experiment. (Voronoff, 1928)

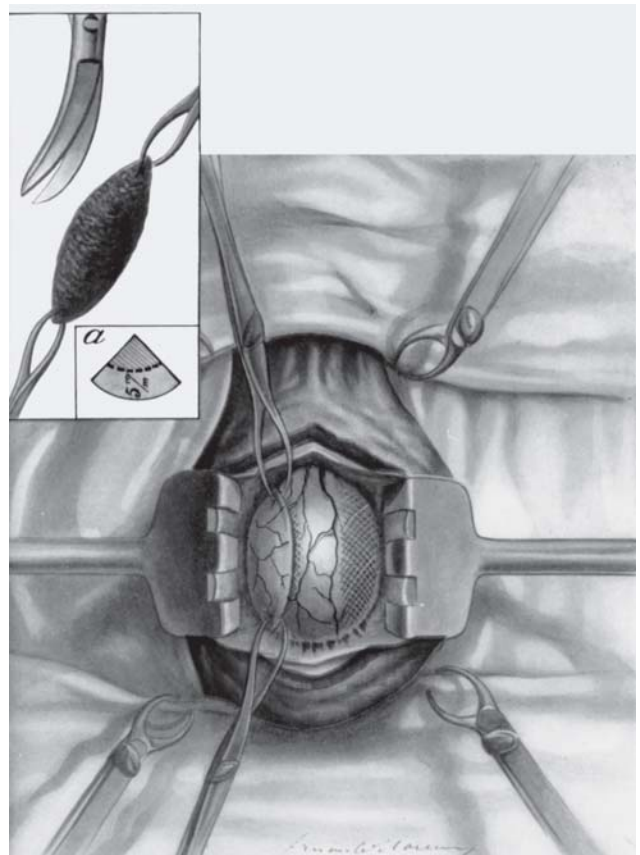


Figure 2: Testicular grafting. (Voronoff, 1939)

Dartigues, a well-known gynecologist (Voronoff, 1928, p.185). In his 1928 book, he devotes one chapter to the topic "The grafting operation for women." However, he does not describe the surgical method until his 1939 book, where the procedure is richly illustrated with slides.

Voronoff was the butt of jokes in magazines and newspapers. He was eager to spread the word about the true effects of these grafts and their benefits, so he endeavored to publicize his technique among people interested in forming their own opinion based on serious, reliable data. One of the two cases of ovary xenotransplantation described by Voronoff involved a Brazilian woman. According to his report, she was 48, lived in São Paulo, and wanted to undergo the transplant in order to regain her youth, because her husband had left her. She wanted to reestablish their relationship and keep her family together, in tune with that era's status quo. Voronoff believed in the moral power of this graft but did not attribute its surgical results or benefits to self-suggestion. The xenotransplantation took place on July 15, 1924. The woman

