Introduction

A Brave New World

In William Shakespeare's play *The Tempest*, Miranda, daughter of Prospero, marvels at the sight of the men her father has summoned to the island where Prospero's brother had exiled them. She utters: "O, wonder! / How many goodly creatures are there here! / How beauteous mankind is! / O brave new world, / That has such people in't!"[1] Aldous Huxley, borrowing Shakespeare's expression to brand his 1932 novel, "Brave New World," adapted Miranda's promising and naïve brave new world to an imaginary society set in 2540, where science and progress would hold the promise of happiness. Huxley's dystopian novel depicts a world where reproduction is under control of the government with catastrophic consequences. Individuals, conceived in the lab, lose their personal identity before the well-being of the community. As the story opens, the director of the "Central London Hatchery and Conditioning Centre" shows his new students the "Fertilizing Room." There, new embryos are created through the "Bokanovsky's Process," whereby technicians efficiently work in labs to fertilize eggs in vitro, each egg able to divide multiple times into genetic twins. This process will allow, "Ninety-six human beings [to] grow where only one grew before. Progress," the director proudly utters. The students take notes; only one daring young man questions "the advantage" of the process. Scandalized, the director exclaims: "My good boy! … Can't you see? Can't you see? Bokanovsky's Process is one of the major instruments of social stability!"[2] Human cloning would produce custom-made individuals: Alphas, Betas, Gammas, Deltas and Epsilons, each genetically made-up to happily fulfill a specific role in society without resentment or complaints.

Political and social changes in the early twentieth century fueled Huxley's satirical and critical view of a future society, which centers on the government's control of bodies through science that translates into a loss of individual freedom. A topic also central in other dystopias, famously in George Orwell's *1984*, the advances in technology in

Huxley's novel provoke awe and admiration in John, the single character in the novel born out of a mother and raised in the "Savage Reservation" in New Mexico. John's only knowledge of the outside world comes from his reading of the complete works of William Shakespeare. The son of an outsider, John appears ill-fitted to the community where he was born and raised, and dreams of traveling to London, the ideal place of the World State, where his mother comes from. To him, just like to Miranda, the equally naïve character in *The Tempest*, this has to be a truly brave new world. John, however, becomes a tragic character in Huxley's novel. The World State does not deliver the promise of happiness he envisioned. The novel ends with John's suicide representing the failure of both the London and Reservation societies to provide him with an identity and a place of belonging.

More than 200 years before Huxley and Orwell's time, at the beginning of the eighteenth century, physicians, philosophers and lawyers also felt theirs was becoming a world that science and technology were turning into a promising brave new world. Unlike Huxley's novel, this brave new world was not so much going to be ruled, dominated and dictated by the government but by medicine, and in particular by anatomy. The large number of anatomical works and manuals published from 1650 until the end of the seventeenth century – in England alone from fifty works between 1600 and 1650 to over 200 titles by the end of the century – reflects the interest and curiosity that anatomical observation created not only among physicians but also among educated readers.[3]

At the core of the new scientific euphoria in the eighteenth century was the belief that finally science would provide the tools, through the study of anatomy, to fully comprehend the human body. Their "science" was, to quote the 1726 dictionary of the Spanish Royal Academy, the "knowledge of something by its causes and principles." Anatomists and physicians saw themselves as "scientists," who through observation could discover nature's universal laws. "Physician" was the umbrella term that embraced both the university-trained anatomists and also the surgeons. Some held university degrees while others were trained through the practice of treating patients (think of the barber-surgeon of the medieval period).[4] But it was the anatomist, more than surgeons or other physicians, who became the highest authority on matters of medical science. The anatomists' knowledge of the naked body authorized them as trustworthy guides to translate nature's design onto society and its organization.

