Historical Biological Theories of Sex – Theories of Two or More Sexes

So far, we can appreciate that human beings cannot be understood independently from society – as they already and always are social. They are in society and society is in them. Therefore, the existence of a human »naturalness« free from social influences is impossible. Human embryos are already influenced by other humans in the womb. They are affected, for instance, by the mother's nutrition, other intake or mood, of course, but also by external factors such as temperature, light, noise or even tone of voice spoken to mother and child. After birth, every human being grows up in society. And, of course, all biological theories concerning sex are scholarly theories after all – thus always also the result of the social order in which they were perceived.

Western societies, for a long time, foresaw the existence of two different sexes. They were subjected to a hierarchy, and women and men therefore were granted different opportunities within society. Even researchers who are otherwise not restrained by economic considerations, are embedded in the social reality of the existence of two sexes. When trying to understand the sexes, they must always have with the presupposition of two sexes. Moreover, considerations that do not follow the currently presupposed difference between the (no more than) two sexes, meet obstacles. They are required to face the reality of two sexes that live differently – and have different opportunities in society – and argue against that as the basis for all theory. Such considerations move equally in rough waters in regard to language which simply does not foresee the existence of anything but binary descriptions and concepts (German even more so than English, one might add).

Today's situation might lead to short-sighted conclusions, as the one Andrea Trumann presented in her *Feministische Theorien [Feminist Theories]* (*theorie.org,* in German): »Nobody has ever questioned the natural difference of the sexes until the end of the 20th century« (Trumann 2002 [German original]: 107). The discussion above itself proves this to be a misconception. Marx and Beauvoir described human beings as a social species. They argued that abolishing the enslavement of mankind by capitalism, or that of women by men, the human = sibling-like relationship toward one another would present itself as the actual feature of the species homo sapiens sapiens. Neither Beauvoir nor Marx demonstrate sex and the concept of the binary sexes as pre-determined, eternal, or a-social components.

The following pages are dedicated to explicitly biological theories of the sexes. Those theories will be critically evaluated for the way they discuss the »natural difference of the sexes.« It may be assumed that biological theories, too, have entered numerous discussions about the sexes, and the (in-)equality of women and men. It is difficult to conceive those discussions otherwise as the biological sciences, and their representatives, are/were also deeply embedded in their social orders as well as the heated discussions over the position of the sexes – especially the position of women in society.

More recent conclusions of gender studies research – like the ones Trumann ties into – must be rejected as too short-sighted and simplistic when taking into consideration those debates within the field of biology. Let us begin by summarizing the state of research and continue with discussing *more in detail* the differentiation of *modern* biological theories of the sexes and the debates they provoke.

Too Simplistic: The Current State of Research in Gender Studies Concerning the *Biological Theories of the Sexes*

The research of the sexes, particularly in the social and cultural studies, largely follows the few works dedicated to the genesis of the biological-medical differentiation of the sexes. The works of Thomas Laqueur (1986; 1990), Claudia Honegger (1991), and Londa Schiebinger (1986, 1989) are virtually canonical for the field.

Thomas Laqueur's study is most influential, when he contrasts the ancient understanding of a »one-sex model« with our »two-sexes model« which evolved only with the dawn of enlightenment. The ancient societies, according to Laqueur, largely perceived sex and the corresponding roles in society as society made as natural philosophy and science appreciated the human being through one single model. It merely differed in the degree of perfection: man was understood to be the perfect model of a human being, woman as an imperfect version of it, i. e., man/the human being. Laqueur succeeded in identifying this concept from the antiquity to well into the Renaissance period, when it was – slowly – replaced by the »two-sexes model« of our times.

Claudia Honegger and Londa Schiebinger concur with Laqueur's findings. In their works, they particularly cover the beginnings of the »modern« biological-medical sciences. According to them, the concept of two physical and physiological sexes replaced in the »one-sex model« in the eighteenth century. Anatomy and physiology proved the inequality of the bodies (of men and women) and then turned that proof into a social model for sexually differentiated relationships (of inequality). From the early 1800s onward, this biological concept of the binary sexes had provided the scientific/rational arguments for stabilizing man's position in society during the formation period of a bourgeoise and industrialized world. Those arguments also fended off the intrusion of women in hitherto male segments of society by the end of the century. Researchers of the sexes rather simplistically see biology and medicine as safeguards of male dominance in society. Claudia Honnegger's even considers a *Sonderanthropologie der Frau [a special anthropology of woman]*, a term that most poignantly boils down the concept of »naturalizing« the inferior position of women in society (see Honegger 1991: 6, 126 et seqq.).

The empirical core of the concept has been challenged on occasions. Katherine Park, Robert A. Nye (1991), as well as Michael Stolberg (2003) have convincingly argued that the two-sexes differentiation had already existed as early as the 1500s. In Germany, Brita Rang (1986) argued at an early point against the notion of the sex-related characters having developed in the eighteenth and nineteenth century.

What is correct, though, – and Laqueur, Honegger, and Schiebinger contributed greatly to this understanding – is the fact that biology and

medicine in their theories of the sexes must be understood in the context of their societies. Those scholars discussed exceedingly well the primacy of society even beyond the formation of such theories. Or, put differently, the biological-medical theories of the sexes reflect the relationships of the sexes as they were lived in society. This, in turn, also means that the social debates over the roles of men and women in society entered the scholarly fields of biology and medicine as well. The researcher must identify and evaluate such discussions in biology and medicine, but also whether and how some theories were (and are) utilized for the arguments over emancipation. Just as much: it will be quite clear that the classification of a »one-sex« and »two-sexes model« – as well as a radical supersession in specific eras – does not make too much sense. Laqueur sees the idea of an ancient »one-sex model«, meaning the understanding of (male) perfection and (female) imperfection, respectively, with its relative differences between two sexes. It might be argued, though, that this model still holds true for »modernity.«

Antiquity – The »One-Sex« and »Two-Sex« Models

Laqueur's hypothesis of a »one-sex model« is largely founded on the descriptions of genitalia. Galen of Pergamon, for instance, was a physician in the second century CE. He largely understood the male and female genitalia as being identical and differing only in their position. While male genitalia were turned outward, female remained within the body. The internal vagina, cervix, (female) testicles, or uterus merely were the counterparts of the external foreskin, penis, (male) testicles, and scrotum. The fundamental reason for those genitalia's position was »heat«, which should be understood as a physiological element. Man possessed more »heat« than woman – therefore, he was more perfect than she.