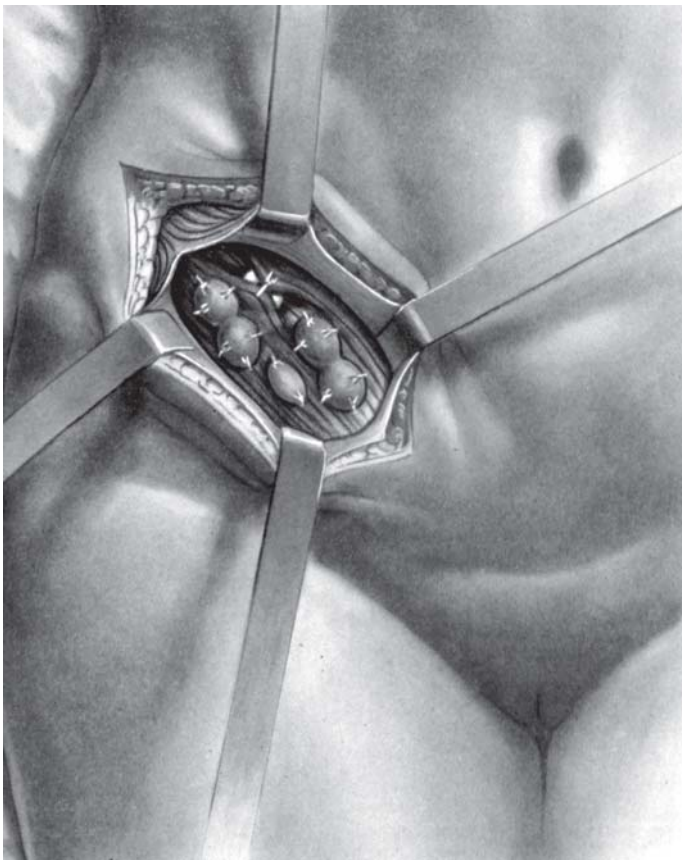


Figure 3: Ovarian grafting. (Voronoff, 1939)

lost sixteen kilograms during the first four months after surgery, but her muscles became strong and her skin regained elasticity and shine. Voronoff received news from the patient two years later. She was lively, thin, rejuvenated. Although she was over than 50, she looked like a young 35-year-old. When he asked whether she had gotten back together with her husband, she said she hadn't, because he was undeserving of her restored youthfulness (Voronoff, 1928, p.188).

Voronoff never had enough primates. Not only were they hard to capture; many died during transport. In the 1920s, commercial warehouses were created in French Western Africa to store animals and guarantee their supply in France. In Menton, Voronoff had his own place for stocking and caring for his monkeys.

Although the word 'hormone' was coined only in 1904 by William Maddock Bayliss and Ernest Henry Starling, the idea that the blood carries substances or principles that can affect physical and mental health was longstanding.

According to Adler (2006, p.14), the Chinese extracted and crystallized steroid hormones from human urine as early as the second century A.D. Physicians had also long been observing the effects of castration on man and animal.

In 1849, the German Arnold Adolph Berthold announced that he had managed to turn capons into roosters by implanting testicles. In 1890, Joseph von Mehring and Oskar Minkowski observed that removal of the pancreas caused diabetes in dogs. They then suspected that the disease was caused by the absence of a substance secreted by that organ.

More specifically, starting in the early twentieth century, physiologists in Europe and the US began to discover substances that acted as chemical messengers, regulating the organism's functioning. Researchers found that these chemical substances shared many characteristics despite their differences: they were all secreted directly into the blood by specific glands and they all had well-defined effects. B. Séquard worked to generalize this concept. In 1902, Bayliss and Starling showed that under the action of acids, duodenal mucous creates a substance called secretin in the blood, which stimulates the secretion of pancreatic juice.

In 1927, Fred Koch and Lemuel McGee extracted from bull testicles a material soluble in alcohol and ether that revived capon's male characteristics following injection. Two years later, in 1929, the hormone testosterone was discovered and, according to Burnie (2005, p.127), it was shown that no rejuvenating effects could be gained from xenotransplantation in men. In order to produce 0.056 g of this hormone, Adolf Butenandt processed over 23,000 liters of urine, enough to fill a small swimming pool! (p.63). In 1935, Butenandt was to discover the structural chemical formulas of the two most important androgens: testosterone and androsterone.

Voronoff was forced to end his experiments under pressure from the scientific community, which was very censorious and questioned the results of his operations.

When World War II began (1939-1945), Voronoff escaped the Nazis because he was in the US. Wealthy but with no academic recognition, he passed away in 1951. According to Jean Réal (2001), many of his archives disappeared mysteriously. The present article is based on news articles about the "wise Slav's" visit to Brazil, where local physicians witnessed his demonstrations of what was then deemed a revolutionary technique and where he also left his mark on the Brazilian imagination.

Voronoff in Brazil

Voronoff appears in the Brazilian press in early April 1928 as an “infamous” surgeon. His name is tied to the method for regaining lost youth by grafting primate glands into humans; his intention was allegedly to create a superior race and to transform children into super-men. His arrival in Brazil was set for early July of that year, together with the monkeys to be used in the experiments he would conduct during the Jornadas Médicas, scheduled for July 15-20 (*Diário de Minas*, Apr. 5, 1928). Yet his fame in Brazil dates back farther still, since he had conducted xenotransplantations on Brazilian patients in Europe: a woman and two of her brothers (farmers), whose names Voronoff did not reveal (Voronoff, 1928, p.188).