From natural philosophers to literary authors, a growing number of intellectuals of the early eighteenth century saw in anatomy and the order of the human body a model of how their new society had to be organized. Institutions would borrow similar bodily organizational principles

by which science would dictate the functioning of the rest of society's vital "organs."[5] Medicine, law, natural philosophy, economy, or politics, it all came down to how well they fit within "the organic economy" that nature operated by.[6] In the natural world, everything was connected and had a purpose that could not be understood outside those connections. From this view, humans were the best expression of nature and the body and its functioning had to obey to the utility principle. Thus, anatomy, as the study of the internal workings of human beings, also bore the "organization, size, form and place of all the members that make the human body or of any other animal."[7] Anatomy symbolized such need for order and organization by literally offering a body of knowledge that emphasized observation and systems of relations; a methodology that spread from the human body to other areas of society from law to art and literature.[8] It was knowledge with a purpose, the highest of which was indeed the reproduction of human beings. The observant anatomist only had to point to what was supposedly physically evident, namely, the core differences between men and women, which would lead to the reproduction of humans. Such division of the sexes was certainly "one of the major instruments of social stability," ensuring political continuity and economic wealth.

My book traces the difficult journey that eighteenth-century Spaniards undertook in order to promote social stability, harmony and social reproduction. The achievement of social stability drew on anatomists and physicians' delineation of the differences between men and women based on their genitalia. It also required discarding traditional theories of medicine not based on an anatomical view of the body. The increasing professionalization of medicine fostered the need among these writers and thinkers to purify medical, and thus scientific, notions of sex formation from popular and non-scientific opinions. Other, non-scientific forms of knowledge seemed to jeopardize a desire to organize society into well-structured precepts by which men and women, anatomically and socially defined as such, would guarantee the reproduction of society, physically and culturally. Just as in Huxley's novel, at the center of such new efforts was the control of human bodies and reproduction: nature's ultimate and most noble cause. However, the road towards the establishment of the division of the sexes was long and winding, as the expectation and excitement generated contradictory feelings about where the new century was going to take them. Throughout the century, supporters of what became known as "the new science" had to face the challenges posed by followers of traditional medical theories, and even by followers of the new science themselves, who sometimes fell the need to rely on traditional theories to explain "rare cases" they encountered in their medical practice.

Traditional medicine had provided not only a venue to understand the functioning of the body but also how bodies fit within the larger understanding of the world. The novel view of the body that the new science offered, challenged not only how physicians cured individuals but also the function of bodies in the overall social and divine order. The new science was in fact proclaiming a stricter division of the sexes than the traditional theory and practice of medicine ever had. At the same time, because the new science emphasized the importance of observation and the practice of medicine to reach to conclusions, it was the reality of bodies that did not fit the anatomical division of the sexes that problematized the whole balance. Individuals who displayed an ambiguous sex and gender represented a challenge to those followers of the new science – physicians but also lawyers and philosophers – as they made obvious the limitations of the new theories.

The promise of this brave new world at the turn of the eighteenth century brought fear and anxiety to those who saw it not as a promising utopia, but rather as a dystopia, threatening to destroy the foundations of their world. Anatomy as the bases of social order received criticism from those who still subscribed to the traditional theory and practice of medicine, but also from the Catholic Church, always watchful of heresy among new ideas. The preoccupation of the Church for the new scientific ideas was on their heretical potential, as a mechanical and rational view of the human body might have questioned divine intervention in the formation of the body as well as severing the relation between religion and scientific knowledge. The Church's concerns of the separation between science and religion were well founded. Without ever disregarding the natural world as the product of God's making, seventeenth-century physicians who subscribed to modern medical theories of the body focused their efforts in understanding nature more in connection with society than the divine.[9] This implied a growing need to set aside religious and theological concerns in the production of knowledge about nature.

The practice of separating science from religion turned into a challenge to anyone who subscribed to the new science. Regardless of how much Spanish scientists saw themselves, as true followers of the Catholic dogma, they still wanted to set limits between what was the job of the scientist and that of the theologian. Exemplifying such a challenge were the Spanish geographers of the late seventeenth century, whose work tried to bring together biblical and scientific interpretations of the formation of the earth. Particularly vivid among Spanish geographers, geologists, and natural philosophers was the debate also characteristic of the European scientific community over the biblical "Great Flood," and whether the earth's fossils were its direct results.[10]

Some authors aimed to prove that the Flood was key in shaping the earth's particular relief.[11] Others, such as the geographer and mathematician José Vicente del Olmo (1611–96), secretary of the Tribunal of the Holy Office of the Inquisition in Valencia, while keeping the narrative of the Great Flood argued for a geological explanation of the formation of life on earth.[12] Del Olmo's own life is a reflection of this effort to make religion and science separate while compatible. The geographer was an avid participant of the academies and literary salons in Valencia and key in the introduction of the new science and European ideas into Spain at the end of the seventeenth century.[13] While keeping his role as a main officer in the infamous tribunal of the Inquisition, del Olmo dared to separate religious from non-religious explanations of the earth formation. This led him to argue that the earth and its topography could alter throughout time, so that mountains "will be ruined" just like "the foundations of many ancient buildings."[14] This argument was compatible with the Bible's narrative, as it did not question the continuous presence of God in nature. The quests of men like del Olmo put in evidence the efforts to enter into dialog with religious arguments even when discussing scientific concerns.