Perfection was not just limited to the position of the genitalia. Ancient natural philosophers further utilized the idea of perfection also in regard to the effect the individual contributions to procreation had, but also to the position of women and men within society. Aristotle in the fourth century BCE, of course, considered woman to be incapable of contributing to procreation through her own seed, but merely provided catamenia

(a precursor of semen). When male semen met female catamenia, according to Aristotle, male »heat« would turn the latter into semen. Only then could they add to the act of procreation. Even then, however, would the female involvement be a limited one, as they merely provided one material contribution, whereas the man would provide the alleged critical moving principle.

Aristotle painted a vivid picture of that concept: the female contribution to procreation resembled a raw rock (thus it was *material*). The male contribution, on the other hand, resembled the artist who turned the rock into a sculpture (thus it was the *moving principle*). Man was »perfect«, for Aristotle, and »perfection« presents itself in the similarities to man. Woman was, for him, the first »deformity« of the human being. Limited »heat« denied her to turn her genitalia outward and producing full-value seed. She was, moreover, light-minded and susceptible to immorality for that reason. For Aristotle, this was enough to put women under constant guardianship.

There were other ancient natural philosophers who rather saw an equal contribution of seed from women and men. The Hippocratic Corpus – written roughly from the fourth century BCE until the first CE – argued in such a way. The value of the female seed (or the comparable quality to the male one) was discussed in them as well, but its existence never doubted. Galen of Pergamon also concluded there were equal male and female contributions of seed for procreation. Yet he also described the female counterpart as »colder« and »moister«, and thus as more imperfect than the male seed (see, also for a more thorough discussion of differentiating the concepts of seed, Lesky 1950).

It is difficult to subsume such concepts as a »one-sex model.« It would not do justice to the number of natural philosophical considerations of the sexes in antiquity – whether they were brought together with the idea of »heat.« Even more so, such »one-sex model« would ignore ancient descriptions of the differences between the sexes of women and men. Galen, for instance, assigned masculinizing properties to the male testicles; removing them would »emasculate« the man. Galen saw the outcome, the castrated man, as loosely resembling woman, respectively does he consider the outcome to be a third option next to man and woman. Galen also described other differences of the sexes for the chest,

arteries, and the flesh. Aristotle emphasized physical and physiological differences. They covered the bodies' differences in the degree of being sinewy, defined, or hairy, but also in »moister flesh« and a smaller female brain.

The idea of a »one-sex model« also ignores the many ancient tractates on »women's illnesses (read: gynecological disorder)« for which exist no corresponding texts for the male sex. Those tractates focused on the uterus as the seat of the »female illnesses« – this itself contradicts reducing the ancient concepts of the sexes merely to a »being turned inward« or »outward« nature of the genitalia. The scrotum, for instance, was seen as the outward counterpart of the uterus. Thus, one would expect similar ancient considerations of the scrotum as the seat of »male illnesses.« It just did not happen.

In conclusion: the ancient natural philosophical considerations of the sexes must be appreciated as differentiating ones. There were discussions then, whether women and men both (and equally) possess seed, and just how the seeds developed into an embryo. Those theories must also be seen before the backdrop of an oligarchic – the rule of some privileged ones – as well as paternalistic society. They were influenced by the actually lived order of the sexes. The only ancient natural philosophical writings on matters of the sexes we have at our command today, it should be remembered, were written by men.

The Middle-Ages – Not Just Reducing but Creative

Historiography often describes medieval Europe as somewhat »semi-conscious.« Thomas Laqueur does, too. Moreover, he describes the natural philosophical concepts of the sexes as continuously valid from antiquity to the Renaissance, well even into the eighteenth century – thus over a period of 1500 years of numerous social changes.

It is, of course, not as simple as that. During the Arab-Muslim middle-ages hitherto gained knowledge, the ancient one, was subjected to syntheses and additions of new observations. Not only the ancient knowledge became part of the process, but also other traditions such as the Indian and Persian ones. The Latin (Western European) middle-ages drew from

that systematization as well as many ancient writings were not utilized in the form of the Greek or Latin originals, but through Arabic translations and syntheses. For our modern understanding of the antiquity, well, for our European heritage of ancient knowledge, we matter-of-factly owe tremendous gratitude to Arabic thoroughness in contrast to European carelessness.

The works of the Arabic-Muslim middle-ages as well as their impact on Latin Europe are hardly more than glimpsed at when it comes to theories of the sexes – including the natural philosophical ones. That glimpse, however, indicates their value for understanding the considerations of the sexes. The Persian physician and philosopher Abū Alī al-Husain ibn Abdullāh ibn Sīnā (980–1037), Latinized to Avicenna, likely brought Galen's theory of the four temperament, the theory of humorism, respectively, to full fruition. We also have (some of) his writings on natural philosophy regarding the sexes and sexuality. When reading those Latin texts, as did Eberhard Kirsch for his *Avicennas Lehren von der Sexualmedizin [Avicenna's Teachings on Sexual Medicine]* (2005 [1964]), it is clear that Ibn Sīnā did not merely translate and edit those texts, but also provided new considerations such as the one for the concept of seeds.

Ibn Sīnā considered two kinds of seed – a male and a female one – and explained them by combining several concepts. He also accepted the idea of the genitalia as being similar but »turned to the inside« or »outside.« Yet he also described some explicit anatomical differences between women and men. His understanding becomes clearer in the following excerpts (which follow Kirsch's German translation of the Persian original):

> »I say, the organ of procreation for women is the uterus, which is analogous to the male organ of procreation in the original formation, meaning the penis and the attached parts; one of those organs is completed, though, and turned outward, whereas the other is incomplete, held back in the interior of the body, and quasi the inversion of the male organs. The scrotum corresponds to the membrane of the uterus, the penis to the cervix. Women and men have two testicles each. Yet they are large, on the exterior and elongated, while the female ones are small, round, strongly flattened, and situated near the cervix« (Ibn Sīnā, following the translation of Kirsch 2005 [1964]: 60).

> »Men have four muscles of the testicles. They protect the testicles and draw them upward to prevent their limpness. Every testicle has its own pair of them. Women make do with just one pair combined, thus one muscle per testicle as theirs are not attached on the outside of the body as the men's are« (ibid: 100).