Maligners claimed there were powerful opponents and enemies of the technique. Indeed, before sailing for Brazil aboard the *Alcântara*, Voronoff had to listen to the following words from the cleric delivering his sermon at Westminster Abbey: “If God created man to be born, live, and die, why then is this hapless doctor changing the divine plan?” (*A Noite*, July 9, 1928). Other articles revealed foreign physicians’ opinions of this method of rejuvenation. Eduardo Back put his fears in these terms: “When monkey glands are grafted into the human body, the animal’s characteristics will likewise be transplanted. Well, the characteristics displayed by anthropoid monkeys in highest degree are cruelty and sensuality” (*Diário de Minas*, July 11, 1928).

A gamut of amusing interpretations started coming out in the press. Journalists wrote that the “Anonymous Society of Old Folks,” whose members were all over 70, was collecting funds to purchase chimpanzees from the Belgium Congo. The newspaper writers also posed scientific questions: “Did the old people rejuvenated by the Voronoff process just become healthy, or did they start monkeying around?” (*A Noite*, July 9, 1928).

For the most part, Voronoff was presented as a master of experimental surgery. He made it a point to explain to the Brazilian public that his method had been developed following years and years of study and countless experiments (*A Noite*, July 12, 1928). He guaranteed that he had treated elderly people with curved spines and restored them to their former vitality; he advised that he would conduct two experiments so the medical community could witness his method and his expertise.

The newspapers then published the advantages of the Voronoff method applied to herds of goats and ewes. There had been extremely successful experiments in Algeria since 1924, with encouraging economic results: “Under these circumstances, for every one hundred grafted sheep, five thousand offspring will be

born, and since every one of them will gain seven kilograms, we will have an additional 36,000 kilograms of mutton and 2,500 kilograms of wool per year!" (A Noite, July 13, 1928).

During the reception at the Jornadas Médicas, Voronoff received a small tribute from the humorist and storyteller Mendes Fradique, who put together a montage where the doctor was in a cage at the mercy of a chimp (A Noite, July 16, 1928). The audiences at his conferences were quite eclectic, comprising not just physicians and surgeons but also ladies and elderly gentlemen interested in regaining their youth. Voronoff talked about the development of his research and his study of the causes of aging, and closed by declaring xenotransplantation a scientific truth (A Noite, July 16, 1928). According to him, the sex gland acted directly on the brain, as well as on the nervous system and muscles.

When he was not either attending or giving a lecture, Voronoff visited tourist sites in Rio. The coverage of his trip to the zoo is comical:

Dr. Sergio Voronoff's visit to the Rio zoo. He was quite impressed, especially by the excellent specimens of simians on display for public observation. These simians should not be an object of Voronoff's curiosity; he should at least spare them this bitter visit. It is impossible that any monkey residing in the Capital of this country has not heard some comment about the visit of the greatest enemy of his species (Diário de Minas, July 18, 1928).

In order to demonstrate his skill and method, Voronoff undertook two interventions: one on a human and another on a sheep. Voronoff operated on Feliciano Ferreira de Moraes, a man of some renown in Brazilian society, as a 'human guinea pig.' He promised Moraes regained youth, a prodigious memory, liveliness, intelligence, muscular vigor, and calm nerves (Diário de Minas, July 19, 1928). Moraes owned a chicken farm in Campinas and was known as the King of Fowl. He had been born in Cantagalo and was 60 years old, married, a civil engineer, father of 11, and nephew of the Baron das Duas Barras, Elias de Moraes.

The operation took place at Hospital Evangélico and was widely publicized in the press. A newspaper article described how the chimpanzee was first chloroformed with the help of the surgeon's brother, Alexandre Voronoff. Doctors Felinto Coimbra and Castro Araújo assisted Serge Voronoff with the local anesthesia, cocaine (A Noite, July 18, 1928).

