The reign of hormones and the construction of gender differences*

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Within the context of the theoretical debate on gender and science, the article discusses the process of redefining gender and sex differences using so-called 'biological' or 'natural' markers. It identifies how gender differences undergo naturalization using a logic of 'substantialization' or 'materialization'. This process is exemplified in how medicine views women, promoting explanatory models of economics of the female body that are at times centered around organs like the uterus and ovaries, at other times centered on the mechanics of hormones, and, most recently, focused on genetic and neurological differences. More specifically, it follows the discovery of so-called sex hormones and its relation to a dualist perspective of gender. These powerful chemical messengers helped shaped the passage from the logic of excess surrounding sex through the late 19th century, to the imperative of insufficiency, prevalent since the mid-20th century.

Keywords: gender; sexuality; hormones; history of science; history of medicine.

The first months of 2007 saw the launching of two major publicity campaigns by the pharmaceutical industry. The first, by Schering laboratories, revolved around 'androgen deficiency of the aging male', also known by the acronym ADAM. According to campaign advertising, which has already hit the Brazilian media, a disorder called 'andropause' is "directly linked to decreased testosterone production after the age of 40"; the main symptoms are loss of libido (sexual desire), decreased muscle mass, loss of energy, depression, erectile dysfunction, and increased risk of cardiovascular disease (*Época*, 26 mar. 2007, p.11). The second campaign – limited to the European market, with no forecast release in Brazil – was to promote the drug Intrinsa, which Procter & Gamble Pharmaceuticals has announced as the "female Viagra". The skin patch promises to boost the libido of surgically menopausal women who have had their ovaries and uterus removed. Once again, the substance in question is testosterone, a hormone that is linked to sexual desire and that is replaced in the blood stream by this drug (*Época*, 2 abr. 2007, p.28).

We have seen an increasing number of science magazines or books, and even articles in wide-circulation newspapers and on television programs, devoted to discussions on the importance of hormones to our health and well-being and the significant role they play in certain behaviors. The more up-to-date or advanced the article, the more likely it will also address the brain-hormone link and delve into the innate, insurmountable differences between the sexes. The idea that our hormones determine everything, even our behavior towards the opposite sex and our intelligence, appears to be gaining ever more followers. We even hear the term 'hormonal intelligence' and similar references. We are witnessing the reign of a 'hormonal body' that appears to override or underpin all other current biomedical conceptions, at least if we look at how a growing portion of the public has embraced this notion.

Likewise hard to contest is the observation that women have much more often been the focus of discourses about the hormonal body, not only in the scientific realm but also among the lay public. This is the case, for instance, with talk about female physiology and about how hormonal transformations inherent to women's unstable, cyclic states 'inarguably' govern their lives. Phenomena like 'pre-menstrual stress' (PMS) or changes during menopause have served as keys to explaining the most varied types of behavior, in addition to feeding a huge industry for treating 'female troubles'. Furthermore, the claim is that hormones lie at the source of intellectual differences between men and women, a 'fact' that little could be done about. A common recommendation is that we understand and admit to these essential differences.

The present article explores some facets of the genesis of these ideas and the reasons behind their overwhelming appeal. My approach is to place produced science within its context, taking into account the intimate interactions between social milieu, the actions of scientists, and the products developed. In this specific case, the analytical dimension of gender relations is vital, since I suggest that certain fundamental stances in the field have been prompted precisely because of gender-related tensions. When we analyze the intentions of scientists, the weight of universities or research institutes, the power of laboratories, the social movements involved, and the broader political field as well, we are dealing with processes of multiple origins and of varied and unexpected results. But we can definitely

identify certain vectors that make us think about virtually permanent or deep-rooted dilemmas in our society. I posit that the history of hormones is one of those cases that can reveal something of this nature and, further, that the gender dimension plays a large role here.

A recounting of what happened with medical conceptions around 1900 quite efficaciously demonstrates the prevalence of a hormonal body model. Within a short space of time an extremely significant change occurred in the understanding of the female body and behavior. To illustrate this change, I will use arguments found in scientific work, such as theses presented at the Faculdade de Medicina do Rio de Janeiro, articles and ads appearing in periodicals, and debates at medical institutions. This material acquires new contours when examined within the context of international developments in the field of hormone research.

A great transformation took place in this period: the female reproductive organs, especially the ovaries, had first been seen as the main culprits behind women's physical and mental disorders, and the solution advocated was surgical removal. This shifted to a phase when problems were blamed on 'ovarian failure', and women were prescribed some form of replacement of the secretions produced by the ovaries, newly viewed as essential to the smooth functioning of the female organism and to a woman's mental equilibrium. Before examining accounts of this shift, we should note that the predominant view on the Brazilian medical scene, and in other settings as well, identified the female sexual and reproductive organs as the center of the economics of the female body. Women were seen as governed by cycles related to reproduction – from puberty, pregnancy, and nursing through menopause. According to this viewpoint, virtually all female behavior could thus be explained, even what had previously been perceived as a manifestation of a disorder.[1]

Starting in the latter half of the 19th century, the relation between the genital organs, female sexuality, and broad, unstable illnesses became one of the chief focuses of concern for physicians. In order to treat these diseases, doctors were to devote themselves to developing a substantial gamut of treatments, including surgeries and seclusion.[2] Furthermore, in some cases – such as post-partum madness – doctors believed the consequences of female disorders could extrapolate the realm of the individual and affect society as a whole, since these disorders were thought to provoke acts harmful to the public good, such as the crime of infanticide. This is in fact a realm of disorders that begin with the female body, mind, and morals, moving from there into society. It was within this vast, indefinite terrain that physicians, and especially gynecologists and obstetricians, were to engage in their practices (see Rohden, 2003).