Ibn Sīnā's description of the male and female testicles found their way into European thought through the medical texts from the late 1600s onward. Here and there, female testicles are »small, round, strongly flattened«, the other as »on the exterior and elongated«, and both as possessing a dissimilar number of muscles. Yet Ibn Sīnā emphasized the analogies while presenting the differences as superficial and negligible. In Europe from the 1600s onward, on the other hand, it is much more important to distinguish between the places of origin of »eggs« and »semen« – »ovaries« and »testicles« – but also to emphasize the differences. Linguistically, too, we see a change in terminology as the Europeans discontinued speaking of male and female »testicles.« More thorough research is needed. It also seems worthwhile to discuss the traditions and changes in the descriptions of the sexes for their analogies and differences (see also Cadden 1996; Thomasset 1993).

Humorism and the Theory of the Temperaments

Moderata Fonte already mentioned the humors and the theory of the temperaments. In her *The Worth of Women* she discussed the differences between women and men through them and called for strengthening the mind to alleviate temperamental disadvantages. It is explicitly stated in one of Fonte's dialogues:

> »›Tell me, my dear, sweet Corinna‹, said Helena. ›Why is it that women, as Leonora says, are kinder and more innocent and trusting than men?‹
>
> ›In my view‹, Corinna replied, ›the explanation for this lies in women's natural disposition and complexion, which is, as all learned men agree, cold and phlegmatic. This makes us calmer than men, weaker and more apprehensive by nature, more credulous and easily swayed, so that when some

> lovely prospect opens up before us, some enticing vista, we immediately drink in the image as though it were true, when it [sic] fact it is false. [...]‹
>
> ›That makes good sense to me‹, said Helena. ›For women's nature is such that ferocity cannot dominate in it, since choler and blood make up a relatively minor part of our constitution. And that makes us kinder and gentler than men and less prone to carry out our desires, while men, by contrast, being of a hot and dry complexion, dominated by choler – all flame and fire – are more likely to go astray and can scarcely contain their tempestuous appetites. And that is the reason for the fierceness, waywardness, and fury of their anger, and the urgency and excessiveness of their burning, intemperate desires, carnal and otherwise‹ « (Fonte 1997 [1600]: 83–84).

Humorism, also humoral theory, humoralism or humoral pathology, refers to the teachings of the humors (body fluids), and can be found in the Hippocratic Corpus. There are four humors: blood, phlegm, yellow and black bile. There are two primary qualities assigned to each of the four humors: »hot«, »cold«, »moist«, and »dry.« Blood is »hot and moist«, yellow bile is »hot and dry«, black bile »cold and dry«, and phlegm is »cold and moist« (see Figure 1). There is further assigned: blood – spring; yellow bile – summer; black bile – autumn, phlegm – winter. This »medical« theory must be distinguished from the natural philosophical one of the Macrocosm. There, the four elements of air, fire, earth, and water were also assigned two primary qualities. Galen combined these two approaches and argued that the elements of the Macrocosm were represented in the body through humors (see Thomasset 1993; Jahn 2004 [1998]): 54 et seqq., 64).

Galen's contextualization turned the world into a complex concept as everything was categorized accordingly: everything in the Macrocosm as well as in the human body, but also food, drinks, or stages in life. Based on this system, a complex medicine was devised which provided suggestions for keeping healthy and treating illnesses. Today, the best-known treatments of their times are likely blood-letting and dietary recommendations. The balance of the humors, diet, lifestyle – all in respect to the seasons and age – allegedly determined the »temperaments«, i. e., the character of a person. The human temperaments were sanguine, choleric, melancholic, and phlegmatic. We have already seen for the ancient times,

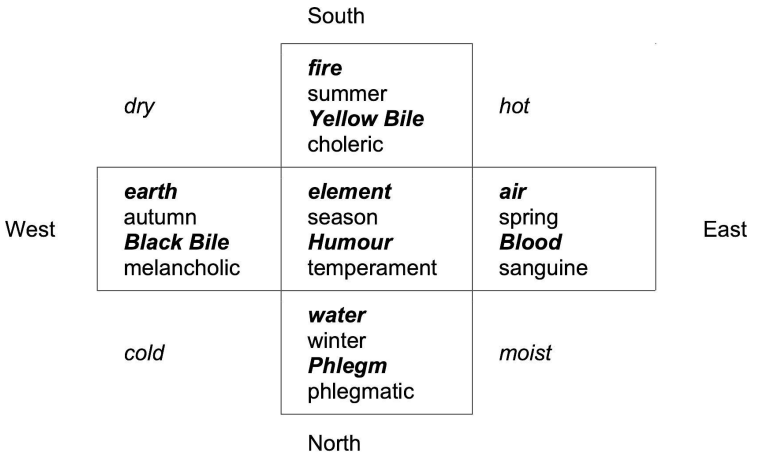

Figure 1: Humorism, or Theory of the Temperaments, as classified in a complex and quadrinomial worldview according to Galen of Pergamon (taken and translated from: Thomasset 1993: 62, emphasis by HV).

that concepts of »heat« (or »warmth«), »moistness«, and »dryness« were assigned to women and men according to their sexes. The theory of the humors/temperaments also had a great impact on the respective recommendations for preserving a healthy body. The Hippocratic Canon, for instance, provides some recommendations that specifically discuss the »illnesses of women.« They are soundly committed to the theory of the humors.

The theory of the humors/temperaments had a strong impact on the Latin Middle-Ages as it offered a comprehensive understanding of the world. There, Galen's ideas had been transmitted through the Arab-Muslim preservations and subsequent developments. The theories made it possible to understand individual abilities, but also how to provide just the right medical treatment, food, or drink. Hildegard von Bingen (1098–1179), the German Christian theologian and expert in naturopathy, was an ardent follower of the theory of the temperaments as her writings show – and the large space she dedicated in them to the concept. They are a fascinating source for the discussion of concepts that emphasize the differences of the sexes.

The theory of the temperaments also had a great impact on societies from the sixteenth to the eighteenth century. The passage by Fonte quoted above is but one example. Fonte considered women (and men) capable of controlling »their nature« through reason. Other authors merely noted the features of the sexes that were allegedly rooted in the different temperaments. They saw them as the reason why women's access to education or social positions of influence were limited. Still other authors, however, argued against the idea of different temperaments of the sexes.

In 1742, Dorothea Christiane Leporin (1715–62, better known by her married name Erxleben but especially for being the first female physician in Germany who held a doctorate) wrote her *Gründliche Untersuchung der Ursachen, die das weibliche Geschlecht vom Studiren abhalten* [*Thorough Inquiry into the Reasons that Prevent the Female Sex from Studying*]. There, she strongly rejected the existence of a temperament just for women which might prevent them from studying. Such a »bad« temperament was to be found in women *and* men, just as there were »good« temperaments to be found in women *and* men. Yet, as she wrote, such a »bad« temperament never prevented men from taking up their studies. Therefore, why should not women study with such a »bad« temperament.