Once the chimp had been anesthetized, its organ was extracted and cut up. The surgeon then demonstrated his curettage and grafting technique. The segment removed from the simian was sliced up with a scalpel and then attached using large stitches. The whole

procedure took only 25 minutes. The surgery was compared to the simple pulling of a tooth:

The operation to rejuvenate man is actually the simplest thing on earth: – extracting a tooth perhaps requires greater care and more precise skill. Dr. Voronoff has discovered his 'egg of Columbus', guaranteeing the infallibility of the graft through his 'curettage' method.

If the simians in our jungles can be used for grafts, imagine how many operations will be performed here in Brazil every day, two or three years from now! (A Noite, July 18, 1928)

On July 20, the papers informed that both donor and recipient were doing fine. Feliciano de Moraes was in no pain and was resting easy, while the simian was at the zoo in his keeper's care.

In contrast with the public's warm receptivity, the academy was resistant to the new rejuvenating technique. Professor Fernando de Magalhães stepped down as president of the Medical and Surgical Society because he refused to receive Voronoff officially. Most members of the Society, however, agreed to invite the Russian surgeon to give a lecture (*Diário de Minas*, July 19, 1928). During a later interview, Voronoff commented on Fernando de Magalhães' attitude: after all, he had traveled to Rio de Janeiro at the invitation of the steering committee of the *Jornadas Médicas*, whose vice-director was none other than the professor. The *Jornadas* were to commence on July 1 but had been postponed precisely because Voronoff could not be in Brazil by that date. During the interview, Voronoff argued that he had not come as a representative of 'French science', and that he had never presented himself as such, since he represented no one but himself. He called attention to the fact that he had earned an international name and pointed out that he was the only foreigner invited to give a course at the University of Cambridge.

After demonstrating xenotransplantation on a human, Voronoff grafted a sheep at this agro-industry's experimental station (*Posto Experimental do Serviço de Indústria Pastoril*). The process was the same but not the purpose. On man, the graft was meant to achieve longevity, while in animals the intention was to boost meat and wool production. Voronoff had the opportunity to go into greater detail about his technique: "Before applying the segments to be grafted, local traumatizing of the recipient organ is essential as well as the traumatizing of the inner parts of the segments so as to produce inflammation and natural irrigation" (A Noite, July 20, 1928).

Voronoff enjoyed broad coverage in the Brazilian media: the main newspaper columns featured articles on his method, his photograph appeared on the front pages, and caricatures and jokes

were constantly showing up in print. Everyone had heard of and talked about Voronoff:

The newspaper gossip has spilled into the streets, and now everyone talks about, everyone discusses, everyone in Rio reads, lunches, and dines on Voronoff. And since Rio supplies all of Brazil with its ideas and sensations, in every state of the country right now, anxious old men and women are dreaming about the wise Russian, boys are thinking up base jokes about his method, and an avid yet evil curiosity surrounds his name, his person, and his operations (Diário de Minas, July 21, 1928).

Voronoff's operations were deemed both simple and complex, divine and diabolical. He was called a 'relative' of Goethe's Doctor Faust. As simple as the surgery was, people started to view it with fear and alarm, and Voronoff became the 'magician of life'. He himself drew this comparison to Faust – though this didn't mean his patients had to sell their souls to the devil. Xenotransplantation was intended to restore lost youth and recover organs damaged by tumors, fractures, or wear-and-tear. In his opinion, the graft was the operation of the future, one that would make it possible to replace organs, tissue, or glands and improve people's quality of life.

The medical community, however, stuck to its position. When asked about rejuvenation methods during an interview, the physician and professor Miguel Couto said the doctrine was age-old. It had been developed in Brazil by Dr. Herculano Penna Filho, who had published an article on the topic in 1891; the method entailed injection of juice from the sex gland to achieve the same results. For Miguel Couto, Voronoff's method of operation was original "but its principle [had] long been part of our scientific heritage" (Diário de Minas, July 21, 1928).