The difficulty of separating what was the tangible and scientific from what was not continued into the eighteenth century. Eighteenth-century scientists were asking themselves to rethink the relation between nature and society in terms of "victory over nature." As in Huxley's brave new world, controlling the natural, expressed in the anatomical division of the sexes, would guarantee social stability, progress and ultimately happiness. Moreover, victory over nature translated into social utility or how nature would lead to social stability. This is where the singularity of Spain stands out: linking this emphasis on usefulness characteristic of the European Enlightenment with medicine. We find this applicability of medicine in other European countries such as France.[15] However, it is in Spain where the usefulness of scientific knowledge reaches a political dimension at the end of the eighteenth century as some of the most prominent thinkers of the Spanish Enlightenment held public offices.[16] The first step in such "victory over nature" was in dispelling the well-established traditional views of the body that reigned unchallenged throughout most of the early modern period.

Victory over Nature

Traditional medical theories challenged by the new anatomically-focused medicine were based on Greek natural philosophy and authors

such as Aristotle (384–322 BCE), Hippocrates (ca. 460–ca. 375 BCE), and Galen of Pergamum (ca. 129–ca.216 CE), and the theory of balance of humors. Humoral medicine posited that the health of the individual was the result of the balance of four types of humors – blood, phlegm, black bile, and yellow bile – corresponding to the four elements – earth, air, fire, and water. Those four humors had qualities – dry, wet, hot, and cold – the combination of these qualities affected the different human organs and shaped specific characteristic personalities of the individual, depending on the excess or deficiency of a humor and its quality. The humoral theory also explained sex formation in a distinctive way. The balance of the humors allowed the reproductive process to happen, since to be able to conceive, a woman had to be wet and cold while the man was expected to be hot and dry. Variations on such an ideal balance could jeopardize conception. A man who tended to be too cold could become sterile since heat was thought to be indispensable for the growth of the male seed. He could also develop an external behavior that revealed his internal humoral imbalance, which made him closer to the combination of humors characteristic of women.

Following Aristotle's and Hippocrates' teachings, Galen also explained that men's and women's genitals were similar in their composition, the only difference being that women's sexual organs were male organs turned inside. As the French physician André du Laurens (1558-1609) saw it, "the opinion of the Ancients, confirmed by the authority of learned men and the writings of nearly all the anatomists" explained why the female genitalia – that was fundamentally the same as men's but colder and wet – was hidden, while men's – hotter and drier – were "outside and hanging."[17] From this perspective, if men's genitals were thought to be similar in their composition to female genitals and their differences were only in degree of development, it was possible to believe that there were stages in between the full development of male and female sexes. Depending on the humoral balance, a person's sex could change from one to the other. External changes could influence and alter the balance of humors in the body, even having an impact on the sex formation of the individual. From the perspective of the humoral theory, an effeminate man could reveal "a lack of heat" and in some cases a "mixture of sexes," or the existence of female genitals along with the male ones. An external influence or the mother's own diet or habits had the unintended consequence of changing the sex of the fetus from male to female, thus giving birth to a child who while appearing to be a boy bore in himself some of the physical characteristics of females.[18]

The humoral theory persisted throughout the early modern period and informed the new anatomical discoveries in the seventeenth century,

partly because of its ability to explain the many changes that the body went through in a lifetime, making it sick or healthy. It was not only a way to understand the body but also a truthful knowledge taught at the university level and in the surgeons' daily practice of medicine. Although the humoral theory was still pervasive in the seventeenth century, it was then when anatomical discoveries brought the physical evidence of the division of the sexes that could no longer be explained on terms of humoral balances alone.[19] This was only the beginning of a process whereby the new medicine, that took the observation of the anatomical body as the measure for all things related to health, sickness and sex, would debunk more traditional theories on medicine and the body. As the French physician Francis Clifton told his readers in 1742, the good physician would be well aware of "the utility of observation in medicine and the inutility of systems and theories."[20] To Clifton the experience of observation overcast reaching at any larger explanation. This fact, the tangible knowledge as the measure of all things, was crucial in the medical theory and practice of physicians of the new medicine. It was the naming and classifying, but also the "seeing and knowing," where true physicians found the answer to all their questions.