Theories of Preformation in the Seventeenth Century – Describing Differences of the Sexes

The ideas of procreation and heredity were important ones for natural philosophical and biological discussions of sex as we have seen in the little excursion on ancient concepts. The debates over procreation mainly focused on the contributions of women and men, i. e., whether their contributions were of equal value or differed from one another. The idea of hereditary features was an important one, as the child's resemblance of the father's was considered a sign of the offspring's legitimacy. The concepts of procreation and heredity, however, were subject to dramatic changes. They were also more or less compatible with theories of the differences or sameness of the sexes – depending on their stage of development.

The so-called »theories of preformation« gained momentum as concepts of procreation by the end of the seventeenth century. They described

the individual human being as fully pre-formed in either the eggs (Lat. *ovo*, which gave the ovaries their name) or in the semen. Adherents to the former theory were *ovists*, to the latter *animalculists* (from Latin *animalculi* for semen or semen-animal). Put differently: a tiny full-fledged human being was supposed to be huddled in either the egg or the sperm. Only the size was to change during the development of the embryo and later until reaching maturity. The term »development« should actually be read as »expansion«, when following the idea. Figure 2 shows the concept of preformation for the male semen according to the Dutch Nicolas Hartsoeker (1656–1725).

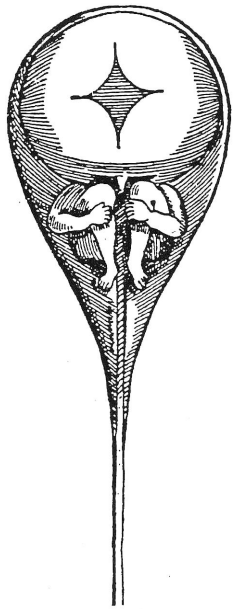

Figure 2: The preformation in the male semen according to Nicolas Hartsoeker, 1694. The human being was allegedly fully formed in the semen. Head, arms and legs are clearly identifiable (detail taken and adapted from: http://www.hps.cam.ac.uk/visibleembryos/s1_4.html [accessed: July 31, 2020]).

The theories of preformation fit very well into the world of Christian-clerical doctrines according to which »God« created humans. Those preformed individuals were thus traced back to Adam and Eve, respectively. Adam and Eve, according to the idea, had in his sperm and in her eggs all future generations preformed and placed one inside the other. To put it crudely, they resembled gonadal nesting dolls: like in a Russian nesting

dolls, a very large number of humans – at least several million – were supposedly placed one inside the other. The huge outer hull were Adam's semen and Eve's eggs.

It would be a mistake to understand women and men as basically equal according to this concept – with the female contribution to procreation sometimes being more important than the male one, and less important at others. Ovists and animalcule alike diminished the female contribution to procreation. The ovists focused on the egg but considered the male contribution as more crucial as it contained the initiating, active principle. Without it, the expansion of the human being would be impossible. The animalculists, on the other hand, diminished the female contribution even further. According to them, women would merely host the embryo, meaning house and feed it. This concept, too, fit well into the Christian-clerical understanding of the times: »God« created woman and man in complete perfection to one another. The parts and contributions of procreation of both were considered different but fitting each other.

Such an idea of procreation was hardly a new one. It could recurse to traditional concepts. The ancient theory of pangenesis, for instance, argued that all body parts would extract the best component parts (basically emit small organic particles), and male and female (!) seed would already entail the fully developed body parts on a very small scale. The adherents of pangenesis, however, considered the extracts of the woman's and the man's body parts equally essential for procreation. Thus, women and men both contributed »their share of heredity« to procreation (both »seeds« were only differentiated according to their quality; see Lesky 1950). This is an important difference to the preformation theorists of the seventeenth century. Then, it was understood that there was a wide gap between the male and female contributions to procreation. The distinguishing terms of »egg« and »semen« were introduced and replaced the one word »seed« for both the male and female contributions.

Different »material« of procreation – egg and semen – now gave grounds for describing the differences for other bodily features. The different raw material of procreation required a different place in the body to be stored. Moreover, it seemed important to distinguish the afferent from efferent vessels. Eggs were now stored in female »ovaries«, semen

in male »testicles.« There had been no such distinction until the end of the seventeenth century, even if some differences had been described. New terminology also began describing the blood vessels that supplied the ovaries and testicles, but also the efferent vessels for the eggs and the semen. Still other descriptions focused on the pelvis and the breasts which apparently »God« had created in perfection, but also in different sizes and functions for women and men.

The theories of preformation were rooted in empirical studies. The ovists referred to the observation of birds, which was transferred onto humans. The animalculists looked through a microscope when they recognized a fully developed human being in the semen. As amusing as those theories of tiny people in the eggs and semen may sound today, they were *the result of empirical studies and personal observations*. This demonstrates vividly, and as an example, that it *was objectively observed what was to be socially expected and what fit the social reality then.*

Concepts of preformation still exist – yet in a different form and under a different name. In genetics, for instance, argues that the smallest molecular structure already entails all information for the development of human features. The cells and the organism would develop those features upon receiving the information. Genetics thus understand all features of an organism as preformed in the »genes.« Let us come back to a more thorough discussion of current theories and their ancestors at a later point.

The Transition to the Developmental Concept (Epigenesis) – Descriptions of Sameness May Tie In

The eighteenth century saw a criticism of the theories of preformation. Among other aspects, they could not – or only awkwardly – explain a child's resemblance to both parents. Regeneration (of wounds) was also difficult to understand under those theories. Some experiments then showed that polyps (»simple« multicellular animals that belong to the phylum of cnidaria) possess a remarkable capability for regeneration. When cut in half, both halves developed into full individuals. There was simply no way to harmonize this discovery with the idea of nesting dolls that were cre-

ated by »God« – those fully developed individuals that are placed into each other.