In the medical production published in Brazil, the link between the female genital organs and functions, on the one hand, and mental disorders on the other appears in different forms, from hysteria to post-partum madness. The topic of menstruation, for example, was rediscovered in the 1890s, in the form of interpretations of the disorder.[3] Menstruation was viewed as a unique way of expressing the unstable, vulnerable character

of a woman's physical and mental make-up. During critical phases of their menstrual lives – from their first period during puberty to the last one at menopause, and throughout the time in between – women were seen as subject to powerful disturbances. It was almost as if women by their very nature border on the pathological. Although the manifestations of this condition might display physical features, as diagnosed by doctors they were mainly mental. Sometimes the relation between these two realms was actually so intertwined that it became impossible to decide which predominated. The genitals appeared to have a singular ability to interfere in the structure of the female mind.

It is within this context that we can understand the frequent references to surgical interventions for treating various maladies afflicting women, especially the oft cited practice of ovarian castration, or ovariotomy.[4] In principle, this surgery was meant to be used to remove diseased ovaries, with cysts. But its use continually broadened, and we find frequent references to this type of intervention as a means of definitively curing mental disorders associated with the genital organs.[5]

Starting in 1866, the ovariotomy began appearing in theses written at the Faculdade de Medicina do Rio de Janeiro. In the 1870s and 1880s, the topic captured the attention of ever greater numbers. Later, in 1895, only one reference is found. Within this group of theses, I found no case in which ovariotomies were directly or exclusively recommended to cure mental disorders. Instead, the theses always put in first place the curing of ovarian cysts. But in every one of them, there is a reference – even if only indirect – to the link with mental problems. The heated debate underway in Europe and the U.S. was in fact finding echo in Brazil (Maia, 1866; Rego, 1871; Vasconcellos, 1872; Silva, 1873; Carvalho, 1873; Santos Filho, 1873; Silva, 1878; Fontes, 1880; Assis, 1881; Silva, 1881; Falcão, 1881; Araujo, 1881; Gomes, 1883; Nunes, 1883; Silva, 1883; Vasconcellos, 1895).

The work of José Rodrigues dos Santos Filho (1873) underscores the major polemic that surrounded ovariotomies before they eventually took their legitimate place at the service of humanity. According to Santos Filho, this was one of the most valuable techniques within the surgical arsenal of that time. Practiced since the beginning of the century, it had been the glory of many physicians in England starting in the 1840s – among them, the famous Spencer Wells and I. Backer-Brown. Historically, France had demonstrated greater resistance. The operation was first tried in Brazil in 1839, and later in 1865 by doctor Saboia, this time successfully. In 1870, Feijó Filho also performed surgery to remove the ovaries. Although Santos Filho makes no direct references to the operation's relation to mental disorders, he does mention that the ovariotomy traced its roots to a father's wish to curb his daughter's sexual desires through castration. In addition, one of the Englishman cited by Santos Filho – i.e., I. Backer-Brown – was involved in a broad polemic that grew out of the abuses committed through castration and cliteridectomy, aimed at squelching female sexual excesses (Rohden, 2001, p.75-76; Kent, 1990; Scull, Favreau, 1986).

Miguel Archanjo da Silva's thesis is more explicit: the author states that the ovariotomy was used to "curb the sensuality of certain dissolute women" (1873, p.8). He declares that this surgery had raised undue suspicions among doctors and that it was regaining its rightful value. One of the problems mentioned was the high mortality rate, which by then had dropped substantially. He cites Spencer Wells' statistics to prove these findings.

Of the five hundred ovariotomies performed by the English gynecologist, the mortality rate had been 'only' 25.4%, a figure Silva felt was quite satisfactory.

Over time, the idea of curing mental disorders through this surgery gained ground, and theses began exploring the topic in greater depth. By the turn of the century, the question was on the order of the day and the object of quite contradictory assessments. Defended in 1901, Urbano Garcia's thesis *Da intervenção cirúrgico-ginecológica em alienação mental* [On surgical-gynecological intervention in mental alienation] represents the position of proponents of the surgery well. Garcia reported that this was one of the hottest issues among doctors at that time; based on cases he had observed in a number of hospitals, he concluded that this surgery would be the future of psychiatry as well. According to Garcia, the data presented at the annual congress of the British Medical Association by Hobbs, director of the London asylum, proved that the operation achieved positive results. In 80 cases, between 30% and 37.5% of the patients recovered; between 18% and 22.5% presented substantial improvement; between 28% and 35% experienced no changes; and only 4% or 5% died (Garcia, 1901, p.9).

For the author, these operations presented fine results because the reproductive organs allegedly impacted brain activity. From this perspective, he observed:

> The preponderant utero-ovarian impact on mental life has been pointed out for quite some time; it is not legitimate for us to doubt there is a complex mechanism, a set of reflex acts, a set of multiple sensations, an unconscious mental processing, and that physical sensitivity is a powerful agent in which all physical as well as organic phenomena are intimately linked to each other through relations of causality" (Garcia, 1901, p.15).