Opothepapeutic medication was in fact already being produced at the Instituto Butantan, as this new type of remedy was gaining broader and broader acceptance inside the medical community with the development of endocrinology. Since 1916, this Brazilian institute had been interested in developing a sector of opotherapeutic products, something like the one at the Bacteriological Institute in Buenos Aires, Argentina. This medicine would be used when internal secretion glands were not functioning properly, a condition that was receiving greater attention in the medical sciences (Benchimol, Teixeira, 1993, p.114). It should be remembered that insulin was discovered in 1921, produced in 1923, and standardized for commercial purposes only in 1927, thanks to the research of Frederick Banting and Charles Best of the University of Toronto (Burnie, 2005, p.58). Animal research was essential to the discovery of insulin. Banting and Best injected an extract of islet cells from a healthy dog to one in the final stages of diabetes. The nearly dead

animal recovered immediately. On January 11, 1922, insulin was injected in a 14-year-old boy at death's door, and in a few days he had regained his health (p.59).

Voronoff offered free demonstrations to members of the medical community and had published a number of books on the topic. But as press coverage expanded and the subject caught on among the general population, some doctors grew apprehensive; they felt a medical topic should be discussed in a scientific environment, away from the eyes of public curiosity and safe from ridicule. After all, the *Jornadas Médicas* were not only about Voronoff. Physicians and scientists had other important matters to address; Alice de Toledo Tibiriçá, for example, was to speak on assistance for lepers in Brazil (*Diário de Minas*, July 21, 1928).

When Voronoff finally spoke before the Medical and Surgical Society, his audience comprised mostly young people. In his speech, he said the discovery of grafting was nearly as old as medical science, but that no one had previously come to the same conclusions he had, that is, that grafting could lengthen life and combat old age (*A Noite*, July 21, 1928). He believed xenotransplantation could have an important impact on society and should be offered to all the elderly, who could thus continue to engage fully in physical and mental activities and contribute to society through their work, without causing their families any onus. Remember that in the 1920s, Europe was feeling the loss of thousands of young people, killed in World War I.

Following the *Jornadas Médicas*, Voronoff went to São Paulo, where he visited the Instituto Butantan and spoke to the Medical Society (*A Noite*, July 23, 1928). Meanwhile, the discharge date for his patient in Rio, Feliciano Moraes, was drawing nearer. Journalists from *A Noite* interviewed the man at the hospital. They reported that Mr. Moraes looked just the same physically as before the operation and confirmed that the doctor had performed the surgery at no cost; in exchange, "because he needed" the operation, Mr. Moraes had agreed to allow the press as much access to him as possible. The article ended: "the 'rejuvenated' man is thus leaving the hospital just as old as he went in. But satisfied" (*A Noite*, July 2, 1928).

Commentators wrote about the contributions of Russian science and speculated about Voronoff's new treatment for extending life. They questioned whether man really knew how to apply his time to useful things. They prophesized: "Whoever wants to extend his life should, in the first place, not waste it. Conserving it is infinitely easier than extending it" (*Diário de Minas*, July 24, 1928). According to the same news item, Russians scientists like Voronoff, with his grafts, and Andrieff, with his resurrection processes, were the ones who were most concerned with the problem of longevity.

Texts on advances in Russian medicine mentioned Andrieff, or Andeinu, back then. The same jocular tone can be sensed in comments on the practice of ‘resuscitating’ people with an injection developed by the second wise Slav:

In our day and age, we have been preoccupied with extending life. Anyone witnessing these wise men struggling with this serious problem might even think that we know how to devote the days of our existence to useful matters. ... What is most interesting about all this is that the Russian doctors are generally the ones who have concerned themselves most with the issue of longevity. In Russia, life is a useless thing, which disappears from one moment to the next without much ado. Nonetheless, it is the land of Bolshevism that has brought us Voronoff with his simians and Andrieff with his resurrections. In this realm, the latter, a biologist, has ventured well beyond his fellow countryman and colleague, our illustrious guest. Voronoff requires that his clients at least have a breath left in them if he is to rejuvenate them. Andrieff does not ask as much: he makes the absolutely dead come back into circulation. As you can imagine, this is quite a bother for the heirs of the deceased (Diário de Minas, July 24, 1928).

In São Paulo, Voronoff was well received. Professor Antônio de Almeida Prado defended the use of his technique on human beings, since its efficacy with livestock had been more than proven. Dr. Moura Azevedo claimed he was the first in Brazil to use Voronoff’s technique, in 1926, and told reporters about this operation. He made mention of a homoplastic graft, that is, between members of the same species, but he asserted that the Russian scientist’s method was of unquestionable scientific value (Diário de Minas, July 24, 1928). Moura Azevedo, a surgical doctor, also reported to journalists on how the first operation using the Voronoff method in Brazil had gone (Diário de Minas, July 25, 1928).