Experience and observation in relation to social utility also brought changing notions of sex and sexuality in the eighteenth century. In fact, Thomas Laqueur has argued that "sometime in the eighteenth century, sex as we know it was invented."[21] Not totally abandoning the Galenic principles of medicine, eighteenth-century European physicians transitioned into bearing a more mechanical, anatomically-based view of the body. Under this modern view, the two sexes were separated, each holding a distinctive set of reproductive organs. As some critics of Laqueur have argued, this division of the sexes partly happened before and it simply persisted in the eighteenth century coexisting with humoral views of the human body.[22] However, Laqueur is right to argue that while in the practice of medicine the lines were blurred and Galenic influences were found throughout the century, in the eighteenth century anatomists and physicians were intending a break. This break was accentuated by those who described the medical practices of previous centuries as prone to error and superstition. There was a change in the reality of anatomical discoveries and how much physicians knew of the human body, but there was also very much a change in perception. It was the collective euphoria at being at the verge of a brave new world. This is characteristic in the writings of eighteenth-century physicians bent on an unwavering battle against superstition in general. Likewise, the anatomists of the eighteenth century saw it as their mission to eradicate what they deemed to be an irrational belief in medicine to do with things that before were perhaps

accepted to happen, such as spontaneous changes of sex or the existence of hermaphrodites. As we will see, the quest in proving hermaphrodites to be non-existent entities, a creation of the populace's imagination, manifests the need to cast away any physical formation that was not intended to fulfill reproduction.

The work and practice of followers of the new science was part of the Enlightenment project in Europe that looked with increased criticism at "the opinion of the Ancients." The list of anatomists who in their publications and participation in scientific salons were transforming the medical science in Spain is long and mostly exemplified by the new group of scientists and thinkers, known as the *novatores*, the innovators, also translated as "the moderns," a term used by their detractors.[23] Some novatores came out of the training of physicians at university level while others were experienced in the practice of medicine. The innovators progressively detached themselves from the teachings of traditional medicine, embracing the new medicine and its reliance on the physical evidence provided by anatomy. They were also great promoters of the applicability of medicine, thus uniting theory and practice, another component of the emphasis on the "utility" of sciences that would characterize the new century. The innovators were scientists, from natural philosophers to anatomists, coming from different areas of the Iberian Peninsula: mainly Madrid and Seville, but also Valencia, Saragossa, and Cadiz. They shared the desire to first make available to others the innovative theories on the body, but also the application to the practice of medicine. The transition to the new medicine was slow, but soon there were an increased number of physicians committed to eradicating the old medicine to give way to a new understanding of the human body.[24] This was part of an epistemological transformation in European thought: wanting to acquire knowledge through observation and the use of reason, rather than rely on authority. Previous anatomists, such as Andrea Vesalius (1514–64), had emphasized the use of observation and reason in the study of the human body.[25] And even in the eighteenth century, the ability to discard authorities was difficult to put into practice. Yet, the new physicians felt the struggle was about recognizing the only authority which scientists had to respond to, the one resulting from the application of reason to what the senses told a vigilant observer.[26]