This observation was one among many which led to debate (and sometimes rejection of) the theories of preformation. There were also other traditions which seemed promising: Aristotle, for instance, described the formation of the semen differently than the idea of pangenesis mentioned above. He did not consider the pangenetic understanding of the semen/seed as a conglomeration of the most valuable extracts of all body parts. He rather proposed that semen was transformed out of blood (the »hematogenous theory of semen/seed«). Under the physiological element of heat, blood would allegedly be transformed into semen and then be available for procreation. Aristotle's hematogenous theory of semen thus did not foresee preformed features, but rather described a process of development. Here, it was tied to the physiological element of »heat.«

Such *theories of process and development* were seized from the second half of the eighteenth century onward. John Tuberville Needham (1713–81), a British natural scientific and Catholic cleric who worked with a methodology based on the use of microscopes, penned some important writings – as did the French natural scientist Georges Louis Leclerc de Buffon (1707–88). Buffon was the one who explained the development of earth through cooling down over a long period. He also argued against the theories of preformation. He considered two seeds (a male and a female one) that consisted of organic matter. *The organization of that matter would increase during the embryo's development.*

The German physician Caspar Friedrich Wolff (1734–94) wrote up the theory of »epigenesis« with his doctoral thesis in 1759. He demonstrated that during the development of the embryo, *initially unformed matter was formed through the processes of development and differentiation into the fully shaped organism*. This was an important achievement: the »epigenesis« did not consider eggs or semen to entail a fully preformed organism. No, the organism with all its body parts and organs was now understood to be the outcome of developmental processes of *unformed matter*.

There seem to be some opportunities to tie in with the theories of social and (natural) scientific developments that came into existence around 1800 and which were described above. The theory of epigenesis, for

instance, worked very well with the understanding of God not as a »creator« but as an all-present force and action (it might be recalled, that the concept dated back to Spinoza). The theory also harmonized with the physical description of energy and electricity. Seizing on those other theories, epigenesis could explain that the initially unformed matter was developed and differentiated through an affecting force, action, energy, and electricity.

Johann Friedrich Blumenbach (1752–1840) was a physician and anthropologist from Göttingen. He might be best remembered for his notorious classification of humans into races. Yet he also described the action that initiates and propagates the development of the organism as a »formative drive.« According to Blumenbach, this »formative drive« was reserved for living matter only – and was not inherent to all matter, as Wolff assumed in his theory of development. Refined in such a way, the theory of epigenesis became convincing to many contemporaries – and even became the definitive theory of natural philosophy and biology around 1800. Today, it is still one important basis for developmental biology.

In respect to considering sex: it is, on the one hand, important to note that epigenesis does not consider human features as pre-determined but as the result of development under varying influences. It is also important, on the other hand, that the »raw material of procreation«, egg or semen, was not discussed for their considerable differences, but largely for their sameness. Accordingly, proponents of epigenesis used the same term for male and female material of procreation: »seed.« Yet, even when the differentiating terminology of »egg« and »semen« was chosen and became normative at a later point, the contribution to procreation was (largely) considered as equal. When researchers described the differences between male and female seeds, those descriptions moved between poles of »more« and »less« rather than between poles of fundamental opposites.

The preformationists' descriptions of differences led to discussing the *differences* between the places in the body where the material for procreation was stored, the afferent and efferent vessels, and many more body features. The epigenists, with their conclusion of the same male and female material of procreation, equally entered debates but now under the idea

of *sameness*. It is interesting to see, that many writings appeared around 1800 which discussed women and men for their *similarities, analogies, the sameness of their procreational material as well as the inner and outer sexual characteristics*. Such considerations strongly influenced those of developmental biology in the nineteenth century.

Analogy and Sameness, as Tied in With Developmental Theories

The theory of epigenesis and the consideration of the (more or less) sameness of female and male procreational material generated more descriptions of the sameness of genitalia.

Gotthilf Heinrich von Schubert (1780–1860), a natural philosopher and historian who was educated in theology and medicine, wrote for example:

> »Thus there is nothing reserved as unique to the sexes. The opinion does not seem to withstand scrutiny that in the individuals of the different sexes would exist utterly opposite forces, contrary organs or efforts [...] The physicists of the past century were wise and careful when they expressed the difference between the matters of the different sexes as a more or less, + and – of the same force, the same features« (Schubert 1806: 208).

Schubert writes elsewhere that »[...] and it was not a mere joke to the great dividers of the past when they assigned to woman the same parts as to man, just hidden on the inside« (ibid: 199).

Schubert thus argued against the understanding of »female« and »male« being fundamentally different, as the preformists did. He emphasized that there was nothing one sex had over the other. Schubert referred to genitalia but also covered the plumage and antlers of animals. Even breasts with mammary glands and menstruation allegedly were not reserved to one sex.

The ideas of the »physicists of the past century«, Schubert mentioned, were the understanding of »heat« as a physiological element as described above. They also referred to the understanding of genitalia as

basically being similar with the exception of their position within the body or outside of it. Such a tradition does not see a fundamental difference between the sexes (as it really did in the preformation theories with their terminology of »eggs« and »semen«). They appeared in the sense of »more« or »less«, and thus were *relative* concepts. It is safe to say that Schubert assumed *relative* to the sexes, meaning between a »female« and a »male« one. Those differences only appear after birth and do not necessarily have to be pronounced: »It seems that the actual difference of the sexes only appears clearly after birth. There are cases when nature gets stuck halfway, or, put differently, in between the two« (Schubert 1806: 201).

Ignaz Döllinger (1799–1890) was a physician and natural philosopher. He took a similar position, when he also emphasized that there initially were no differences of the sexes, and that they developed at a later point. He saw »testicles«, and »ovaries« as the greatest means of distinction, although they were also rather similar to each other. For some humans, he argued and referred to hermaphrodites, such an ambiguity of the sexes would remain. He wrote in an essay from 1816 that:

> »9th [...] Just as much as an embryo can only be human, not female or male, their budding genitalia have no disposition to a [specific] sex. Hermaphrodites possess this non-difference permanently. 10th Human genitalia are not absolutely male but male-female; they are not absolutely female but female-male. Therefore, they profess to a harmony of structure and the option of forming transitory ones. 11th The genitalia of a man are the prostate and the testicles, those of a woman are the uterus and the ovaries. [...] It is self-evident that the prostate is parallel to the uterus and the testicle to the ovaries [...]« (Döllinger 1816: 390).