On July 24, Voronoff went to Santos to catch a boat to Montevideo (Diário de Minas, July 25, 1928). It seems that before departing, he gave a conference at the local Medical Society, during which he was interrupted by a maniac (Diário de Minas, July 26, 1928). When he left, the Russian sage sent a telegram to President Washington Luiz, thanking him for the opportunity to get to know Brazil (Diário de Minas, July 27, 1928).

In Brazil, the surgeon became the topic of a book. Mendes Fradique⁴ was the author of *O Doutor Voronoff*, in which he described the Russian doctor as he appeared in the national imagination: a mixture of Mephistopheles and charlatan, capable of transforming old libertines into hale-and-hardy lads, fit for all the daring-do and excitement of a twenty-year-old (A Noite, July 27, 1928). The novel

⁴ Mendes Fradique was the pseudonym of José Madeira de Freitas (1893-1944), a humorist and storyteller from the state of Espírito Santo. He wrote the novel *O Doutor Voronoff*, which describes a fictitious visit by the title character to Vitória, capital of the state.

⁵ In her introduction to *História do Brasil pelo método confuso*, by Mendes Fradique (2004), Isabel Lustosa states that Voronoff was in Brazil in 1927, but he in fact came to Brazil in 1928 and received an autographed copy of the book from its author.

came out in 1926 to critical acclaim. Mendes Fradique's book also had a moral message: medicine should never assail God's commandments.⁵

But not even all this scientific fame saved Feliciano Moraes from graft rejection (A Noite, Aug. 1, 1928). Dr. Castro Araújo operated on the patient but the newspapers do not tell us whether the graft was removed or not.

The engineer Moraes must nonetheless be indignant, for under the best of circumstances, he will return to his old state.

Nothing more disagreeable could have happened to the patient! Mr. Moraes has suffered greatly: the pain of the operation, an entire month in bed, the nosiness of newspaper reporters, and other vexations. Now, the worst part: the failure of his operation. All sickness is unpleasant, but his case is even more painful. Mr. Moraes is not just another patient.

All of Rio de Janeiro, if not the whole country, has its eyes on his bed. He is the first, number 1 in the series.

Voronoff's very glory in Brazil lies at the head of his bed (Diário de Minas, Aug. 3, 1928).

Though news of the outcome was widely known, physicians were not discouraged by the suppuration of the graft. Dr. Edgard Tostes operated on an 82-year-old man using the organs of a laborer who had died shortly before (A Noite, Aug. 4, 1928). Nearly one month after Voronoff left the country, one newspaper reported on the pioneer work of a Brazilian country bumpkin from Virginópolis, Minas Gerais, who had performed grafts on animals in his corral (Diário de Minas, Sep. 18, 1928).

Rejuvenating solutions soon began appearing on the pharmaceutical market. Dr. Silvino Araújo took the title of "Brazil's Voronoff" when announcing his product, Fluxo-sedatina. In late 1928, a physician in Cambuquira claimed to have developed a rejuvenation method involving injections that acted on the nervous system. The doctor, Las Casas dos Santos, had earned his medical degree in Germany and was a disciple of Koch's (Diário de Minas, Dec. 15, 1928). The medicine was supposedly a kind of "long-life elixir," which could restore old energies. Dr. Las Casas had allegedly tested the injections on himself for five or six years, and the newspaper reporter wrote that the 65-year-old looked twenty years younger. Las Casas also explained that his hair was returning to its original color.

In February 1929, the papers carried the story of a load of monkeys that Voronoff had sent to professor Belmiro Valverde for use in experiments (Diário de Minas, Feb. 7, 1929). The paper highlighted news about the success of rejuvenating methods by scientists around the world: "A telegram from Italy reports that a well-known Italian physician, Francisco Cavazzi, has discovered a

new method of rejuvenation, involving hypodermic injections ‘based on the internal secretions of young, healthy animals’” (Diário de Minas, Feb. 10, 1929).