The relation between gynecological problems and mental disorders was corroborated by the 'fact' that most of the insane presented lesions on their genitals. According to Picqué and Febvre, 89% of those committed to the Évrard asylum suffered from gynecological disorders. This situation was echoed at the Casa de Saúde Dr. Eiras hospital where Garcia himself worked. The author added that in most cases these illnesses preceded or developed in parallel with mental illness. Garcia believed it was vitally important for patients entering the asylum to undergo a thorough examination that might detect any lesions, especially inflammatory ones. Once a diagnosis had been made, surgery would be the most indicated procedure.

The author regretted that only a few patients had been operated on at the Casa de Saúde Dr. Eiras until then; he reported on the six cases in which the surgery was performed between 1895 and 1900 (Garcia, 1901, p.21-33). The summary of these descriptions helps us understand the conceptions at play and lets us appreciate the concrete ordeals surrounding these surgical interventions. According to clinical observations, the women presented symptoms such as alcohol abuse, exaggerated irritability, melancholy, stupor, suicide attempts, ideas of persecution, hallucinations, and so on, in association with menstrual irregularities, endometrites, papillomas, cervical atresia, and other maladies that warranted surgical intervention. The case of M. J. provides a good example. She was a 29-year-old married, multiparous white Brazilian woman who was hospitalized in May 1896 because she was "behaving in an inappropriate manner", engaging in extramarital sexual

relations with "three low-class men". Committed and unable to leave, she began suffering from "nymphomania" and "casting libidinous looks at members of the opposite sex". Her treatment was uterine curettage. In September of that year, M. J. left the Casa de Saúde "cured". Her disturbances later returned, however, and she was then committed to the Hospício Nacional dos Alienados, where she eventually passed away.[6]

From these descriptions, we can perceive that these were young women presenting deviant conduct. In the opinion of the doctors, such behavior characterized mental problems and was serious enough to warrant seclusion. Each woman's inherited qualities, which could consist of a wide variety of traits, helped define or legitimize medical decisions. What is most remarkable is how readily an association was drawn between problems involving the genital organs and mental disorders. Garcia writes as if this link were obvious and as if it were even more natural to operate on the genitals as a way of eliminating mental alienation. Moreover, the conclusion of his thesis indicates that from the author's viewpoint, these cases validated the argument and the success of this approach (Garcia, 1901, p.35).

Around the same time that Garcia was defending his thesis, another aspect of this surgery and particularly of the removal of the genital organs entered the discussion: to what extent was the integrity of these organs important to a woman's mental health and to maintaining sexual desire. The debate that took place at a session of the Rio de Janeiro Sociedade de Medicina e Cirurgia (*Brazil-Medico*, 1901, p.389) indicates how these doubts had come to the fore. It all began when Dr. Vieira Souto used the occasion to present an anatomical-pathological specimen from the Society's museum. It was a uterine fibroma that he had excised from a patient at the Casa de Saúde de São Sebastião. Since the woman suffered from constant metrorrhagia, the decision was made to perform a supra-vaginal uterine amputation. Vieira Souto made the case public to demonstrate that while some women were leery of losing their 'genesic sense' after the surgery, these fears were unfounded. The widespread nature of this fear was a serious problem, since it meant some women would only go to a surgeon once their problem had progressed quite far. The doctor declared it necessary to combat this prejudice, which was belied by the data. In his own experience, of the twenty-four to twenty-five ailing women he had submitted to utero-ovarian castration, the 'genesic sense' of two had remained intact.[7] He added that his observations were confirmed by the work of Jaonny Roux entitled *Psychologie de l'instincte sexuel* and by other authors, like Richet, Talbot, Havelock Ellis, Gloevecke, Jayle, and Guinard. Drawing inspiration from the latter, he declared there was no serious psychological reason that would make castration responsible for the complete disappearance of sexual appetite or would completely hinder realization of the sex act.

Dr. Daniel de Almeida, who spoke next, said he had already addressed this issue. He stated that he agreed with the preceding orator because many of the women he had operated on said they had experienced no change in their sexual appetites, when asked about it. Dr. Moncorvo Filho, on the other hand, pointed out that the nervous system wields the greatest influence over the loss or preservation of the genesic sense, and the phenomenon should thus vary in accordance with the specific conditions of each woman undergoing surgery (*Brazil-Medico*, 1901, p.389).

This account shows that the topic was earning the attention of doctors and that no definitive, absolute position had been arrived at yet. Still, there was apparently a tendency

to believe the surgery did not harm sexual desire. Moncorvo Filho, however, brought up the primacy of the nerves, raising the question of the source of sexual desire and the relation between the genitals and mental functions. Garcia's thesis, defended that same year, recommended genital surgery as a way of treating mental alienation, one possible sign of which was intensification of sexual desire.

Some years later, in 1904, this debate took a bit of a turnaround. A thesis by Theodorico T. da Silva e Souza is uniquely helpful to understanding what took place then. According to the author himself, he wrote his first thesis on the topic of ovarian failure, that is, the set of disorders provoked by hypofunction of the ovarian gland (Souza, 1904, p.3). Souza traces the history of how this clinical presentation was identified, starting in 1889 when Brown Sequard presented a communication before the Société de Biologie in Paris on the importance of testicular fluid. The French physician had injected himself with the fluid, of animal origin, and experienced noticeable rejuvenation as a result. Brown Sequard was the first to classify the testicles and ovaries as glands of internal secretion and to posit that these secretions influenced the nervous system. According to Souza, valuable work endeavoring to demonstrate the existence and importance of these substances had been underway since the mid-1890s (Souza, 1904, p.14-21).