At the beginning of the 1800s, Schubert and Döllinger are far from being alone with their ideas. There are several more descriptions like these. Both should be understood as representatives of the research of nature and speculative natural philosophy in the Romantic period, true, but the concepts they outlined were more than that. They could also be found in empirical studies. Jacob Fidelis Ackermann (1765–1815), for instance, was a German physician, professor of anatomy, and proponent of a chemi-

cal perspective. He wrote in 1805: »Every individual may have the tools of procreation [genitalia] of both sexes.« He elaborates elsewhere that

> »[a]s we can see through these descriptions of the tools of procreation [genitalia]: every individual has [a disposition to] both genitalia but only one is fully developed. [We also see] that the penis is analogous to the clitoris, the prostate to the uterus, the male urethra to the vagina, the testicles to the ovaries *ductus deferens* [seminal duct] to the [Fallopian] tubes, and the scrotum to the outer labia« (Ackermann [1805]: 136).

Just like Schubert, Ackermann also does not understand the similarities between male and female features a limited to the embryonic stage. He also considered human beings who possess both male and female features after birth and as adults. This apparently held true for genitalia as well as other bodily features, according to Ackermann. In his doctoral thesis (originally written in Latin) he focused on the skeleton and bone structure. Yet he asserted once more that »it is an eternal truth, and I feel obligated to remind the reader, that even the individual limbs of both sexes differ; well, there are male bodies whose structure resemble that of a female one, and the other way around: there are female bodies that resemble male ones« (Ackermann 1788: 5). Among others, Ackermann considered the following origins of the differences of the sexes: lifestyle enabled men to manual labor. A life spent sitting down (he considered the more privileged classes) enabled women to pursue the sciences (Ackermann 1788: 148).

Johann Christian Rosenmüller (1771–1821), a fellow German physician, concurred to Ackermann's theory. In his 1810-essay *Analogie der männlichen und weiblichen Geschlechtstheile* [*Analogy of the male and female genitalia*] he agreed that »in the earliest stages of development, genitalia are neither male nor female« (Rosenmüller 1810: 47). To prove his understanding, he studied the similarities of male and female genitalia. He found many of them and suggested even further research.

As a side note on the contemporary German terminology Ackermann and Rosenmüller used (and which was translated into English accordingly): »analogous« (Ackermann) and »analogy« (Rosenmüller) should be understood in the meaning of our modern »homologous.« Then, around

1800, there was no terminological distinction between »analogy« and »homology.«

Throughout the nineteenth century, scholars described the sameness of genitalia in early embryonic development. Heinrich Rathke (1793–1860), a physician, zoologist and natural historian, wrote in 1825: »The individuals of the same species of all mammals show in their earliest developments the sameness not only their internal but also their external genitalia« (Rathke 1825: 136). Rudolf Leuckart (1822–98) was, like Rathke, also a physician and dedicated to anatomy and developmental history in the mid-1800s. He discussed this hypothesis repeatedly and stated: »Viewing nature without bias or prejudice demonstrates that there is no other difference between male and female genitalia as there is between any two organs or groups of organs that support and complement each other in their function« (Leuckart 1853: 742 et seq.).

Heinrich Wilhelm Gottfried Waldeyer (1836–1921) came to similar conclusions but found a broader audience. He discussed *two different theories of the sameness of the sexual disposition*. In summary, he rejected the one (of sexual neutrality of the embryo) and followed the other which understood the embryo possessing hermaphroditic features. Thus, Waldeyer assumed, too, that male and female features exist side by side in one individual embryo at an early stage of development. Typically, only one feature would develop further from there. He concluded that

> »[t]here is no doubt that the *most primal disposition of even the highest vertebrae is a hermaphroditic one.* Until now, scholars have sought to explain the peculiar behavior of the genitalia in the initial stages of development by an alleged common, so to say neutral primal condition. The one or the other sex supposedly develops out of this until sometimes a male or a female individual comes into being. Yet, scholars have put far too much put emphasis on the behavior of irrelevant side issues such as the outer genitalia. There is indeed an undifferentiated, well neutral primal condition which develops either into male or female. This is not surprising, though, as the external genitalia of men and women are anatomically indeed the same constructs that merely develop into different directions for the different individuals. [...] When considering the development of those constructs, however, that constitute the essence of both sexes, the gonads [hitherto

> differentiated and better known as ›testicles‹, and ›ovaries‹, HV] it is exceedingly hard to see an undifferentiated, virtually neutral primal disposition. [...] put differently: every individual is a true hermaphrodite on a certain stage of development« (Waldeyer 1870: 152 et seq.; emphasis in the German original).

Within the canon of biological writings of the nineteenth century, it was the dominant consideration that the disposition of all individuals according to sex was not classifiable as »male« or »female.« As Waldeyer demonstrates there were even several theories available to explain such a sameness of the dispositions to sex. They were further debated. The theories ought to be outlined as well:

1. Waldeyer presents one explanation with the existence of »an undifferentiated, well neutral primal condition« – a *neutral disposition of sex*. This theory thus outlined the inexistence of any sex in an embryo. Sex and differences of the sexes thus developed at a later stage of the embryo (see figure 3).

   Depending on the point the development according to sex was assumed to diverge, the developing genitalia could be either described for their similarities or differences. Some authors also pointed out the similarities of the genitalia of adults: »testicles«, for instance, would correspond to the »ovaries«, the »prostate« to the »uterus.« Other scholars argued that the disposition was initially neutral, differences according to the sexes, however, would manifest at the initial stages of development.

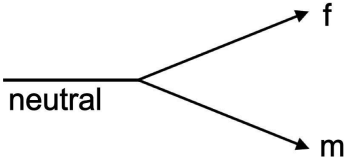

Figure 3: Schematic of the development according to sex from a sexless, neutral starting point toward a »female« (f) or »male« (m) genital tract.

2. Waldeyer describes a second theory, the one of a *hermaphroditical sexual disposition*. This is the one he himself followed. It assumes the possibility of distinguishing between male and female dispositions at an early stage of the embryonic development, but also that all individuals possess both female and male dispositions then. Typically, one or the other disposition would develop further and reach completion. The other one would not disappear but continue to exist in its underdeveloped stage. In some cases, it was possible for the second disposition to continue its development so that its resulting genitalia would be clearly identifiable in the individual (see figure 4).

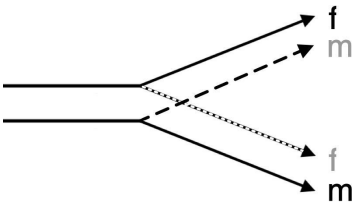

Figure 4: Schematic of the development according to sex from a sexual disposition as starting and which always contains »female« (f) and »male« (m) features. Further development shows the clear dominance of one disposition over the other (bold). The other, however, does not disappear (faint).