In Brazil, Voronoff was captured in music. Lamartine Babo and João Rossi wrote “Seu Voronoff” (Mr. Voronoff) in 1929, which tells of the scientist’s fame and the sad results of his method (Francisco Alves & Orch. Pan American, 1929):

<i>Toda gente agora pode</i>	Now everyone
<i>Ser bem forte, ser um taco</i>	Can be strong and healthy
<i>Ser bem ágil como um bode</i>	Nimble as a mountain goat
<i>E ter alma de macaco</i>	But with a monkey’s soul
<i>A velhice na cidade</i>	All the old folks around town
<i>Canta em coro a nova estrofe</i>	Have joined in the refrain
<i>Já se sente a mocidade</i>	They’re already enjoying the youth
<i>Que lhe trouxe o Voronoff</i>	Brought to them by Voronoff
<i>Seu Voronoff</i>	Mr. Voronoff
<i>Seu Voronoff</i>	Mr. Voronoff
<i>Numa grande operação</i>	Your operations
<i>Faz da tripa coração</i>	Take real guts
<i>Operado foi na pança</i>	A pretentious old man
<i>Um velhote com chiquê</i>	Had his paunch opened up
<i>Ele vai virar criança</i>	Now he’s like a kid again
<i>Das cartilhas do ABC</i>	Right out of a primer
<i>Um sujeito que operou-se</i>	One fellow had the operation
<i>Logo após sentiu-se mal</i>	And soon after felt quite ill
<i>Voronoff desculpou-se</i>	Voronoff apologized
<i>Que houve troca de animal</i>	He’d gotten his animals mixed up
<i>Seu Voronoff</i>	Mr. Voronoff
<i>Seu Voronoff</i>	Mr. Voronoff
<i>Numa grande operação</i>	Your operations
<i>Faz da tripa coração</i>	Take real guts

That same year, Noel Rosa wrote “Minha viola” (My guitar), also drawing inspiration from Voronoff:

...	
<i>Eu tenho um sogro cansado dos regabofe</i>	My father-in-law got tired of carousing
<i>Que procurou o Voronoff, douto muito creditado</i>	He went to the famous Voronoff
<i>E andam dizendo que o graft foi de gato</i>	They say his graft came from a cat

<i>Pois ele pula de quatro</i>	Now he crawls about the
<i>miando pelos telhado</i>	rooftops meowing
<i>Aonde eu moro tem um</i>	Where I live there's a bunch of
<i>Bloco dos Filante</i>	moochers
<i>Que quase a todo instante</i>	Who are constantly
<i>Um cigarro vem filá</i>	Bumming cigarettes
<i>E os danado vem bancando</i>	And those rascals are getting
<i>inteligente</i>	tricky
<i>Diz que tão com dor de dente</i>	They claim to have a toothache
<i>Que cigarro faz passá.</i>	That a cigarette will cure.

Conclusions

Voronoff undertook his work at a time when nothing was known about the mechanisms of rejection or the action of the immune system. The use of grafts was based on behavioral observations only, since there was then no concept of hormones nor was anything known about their role. Based on our current knowledge of the immune system, we can conclude that the xenografts done by Voronoff and his followers may have been condemned to failure. Peter Brian Medawar⁶ has described and analyzed the concept of tissue rejection in transplant operations (Nobel Foundation, 2006). The major histocompatibility complex (MHC) accounts for this result (Calne, 1985; Schwartz, 1988). T-cell reactions have a direct impact on the cell surface proteins of primate tissue, producing inflammation accompanied by necrosis. The polymorphism of MHC molecules and the high number of alternative forms of genes present in primates make it impossible for a simian donor to be compatible with a human (Schwartz, 1988; Alberts et al., 1994). Yet the literature indicates some apparent success, perhaps because Voronoff somehow managed to reduce the incidence of serious aftereffects, so his patients suffered from chronic rejection, which brought a slow and steady deterioration of their clinical state. Another pertinent clinical aspect is that his grafts may have prompted no immune response, since testicles, like the eyes and the brain, are immunologically advantaged regions protected against an immunological attack by the host (Janeway et al., 2002).