A good number of these studies had been devoted to proving that women experienced a series of disorders following an ovariotomy because there was no longer any internal secretion by the ovary. Consequently, the organ gained importance within the overall economics of the female body. It became commonly accepted that the ovary, in addition to its external secretion – that is, the production of ova – is also an internal secretion gland. The discussion of extractive surgeries was reopened, and the idea was developed that these internal secretions should be replaced when a woman had already undergone surgery or when an operation was inevitable, due to a lesion. The method used was 'ovarian opotherapy', that is, a treatment involving replacement of the substances produced by the ovary. Some doctors claimed they had already obtained positive results through this treatment, including the eminent Jayle, who used the method on castrated women (Souza, 1904).

Souza (1904) argued that a wide gamut of problems occurring in women's lives are due to the ovaries. They would account for the physical and mental disorders of puberty. Internal secretion by the ovaries would play a role in these changes, which affect the entire female organism during this stage of life. Diseases – like chlorosis, for example – were discussed from the angle of this new conception. In menopause, the absence of this secretion was allegedly the chief reason for all accompanying maladies and imbalances. The same thing would occur, for other reasons, if a woman were deprived of her ovaries during the productive stage of her life. If the ovaries were surgically extracted, the woman would enter a kind of artificial menopause and would then grapple with the same order of menopausal problems. The most remarkable consequence of castration would have to do with mental disorders and decreased desire and pleasure during coitus. In other words, this way of thinking supported the link between castration, mental disorders, and the absence of desire. But this time, the explanation involved specifically ascertaining the function of the substances produced in the ovaries.

The author relied on statistics to show how these facts had been firmly proved. Animal experiments were also claimed as corroborating the new theory. Souza (1904) transcribed tables on experiments conducted in Europe (and repeated by Souza himself in Brazil) with female dogs and rabbits. In all cases, the method was castration, followed by ingestion of substances produced in the ovaries. As far as women, the author stated that following a diagnosis of ovarian failure, the treatment should take two forms. The first, indirect, method would be marriage, or the exercise of sexual functions, as a way of stimulating and awakening the functioning of the ovaries, if still intact, even if only partially. The second, safer method – and which should be preferred – was 'ovarian opotherapy' using animal ovaries. Pharmaceutically, there were three choices in this case: raw ovaries, ovarian fluid, and dissected ovary, also called 'Ovarine'. The doctor should choose the best option for each case and prescribe periodic ingestion. Souza stated that ingesting these substances could even re-establish menstrual periods. As ultimate proof of the adequacy of this treatment, Souza described ten observations of ovariotomies, some of which accompanied by hysterectomies, performed because cysts or other lesions were present. In all cases, Ovarine treatment was used and the patients allegedly got better. In these cases, the symptoms upon which the diagnosis of ovarian failure was based were mainly heat vapors, headache, pain, and insomnia.

Ovarian failure remained on the agenda from then until at least the 1930s.[8] The problem began to be framed within the development of a new medical specialty: endocrinology. In 1917, a thesis by A. Americano do Brazil cited the important role that French doctor Brown Sequard, renowned and polemic pioneer, played in the advance of this field. Even then, the text was speaking of endocrine organs and hormones. Gabriel Duarte Ribeiro's thesis, defended in 1922, placed ovarian failure in this context. Ribeiro affirmed that the problem was caused by endocrine gland failure. He provided in-depth description of the anatomy and physiology of the ovaries and detailed the consequences of castration. He explained that after this kind of surgery, the uterus atrophies, as do the external genital organs. Patients gain a great deal of weight and their nervous systems undergo major changes. The author added that the best solution for these cases would be an ovarian graft, in which an ovary would be removed from a healthy woman and implanted in a castrated one. But this technique faced the huge challenge of finding donors willing to give up a healthy ovary.

Since the grafting method presented a number of downsides, the most often used option seems to have been drug-replacement of missing hormones. This phenomenon was observed in our analysis of the pages of the journal *Revista de Gynecologia e d'Obstetrícia*, in the 1920s when the sale of products with hormone components was of special note.

'Opotherapy' or the use of 'hormonal sera' was apparently one of the great novelties of that time, proclaimed as the solution for a wide variety of problems. The compound Thelygan (Fig. 1), for example, contained "sterilized extract from the ovaries of young cows", among other ingredients, and was indicated for "all maladies of the female sex life", such as "general nervousness" "overtiredness after physical and intellectual labor", "menstrual disorders", "chlorosis", "genital weakness", "sterility", "frigidity", "cosmetic flaws", and so on. Along the same line, doctor Aché (Fig. 2) proposed "hormonal sera"