3. These two theories as described above were not the only ones, though. A third one saw the *sexual disposition as a differentiated one* from the beginning of the embryonic development. Proponents argued that the embryo appeared neutral, thus sexless, but already possessed a clear sex – female *or* male (see figure 5). Theodor Ludwig Wilhelm von Bischoff (1807–82), also one of the German physicians, physiologists and anatomists, was one of the proponents of

the third theory. He considered the differences of the male and female sexes as too profound to assume a sexless, neutral disposition. Bischoff is otherwise remembered as vehemently opposing the acceptance of women to the studies of medicine (»vehemently«, by the way, even for his times).

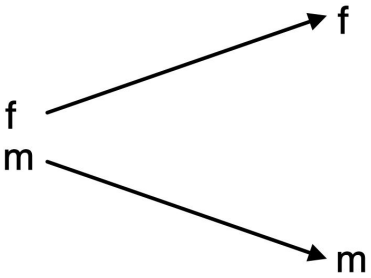

Figure 5: Schematic of the development according to sex from a sexual disposition from the beginning. Such disposition would be either »female« (f) or »male« (m). The genital tract would therefore develop unambiguously and to one sex only.

The theory of the clearly differentiated disposition according to sex was not the dominant one, though. It was considered more likely that the embryo – at least in the first stages of its development – had the organic potential to develop both female and male genitalia. Today, this is also the dominant understanding in the biological and medical studies and writings on the development of the sexes.

As demonstrated, there were different positions within biology when it came to the similarities or differences of genitalia. Then, in the nineteenth century, too, considerations of similarity, correspondence, and sameness did play a greater role. Some of the scholars even considered them to play a crucial one. Several authors understood the disposition of the genitalia to offer the opportunity to develop into female but also into male ones. The developed features would thus not present fundamental opposites,

but relative differences that were based in time. Even after birth and with adults, the fully developed features of the human being did not necessarily have to be clearly »female« or »male.« They could be present side by side in different stages of formation.

Human Beings are Paired in Themselves – Being Adult »Female-Males« and »Male-Females«

In another tradition of theory, *every* human being – even in new-borns and into adulthood – was described as female and male at the same time. Wilhelm von Humboldt (1767–1835) is otherwise known for his linguistic theoretical work but also for his efforts in modernizing the education in Prussia. He was a co-founder of the elder of the two universities in Berlin which was named *Humboldt Universität* in his honor. Humboldt wrote about the distinctive differences between »female« and »male«, yet mostly in an appreciative way. He also considered »female« and »male« as *ideal-typical principles* that depended on each other and could only reach perfection in their combination. He also doubted the validity of the idea there were only one sex present in any given human being. The features of one sex would dominate in a person, but the traits of the other would still be present. In his article *Über die männliche und weibliche Form [On the Male and Female Shape]* (1795), Humboldt wrote:

> »Yet the highest and most perfect degree of beauty is not merely based on bringing shape and substance together but doing so in *an utterly balanced way* with the right artistry, liberty, as well as mental and sensual unity. The highest and most perfect degree of beauty theoretically requires bringing the characteristics of both sexes together in an utmost union of pure maleness with pure femaleness forming humanness. But, even finding such pure maleness and femaleness is exceedingly difficult and, if experience is any indication, virtually impossible …« (Humboldt 1959b [1795]: 81; emphasis in the original).

Humboldt wrote elsewhere that »of these two characteristics of the human form, whose peculiar differences disappear in the one-ness of the

ideal, one is preferred in every sense while the other is merely just not missed« (ibid: 102).

When Humboldt was writing his essays *Ueber den Geschlechtsunterschied und dessen Einfluss auf die organische Natur [On the Difference of the Sexes and its Influence on the Organic Nature as well as On the Male and Female Shape]*, the natural philosophical lectures he attended in Jena, Thuringia, had shaped his assumptions (see Rosenstrauch 2009: 107 et seq.).

Long standing traditions in the history of thought equally provided grounds for such perspectives. They may go back to ancient sources. In the Chinese concept of the »yin and yang«, for instance, »female« and »male« are sometimes described as residing in one human individual in an intertwined way. Plato, in his ancient Greek *Symposium*, has Aristophanes speak of »globular people.« Initially, »female« and »male« had been joint in them, until they were cut in halves. Since then, according to Plato's Aristophanes, every person is one half of a »globular« past in search for the lost other half (on those traditions in the history of thought, see Römer 1903; Neuer Berliner Kunstverein 1986).

These are the historical assumptions into which the natural historic theories of a common embryonic disposition as undifferentiated according to the sexes could connect. They understood a presence of female and male features in every individual and a woman-man-nature of every person, respectively. While it had been propagated widely and also forms the basis for modern developmental biology, some researchers moved beyond the understanding of embryonic sexual characteristics as being undifferentiated: *every human being* should be considered both female and male after birth and even into adulthood. Thus, everybody harmonizes female and male features in one body.

More recent research into the historical understanding of the female-male-nature of every human individual is basically focused on the period around 1900. Then, those theories were often labeled with terminology such as »constitutional bisexuality« or »interstage theory.« Their proponents, such as Otto Weininger, Wilhelm Fließ, Magnus Hirschfeld or Sigmund Freud, often found themselves in the center of attention. Scholarly works thoroughly discussed the situation of around 1900, when priorities concerning the theory of the »constitutional bisexuality« were

heatedly debated. When discussing physical and psychological features, Weininger, Fließ and Hirschfeld described ideal forms of »female« and »male«, »woman« and »men.« Yet, they would never (or, depending on the interpretation of Hirschfeld's work, rarely) appear in a pure form. Every person was supposed to be a combination of female and male components in their specific quantities.

The »interstage theory«, presented the notion in such a sense that there was a vast number of possible »interstages« between the (extreme) poles of purely »female« and »male« (which in reality did not exist in their purity). Those »interstages« allegedly presented some »female« and some »male« features in a person. Hirschfeld calculated more than forty-three million possibilities of such interstages (see Hirschfeld 1926–30, vol. I, 595 et seq.). Freud, on the other hand, limited himself to discussing the psychological nature of the bisexual constitution.

There is a limited amount of research into such theories for the time before 1900. It might be based on the modern assumption that then, in the 19th century, scholars merely described the differences of the sexes and thus did not raise further questions. Notes in Magnus Hirschfeld's and Otto Weininger's works, however, indicate a difference picture. Apparently, the 19th century, too, referred to historical and wide-spread concepts of a male-female-being of every human individual.