Is the thyroid also an immunologically advantaged organ? According to the documentation we researched, apparent psychological improvement was noted; photographs are shown of children before and one year after xenotransplantation of the gland and also of elderly patients before and four years after a testicular xenograft. Voronoff limited his observations to physical aspects and vitality. But his publications report some cases in greater detail, such as the case of a Brazilian woman from São Paulo at the beginning of the century. Voronoff (1939) also states that he was invited to work with professor Max Thoreck, of the University of Chicago, and that he took part in the first steps to develop protocols for implants at that university.

⁶ Peter Medawar, winner of the Nobel Prize in Medicine or Physiology in 1960, was born in Hospital Santa Teresa, Petrópolis, the town where he lived with his parents until he was 14. His parents spent forty years on João Caetano Street, in the neighborhood of Caxambu (Nobel Foundation, 2006).

Equally noteworthy is that Voronoff's procedures between the 1910s and 1930s involved direct contact between a large number of patients (around two thousand, according to him) of different nationalities and the tissue of simians. Such procedures could allow the human species to absorb pathogens from the donor species, which raises the hypothesis – even if remote – that the simian immunodeficiency virus may have been transmitted to a population of patients who apparently suffered from sexual disorders. We know that SIV infects a wide variety of African primates by nature and has also been found in Caribbean primates. It is also known that this virus displays multicompartmental localization in different tissues and organs (Goldstein et al., May 2006; Pandrea et al., Jun. 2006). Voronoff described the primate species he used and that were present in his laboratory ("*hamadreas, Cynocéphale-papion e Magot ...*"); from photographs, it can be seen that these are *Pan troglodytes troglodytes* and *Cercocebus atys atys*. Today these species are recognized as precursors of HIV-1 and HIV-2. The scientist captured primates in areas of equatorial Africa now constituting Congo, Sudan, Guinea, and Cameroon, as well as Gibraltar, which is where the species related to human HIV originated (Reeves, Doms, 2002; Keele et al., July 28, 2006; Gao et al., 1999). As the most virulent and easily transmitted agent, HIV-1 spreads rapidly. The virus most similar to HIV-1 is SIV, identified in the chimpanzee subspecies *Pan troglodytes troglodytes* in captivity.

Based on current scientific knowledge, we believe Voronoff's xenografts of the 1920s and 1930s may have been one of the possible means by which this virus was introduced into the human species. Using genetic sequencing, researchers can now estimate the moment of virus mutation. Molecular studies place the passage of the virus from chimp to man with the occurrence of the HIV-1 M group sometime between 1915 and 1941 (Korber et al., June 9, 2000; Apetrei, Robertson, Marx, Jan. 2004; Zdenek, 2001). These facts challenge Oriol (May 2001), who has stated that Voronoff's patients cannot be linked to AIDS since the virus originated in African monkeys many decades later.

Another fact merits investigation. Kaposi sarcoma, a rare type of cancer, was first described in 1872 by the Jewish physician Moritz Kaposi (1837-1902), who called it idiopathic multiple pigmented sarcoma (Schwartz, 1988). In the 1910s it was once again observed in Europe, where it received its current name. So-called classic Kaposi sarcoma, that is, not related to AIDS, is more frequent in central Africa and among the European Jewish population. It is also seen in people who have received transplants and whose immune system has been suppressed (Schwartz, 1988). It would thus be wise to research the possible presence and progression of this disease in reports written by Voronoff's followers in the medical

field, in order to investigate how these protocols influenced the epidemiology of HIV in the twentieth century.

Lastly, we would like to call attention to how the curious history of Voronoff came to influence popular Brazilian culture, as illustrated by Noel Rosa's, Lamartine Babo's and other Brazilians' references to the physician. Always in a joking tone, the mass media back then did not fail to report on the limits of this amazing technique: "The news of the disaster swept through the country. The elderly, above all, are in a panic. If Voronoff comes back here, no one will risk it. By sacrificing himself, Mr. Moraes has saved a great number of future victims" (Diário de Minas, Aug. 3, 1928).

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Received for publication in July 2006.

Approved for publication in November 2006.