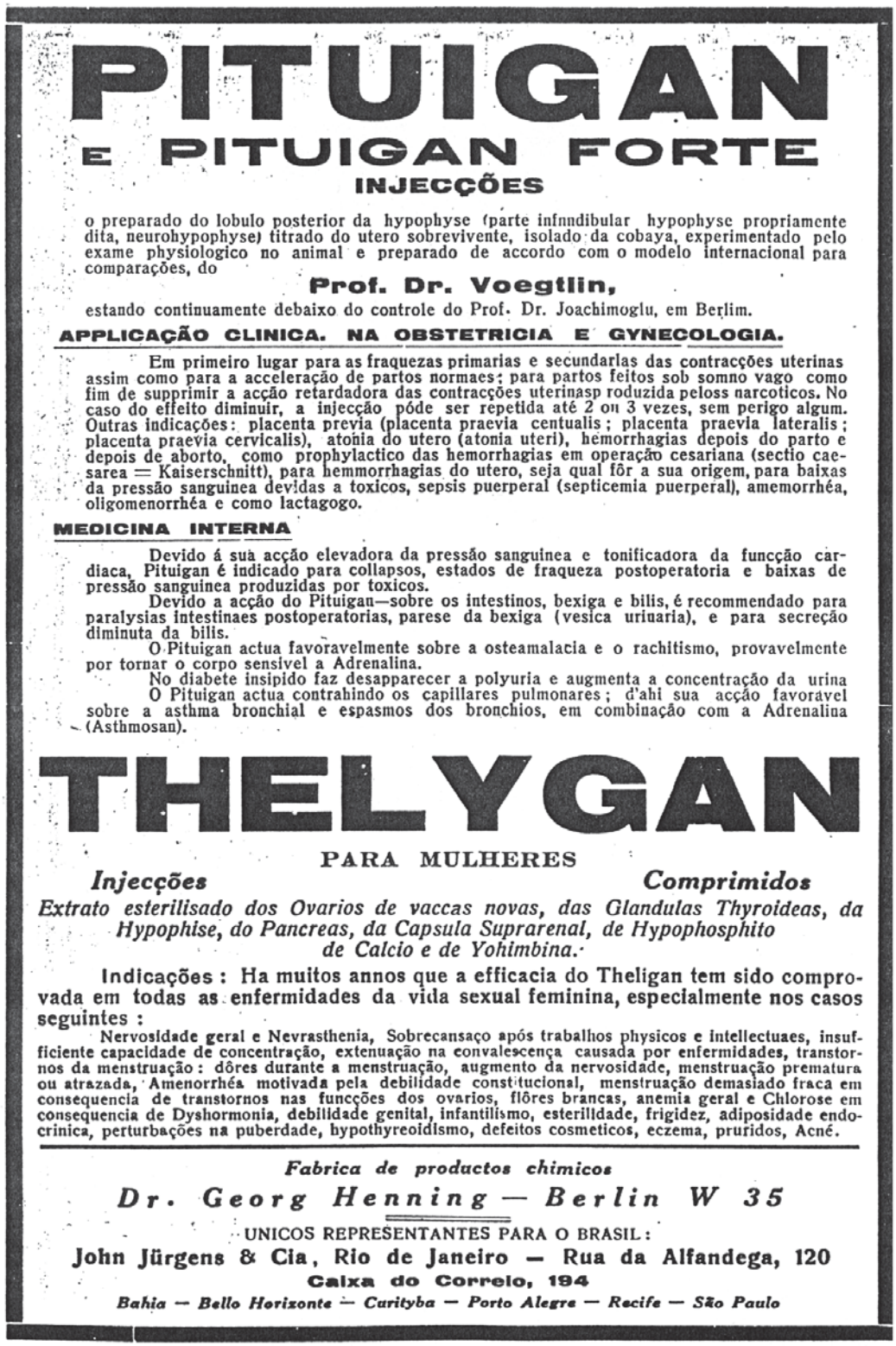

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Figure 1 – Advertisement published in *Revista de Ginecologia e d'Obstetricia*, v.22, n.6, Jun. 1928

from “separated sexes”, which had yielded excellent results in one case of “psychoneurosis with ovarian failure”. The illustration appearing with this advertisement notably reveals eugenic inspiration: a horse – which evokes the desire to create a ‘human stud-farm’, a recurring theme among some eugenicists back then – surrounded by the sentence “The soul lies in the blood”. The Silva Araújo laboratory (Fig. 3) also sold “sexual hormones”, composed of “injectable pluriglandular combinations”, as well as “hormovitamins”, which

Figure 2 – Advertisement published in *Revista de Ginecologia e d’Obstetricia*, v.20, n.11, Nov. 1926

were a combination of "food hormones" and the "components of internal secretion glands". In terms of menopause itself, we can see the forerunners of today's popular hormone replacement therapy in the illustration of "Klimakton" (Fig. 4), "proven effective" against "menopausal disorders" by acting simultaneously on the nervous and glandular systems.

Scientific discoveries regarding hormones and the workings of the menstrual cycle assigned ovaries a role in defining the female nature. In fact, ever since the final decades

Figure 3 – Advertisement published in *Revista de Ginecologia e d'Obstetricia*, v.21, n.9, Sept. 1927

Figure 4 – Advertisement published in *Revista de Ginecologia e d'Obstetricia*, v.22, n.6, June 1928

of the 19th century, at the height of the ovariotomy trend, there was much debate about the role these organs played in women's proper physical and mental functioning, not just in Brazil but in Europe and the U.S. as well. Tracing the general lines of this debate, Ornella Moscucci (1996, p.134-164) stated that many doctors were against ovariotomies because they left women sterile and deprived them of their sexual desire while endowing them with male characteristics.[9] This de-sexualization of women was seen as a threat to marriage and to the sexual division of labor, judged the two main pillars of society and nation. In the case of England, which is the context analyzed by this author, feminists were on the same side as the doctors who condemned ovariotomies[10], who believed castration divested a woman of her true essences and of the fulfillment of her destiny as a mother and as the moral leader of society.[11]

In the early 20th century, there appeared new scientific arguments condemning ovariotomies. At that point, the ovary was transformed into the organ that concentrates femininity and enables a woman to reproduce. Its presence became indispensable, and castration moved into the background. From then on, the reference point for evaluating a woman's health and her very identity has been her ovaries. And the substances produced by this organ dictate a woman's difference from men and testicular secretions. If women who had been castrated or who were in menopause had been devalued earlier because they could not reproduce, now the absence of substances seen as defining a woman's sexual characteristics were added to the mix. It can be said that a new account of the

difference came into being, embraced by the specialties emerging within the context of endocrinological discoveries.