The quest of eighteenth-century anatomists in Spain to advance a new science that would expel all superstitions from medical knowledge and practice was not an isolated effort. The networks that these anatomists created revealed their interest in connecting with the anatomical discoveries and novelties in Europe, but also the transmission of knowledge within Spanish anatomists themselves. It responded to a web of scientific

relations that transmitted and exchanged knowledge all over Europe. An effort that, as the Royal Society of Medicine and Other Sciences of Seville pointed out in 1736, had started "with curiosity, because satisfied with the recent inventions, shook off the heavy yoke of captivity and proclaimed their freedom."[27] In this transformation of the medical world in Spain, the exchange of knowledge with European experts was crucial. In 1699 the Italian physicians and anatomists Luca Tozzi, Lucantonio Porzio, and Tommaso Donzelli arrived in Madrid to attend Charles II of Spain in his final illness.[28] The king's successor, Philip V, the new Spanish monarch after the war of succession for the Spanish throne (1701–14), furthered the policy of openness to Europe his grand-uncle had started.[29] Anatomists coming from France, such as Florencio Kelli, who arrived in Spain in 1701 with the court of the new monarch, joined a number of French anatomists, such as Blas Beaumont and Guillermo Jacobe. The marriage of the monarch to the Italian princess Isabel de Farnesio in 1714 also facilitated the arrival of foreign experts from Italy, such as the influential anatomist José Cervi (1663–1748).[30] Many of these foreign anatomists settled in Spain to produce their most notable works, becoming key in spreading the knowledge of the new anatomical discoveries.[31]

The involvement of the monarchy in bringing in foreign experts onto Spanish soil blended with a growing interest among Spanish physicians to learn more of the new medical theories and practices. Spanish anatomists thus relied on information from European sources: either physicians transplanted into Spain, manuals arriving from Europe, or the information anatomists themselves could gather by traveling abroad. These three venues represented sources of authority, a "useful and reliable knowledge" to employ the term used by historians of economy and science of eighteenth-century Europe.[32] Used oftentimes in the context of technological advances in pre-industrial Europe to highlight the close connections between science and technology, scientists "used knowledge to create more knowledge." Knowledge of "what and how," what to look for and how to do it, applies to the bold aspiration among Spanish anatomists: to marry theory and practice – the theory of medicine represented by the anatomists, and its application in the hands of the surgeons.

European networks of useful knowledge express the continuous fight for understanding the place of the individual, now more disconnected with the divine, in the natural world. In this book, I examine precisely those controversies that highlight the involvement of the medical community and its emphasis on the division of the two sexes in establishing the main parameters of relations between nature and society. For instance, how did the existence of individuals with ambiguous sex compromise the expected relation between society and nature and the clear

division between men and women? Could nature cause people to acquire traits of the opposite sex? Although they did not express it in terms of nature versus nurture until the nineteenth century, philosophers, political thinkers and even writers of fictional works throughout the early modern period asked essentially the same question that nineteenth-century scientists posed: Were natural predispositions powerful enough to overcome the influence of rearing and education? Or, conversely, could a bad education ruin good natural tendencies? In other words, if the division of the two sexes was so important, what did it account for? What made someone a woman or a man? In the eighteenth century, surgeons and anatomists, as well as educators and jurists tried to answer these questions in order to understand the rightful place of men and women in their new society.

The implications of these changing views of the relationship between nature and society go beyond understanding the human body as part of the natural world and instead focus more on the body in its place in the natural and social worlds. It proclaimed man's victory over nature, but this implied that the natural functions of the human body could not be detached from the social ones. Explaining the division of the sexes became all the more important since the parameters that formed that division helped anatomists shape discussions on what the human was in relation to nature, the place of individuals within the natural and divine cosmos and their place in reproduction. Findings about the division of the sexes would have an impact in the legal, philosophical, and educational arenas, in university wards and the practice of medicine, but also in the courthouse. Characteristic of these efforts were their applicability, the practice that must shape the theory and universal laws. Ironically, as we will see, this credo created its own trap as the practice sometimes discredited the theory.

The practice of medicine revealed any overarching theory to be flawed. An example lays in the crime and sin of sodomy. Sodomy tested one of the basic tenets of the Enlightenment, and in particular the Spanish Enlightenment: everything under the sun had to obey the principle of social utility. Sodomy was unproductive sex, sex sans utility; but, unlike masturbation, sodomy trespassed the laws of society and nature to threaten divine laws.[33] We find sodomy at the difficult crossroad[s] where law, religion, and medicine met in the eighteenth century. The union of a man and woman for the procreation of the species was something that still in the eighteenth century theologians, lawyers, physicians, and philosophers agreed upon. As Immanuel Kant stated in his *Anthropology from a Pragmatic Point of View* (1785) the goal of nature's economy was "nothing less than the maintenance of the species."[34] The practice of sodomy