It is curious that we see the link between female behavior and reproductive organs being reaffirmed here – more specifically speaking, the link between mental or moral disorders and problems with the ovaries. But what truly occurred was a reversal. Until the turn of the 20th century, ideas about female sexuality or the very concept of femininity, which was so clearly evident in women's different cycles, centered on the notion of excess; the next phase, however, was marked by the notion of deficiency, from ovarian failure – seen as representing a lack or absence of femininity, expressed in different ways – to sexual desire and the ability to procreate. In step with this trend, proposed treatments also changed. Instead of removing potentially dangerous ovaries, the touted approach was to replace the substances they secreted so women could recover their physical and mental equilibrium. We leave behind a logic of excess that should be curbed to a logic of a deficiency that needs to be compensated for; even today this viewpoint governs ideas about gender differences and especially about male and female sexuality.[12]

The description of this shift from one logic to the other compels us to try to understand what may have influenced the process. A fundamental event was certainly the history of the creation or discovery of so-called sex hormones.

The topic of the creation of hormones has merited studies that while still limited are so commanding that they cause us to reflect on science in general and on gender relations in particular. The 'discovery', nomination, marketing, and publicizing of these new entities constitutes a privileged case for analyzing the production of science and its relation to the contexts that surround and determine it. Various aspects have been addressed by renowned authors in the production of gender and science, such as Anne Fausto-Sterling (1985; 2000), Ruth Bleir (1997), and Londa Schiebinger (2001), in the anthropology of the body; Emily Martin (2006); or Vern Bullough (1994), in the history of interventions in sexuality. Perhaps not as well known by the broader public, of special note are two studies that taken together paint a fine trajectory of the establishment of hormones, including negotiations between the scientific field per se, medical intervention, the role of the pharmaceutical industry, and the role of other central social actors, like the media and social movements, especially feminism. In *Beyond the natural body: an archeology of sex hormones*, Nelly Oudshoorn (1994) describes the birth of sex hormones, the processes of measurement and reproduction in the laboratory, debates about nomenclature, marketing, and the dramatic appearance of the birth-control pill and its first mass-scale tests. In *Reinventing the sexes*: the biomedical construction of femininity and masculinity (1997), Marianne Van Den Wijngaard paints a strong feminist critique of science in her analysis of the scientific theories explaining the difference between the sexes, above all in the field of the neuroendocrinology of behavior.

For the purposes of the present article, we will take a look at some landmarks in the history of hormones. In Oudshoorn's extremely comprehensive version (1994), creation of the 'sex hormones' involved the interaction of three main groups: practicing physicians, especially gynecologists; laboratory scientists, from physiologists to biochemists; and the pharmaceutical industry. From the late 19th century until 1910, these three groups acted independently, with gynecologists enjoying a key position since they had a monopoly over knowledge of the female body and since their direct access to patients allowed them to conduct experiments and collect substances. Laboratory scientists were using animals to research hormones while pharmaceutical companies were already gathering large quantities of material from slaughterhouses. As of the 1920s, the pharmaceutical industry began to play a determinant role as the collection of large amounts of material in order to isolate hormones became requisite. This trend was accompanied by a shift from a biological model to a biochemical model of the human body.

Until at least the late 19th century, there was a clear search for an organ that would explain the difference between men and women, but in the first decades of the twentieth, the challenge became understanding how the substances produced by the gonads accomplish this process of differentiation. If the ovary had earlier been seen as a center that encapsulated femininity, as the testicle did in the case of masculinity, now it was a matter of discovering the mechanism that produced femininity and masculinity. The biochemical paradigm of cause and effect determined what to look for and how far the explanations should go. It was within this context of tracking down the ultimate causes of these phenomena and of a sharp relation between gender and physical-corporal sex – first substantiated in the organs and now in internal secretions – that the so-called sex hormones were 'discovered'.

The concept of hormone was first formulated in 1905 by Ernest Henry Starling, a professor of physiology at University College in London who had already spoken of the chemical substances produced by certain organs, which were capable of affecting other organs through the blood stream. From then until the 1920s, the prevailing notion was that specific hormones were produced by the ovaries and the testicles, unique to each sex and equipped with a unique role in determining gender. This meant female hormones could only be found in women and would determine their sexual characteristics, just as male hormones were unique to men and would determine their masculine characteristics. However, starting in the 1920s, animal experiments indicated that both types of hormones were found in males and females. Despite the clear-cut scientific evidence, there transpired no immediate transformation to the field. The new data were received with great resistance and discomfort, and only a decade later was a new relation between hormones and gender accepted. In the 1930s, experiments in which female hormones were found in males – and, garnering notably less attention, in which male hormones were found in women – were still described with amazement. A quantitative difference in the presence of hormones typical of males and of females was gradually demonstrated. Although scientists had ascertained that the origin and function of the hormones was not exclusive to either gender, practicing gynecologists continued to employ the dualist model. As we know, what still holds sway today is a common notion that may not reaffirm the existence of

gender-specific hormones, but does posit an intimate tie between certain types of hormones and certain types of bodies. According to Oudshoorn (1994), the pre-scientific idea of gender dualism, so influential since the Victorian age, continued to lend direction to the scientific production and discoveries of the early 20th century.

One important aspect of this process is how claims about gender also determined that men's and women's bodies received differentiated access to and treatment by science and medicine. We saw earlier how gynecologists enjoyed a central role as far as access to patients as well as to the substances they produced. In contrast with men, women had greater access to the doctors who wanted to find explanations and treatments for the 'dysfunctioning' of their sexual organs. Furthermore, when the production of drugs based on hormone research eventually got underway, women were already part of the network that started with scientists, involved laboratories, and ended up in the doctor's office. As a result, women were more often reached when it came to testing and marketing products. It is especially noteworthy that marketing of male sex hormones met with failure, as did the attempt to create a clinical entity similar to menopause (Oudshoorn, 1994). One of the effects of these concrete conditions in the field, allied with historical differences in treating male and female sexuality, was a more radical transformation of the female body into a hormonal body.[13] From then on, the whole body/mental economics of women has been determined by hormones.

It must also be added that, pursuant to the nineteenth-century logic that purported a tight connection between the sexual/reproductive organs and mental disorders, the new hormonal model also addressed these disorders in terms of hormones. What underlies this is a perspective so radically centered on the power of chemical messengers that a series of other phenomena are seen as encompassed by them. If until the turn of the 20th century, women were ruled by their ovaries – the organs of femininity – now they are ruled by hormones – the substances that determine their sex and gender. To understand this, we must keep in mind the fact that the history of hormone research is also a history of the interest in studying behavior, especially behavior differentiated according to sex.[14]

According to this new model, the disorders that had been treated by removing the ovaries could only be resolved by taking into account hormone balance. Hence can we understand the transformation from a standard based on excess, to another one, centered on insufficient femininity and the ensuing need to replace substances typical of women. The push to market hormone products headed in this direction. Oudshoorn (1994) points out that the first clinical tests of these drugs, back in the early 1920s, were limited to the treatment of menstrual disorders, mainly amenorrhea. Until 1927, its uses were primarily limited to gynecological practice, including the treatment of menopause, infertility, and genital organ problems. But in 1927, Europe's top laboratory, Organon, expanded indicated uses to the field of clinical psychiatry, officially creating a new market for female sex hormones. Some clinical tests in Germany, for example, used hormones to treat patients with schizophrenia and melancholy. It was also prescribed in cases of psychoses and depression attributed to disorders of the menstrual cycle, as well as epilepsy, hair loss, eye diseases, diabetes, hemophilia, and so on. By the end of the decade, female sex hormones were being recommended for a broad and varied spectrum of cases (Oudshoorn, 1994, p.92-93).

To judge from the type of problems treated with hormones, on stage once again were disorders that were not restricted to female bodies but that were indicative of behavioral maladjustments and, in a broader sense, of social disorders. Hormones appeared to be new substances that could return desired femininity to women who had for some reason lost this path. If the pattern of sexual, social, reproductive, or aesthetic behavior did not fit with the expected gender model, administering hormones – the true substances of femininity – could lead women back to their proper place.

Around this time, the scientific production on hormones reveals a juxtaposition between what were considered physical characteristics, associated with sex, and those related to gender. There seemed to be an inextricable link between the physical and moral planes, which in the context of nascent endocrinology translated into the reduction of individual behavior to causes of organic – and, more precisely, biochemical – origin. Considering the recent theoretical debates about the sex/gender dichotomy and its correlated oppositions, we can suggest that gender is the analytically 'all-encompassing' category, since in this case all references to what would be sex, or organic, are visibly structured around the logic of this society's gender relations. What we therefore note in the discourse on ovaries and hormones is not only a description of their function within the female body but a treatise on how women behave as a function of their ovaries and hormones. The reference to behavior paves the way to understanding that this scientific discourse is actually portraying the 'expected gender' or the behavior appropriate to these women.

It is apparent that we are not only describing isolated scientific discoveries or clinical treatments but a complex network of events wherein the vector of gender is a cornerstone. From this angle, the process makes us ask what logic or concerns might lie behind these events.

It seems clear that there is a persistent attempt to wrap gender in a logic of substantiation of difference. The object of this substantiation may vary, ranging, for instance, from the ovaries to sex hormones. But the reference to some kind of materialization of gender holds steady; better put, it seems to be refined with each new scientific discovery. We realize there has been a pregnant need to 'essentialize' the differences between men and women throughout the last century, which necessarily points in the direction of the dualist tradition that has characterized modern Western culture. Renewed forms of 'essentialism' have basically implied a need to delimit what constitutes the natural, allegedly immutable, plane and what constitutes the social or cultural plane, which is open to transformation. With a closer look at the medical discourse in the late 19th and early 20th centuries, for example, we recognize that it is precisely the instability of these boundaries – that is, our detection of their precariousness – that fosters a persistent reaffirmation of these oppositions.[15]

This discussion of the dualist tendency in our tradition of thinking is long and thorny, and at the very least forces us to reflect upon the order associated with the nature/nurture conflict. Yet much as there are no easy solutions for 'escaping' dualisms, posing the issue has proven quite profitable in many branches of scientific production. The critical view of science that finds its source in gender theories has run counter to the usual reification of dualisms. One of the main contributions has been to demonstrate the quite complex

consequences of the political separation advocated by some feminist streams since the 1960s between the realm of sex and of what would later be called gender. At that time, it was important to emphasize the historical and social aspects of gender and to strategically ignore the biological realm, which was left up to the scientists, especially biologists and endocrinologists. Gender theoreticians did not address biology – or, better put, they admitted biology as a given while working solely with cultural factors (Fausto-Sterling, 2000; Wijngaard, 1997). It has only been more recently that a group of women scientists – principally biologists – has taken an interest both in reviewing the history of gender in the biology of sexual differentiation and also in showing how what has been widely defined as an immutable biological given is actually permeated by our society's dominant gender conceptions. This perspective has had a powerful influence in ensuing analyses and it certainly opens new doors, in terms both of research in 'traditional' scientific production and of a more in-depth theoretical debate on gender and our notable dualisms.

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NOTES

[1] For a detailed discussion, see Rohden (2001).

[2] E. Showalter (1993, p.171-190) describes how pelvic surgery "became the fashion" among women in England in the last century. The author ties this into the more general medical curiosity about the female body, expressed first and foremost in a desire to dissect it and put to use new gynecological examination instruments. There were not as many fantasies about the male body and the idea of opening it up did not seem as fascinating, perhaps because the penis and testicles are located on the outside.

[3] C. Groneman (1994, p.346) states that at the close of the 19th century, U.S. and European doctors named menstrual problems as the central cause of diseases like nymphomania and hysteria.

[4] Ovariotomy was a major phenomenon not only in terms of women who underwent the procedure but also as a technique that solidified the specialized field of gynecology. It is noteworthy that medical works on the history of this specialty devote entire chapters to the topic. See Cianfrani (1960, p.272-287), Rozembaum and Peumery (1990, p.113-121), and O'Dowd and Phillip (1994, p.4004-4009).

[5] At least in Europe, castration seems to have been used as a birth control method as well. In Brazil, I found no significant data on this point, except Erico Coelho's mention of the French situation, based on E. Zola's *Fecondité*. Coelho transcribes an excerpt of Zola's book, which he felt was the best account of France's declining population: "From top to bottom, from large to small, the heinous industry that renders women sterile reaps its money. Behold a wife whose womb they open, from there ripping out the cluster of life filled with ova. Behold a mutilated virgin, in whom they crush budding maternity before it flowers. Cutting, always cutting, and in all social ranks. You know what extremes we have reached. Two to three thousand women a year are castrated at our hospitals. This number is at least twice as high as at private clinics, for there are no indiscreet witnesses or accessible records there. In Paris alone, over a fifteen-year period, thirty thousand to forty thousand of these operations must have been performed. Ultimately, calculations are that five hundred thousand, or half a million, women in France have had the flower of their maternity amputated or pulled out, as if it were a weed. In ten years, the knife of castrators of women has done us greater harm than Prussian bullets" (cited in Coelho 1915, p.22-23).

[6] This same case is reported by Maia (1896, p.95), although the latter does not mention that the final outcome was the patient's death. Magali Engel (1997), in a text entitled "Psiquiatria e feminilidade" [Psychiatry and femininity], analyzed the same case as well.

[7] Vieira Souto did not clarify whether he had no information on the remaining, vast majority of the women, or if they lost their "genesic sense", which would contradict his hypothesis.

[8] In addition to those cited in this text, I found records of theses by the following authors: Cardoso Junior (1911), Moreira (1921), Barretto (1924), Barbosa (1924), Teixeira (1925), Ferrari (1927), Fortuna (1927), Costa (1928), Cardoso (1932), Magalhães (1934).

[9] The author believed there were significant differences between the French and British, which, in her view, had to do with each country's predominant religion (Catholic or Protestant). The French were much more critical of ovariotomies. The French Academy of Medicine went so far as to declare itself officially against removal of the ovaries in 1857, a position that would later be revised (Moscucci, 1996, p.143).

[10] British feminists made their fight against ovariotomies part of a broader campaign against vivisection, which was often seen as related to misogyny. This was the case with the common perception in 1888, which saw the crimes of Jack the Ripper as the work of a surgeon from the University of London (Moscucci, 1996, p.158-159).

[11] Margaret J. Sandelowski (1990, p.484) also refers to the paradox implicit in the practice of removing ovaries to cure diseases, leaving women sterile and unable to fulfill their maternal role, which was considered essential to their physical and mental health. Examining the United States, C. Groneman (1994, p.350-351) argues along the same lines.

[12] I would like to suggest that current investments by the field of sexology aimed at fostering a notion of sexual satisfaction and even of ideal sexual health share this premise that there is a 'deficiency' that needs to be compensated for in the realm of sexuality; this finds expression in the quantitative notion 'more practice' or the qualitative notion 'more satisfaction'.

[13] Oudshoorn (1994) takes this analysis further when she shows that by using birth control pills, the sexual and reproductive lives of women from practically all parts of the world become controlled by hormones, the flagship of the pharmaceutical industry.

[14] On the links between hormones, brain, and behavior, see especially Bleir's analyses of the naturalization of gender differences (1997) and Wijngaard's examination of organizational theory (1997). In regard to the history of nineteenth-century perceived gender differences in the brain, see Russett (1995).

[15] On the theoretical discussion of the instability of differences and the nature/nurture dichotomy, see Rohden, 2001 and 2003b.

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