Rather recently, Manfred Herzer studied that century when preparing for a debate with J. Edgar Bauer. Herzer outlined the understanding of a »constitutional bisexuality« as rather common among middle-class intellectuals around 1900. He argues in favor of a tradition that had existed throughout the previous century and went all the way back to the period around 1800. Humboldt's discussions outlined above may prove Herzer's argument.

The German sexologist Karl Heinrich Ulrichs (1825–95) presents further contemporary evidence for Herzer's assumption. In a letter, which was written in 1862 and published in the *Jahrbuch für sexuelle Zwischenstufen [Yearbook for Sexual Interstages]* in 1899, Ulrichs referred to the embryonic stages and – in varying degrees – to the adult human. Then he wrote that

> »the sexual dualism exists in a seminal stage in every human individual without exception. It is only pronounced *to a higher degree* in hermaphro-

> dites and Uranians than in the ordinary man and the ordinary woman. It manifests in a different way in a Uranian than in a hermaphrodite« (Ulrichs [1862], as quoted in Herzer 1998, emphasis by HV; see also Ulrichs 1994 [1862]).

In this quote, Ulrichs described »hermaphrodites« as people possessing both female and male physical features – especially genitals. »Uranians« referred to people whose desires are projected onto the same sex and who have sex accordingly.[23]

Such considerations of undifferentiated or hermaphroditic dispositions of sex, but also the understanding of a woman-and-man-nature of every human being, made it possible for emancipation movements to connect. Ulrichs himself was involved in the strife for ending the culpability of same-sex intercourse, and was influential in the foundation of the movement for sexual reform. He himself admitted being attracted to the same sex and argued for the »naturalness« of homosexual attraction, and against its perversity. Every human being carries in them – as outlined above – female and male characteristics. »Uranians« and »hermaphrodites« merely do so in a more balanced way than other »women« and »men.« While »hermaphrodites« manifest that combination especially in their physical features, »Uranians« present the psychological constitutions of another sex than their physical ones. Ulrichs worked with ideas such as »female desires in a male body«, and »male desires in a female body« (Ulrichs 1994 [1862]).

Magnus Hirschfeld's writings, too, may serve as important and often quoted proof that the biological-medical argument of undifferentiated or hermaphroditical embryonic dispositions (thus the woman-and-man-nature of every individual) influenced emancipatory reform movements – especially of sexual reform. J. Edgar Bauer (2002) outlined that

> »it becomes apparent Hirschfeld's biologism – which was repeatedly criticized – aimed at deducing theoretical tools from a scientifically understood

23 »Uranian« as a term describing a homosexual male was coined by Ulrichs around the same time »homosexual« was introduced into the (German) language by Karl-Maria Kertbeny. The translator.

> nature in order to contribute to the erosion of an ideological fixation on the seemingly natural. A scientifically based insight into the immeasurable plurality of nature thus leads to lifting the rigidly categorical sexual-dimorphism as well as the classification of the human species according to races« (Bauer 2002).

Texts that appeared around 1900 and aimed at emancipation did not merely contain references to the biological-medical understanding so summarily – as mere catchphrases so to say. Some writings factually employed the considerations for their *substance* and developed them further, as it had also been done in writings aiming at the emancipation of women. Johanna Elberskirchen (1864–1943), for instance, referred in her essay *Feminismus und Wissenschaft [Feminism and Science]* (1903) to the undifferentiated or hermaphroditical embryonic disposition before drawing conclusions to physical features. She wrote that

> »there is no substantial difference; there is no disposition of a fundamentally male or fundamentally female sex [...] Man and woman thus have the same genitalia in their dispositions. Only later does a sexual differentiation set in in such a way that women develop the specifically female organs, and men the specifically male ones, respectively. The specifically male and specifically female ones then either halt in their development or devolve. One example is the female uterus which does not develop further in males, but is kept preserved as ›uterus masculinus.‹ Man thus has a uterus, too!« (Elberskirchen 1903: 9 et seq.)

After Elberskirchen recalled the state of research then, she assigned those organs the status of »auxiliary organs.« They were not the sexual »main organs« and therefore had no fundamental importance. She considered the sexual »main organs« – the gonads (testicals and ovaries) were understood as the most important sexual features then – as such:

> »Speaking of the gonad, thus the most fundamental aspect of the male and female sexual apparatus, is in its disposition *uniform, unisexual, not bisexual*. There is no specifically female sexual gland in the disposition, and which would develop just as the auxiliary organs do merely in a woman

> or a man, and which would remain rudimentary or devolved in the other sex. The gonad is the one organ in the sexual apparatus (and the only one) which develops in both man and woman, *and which is and remains one and the same in both sexes in shape and function* « (Elberskirchen 1903; emphasis in the original).

Johanna Elberskirchen was a dedicated Social-Democrat who initially studied medicine before publishing her works and getting involved in the sexual reform movement and the emancipation of women (see www.fembio.org). She also based her demands for emancipation on the biological-medical argument of similarity and equality of the assumed sexual features, and the woman-and-man-being of every individual. This indicates, of course, that some current biological-medical theories then allowed their employability for emancipatory debate. Other theories indubitably were unsuitable for being used for this purpose, as they cemented the undisputed and unsurmountable »naturalness« of two sexes with distinct abilities and, according to those, different positions in society.

»Activity«, »Advancement«, »Lag« – Descriptions of the Differences of the Sexes Which Tie in with Developmental Theories

On the one hand, some scholars took the undifferentiated dispositions (or hermaphroditic one) to the conclusion that all human beings harbored female and male features at the same time. Thus, they considered a binary differentiation as too simplistic. On the other hand, other scholars concluded the opposite of far-reaching differences of the sexes from that observation. From an initial state of sameness, individuals would develop into a clearly female or male direction in their view. They could thus build upon far-reaching differences that explained different physical constitutions, and from there the different opportunities for women and men in society. Individuals who were unable to present such clear-cut differences in their sex were subjected to an understanding of their non-normative (and therefore pathologic) development.

The German philosopher Georg Friedrich Wihelm Hegel (1770–1831) in his natural philosophical writings concurred with Schubert's and Ackermann's assumptions: there was an initial phase of a common embryonic disposition of the sex. Yet, Hegel further emphasized the differences of the sexes at a later point of development:

> »Identifying the uterus among the male body parts was most difficult. Rather clumsily, the counterpart was believed to be recognized in the scrotum (Hegel refers to one of Schubert's footnotes, HV). This was done merely because the testicles appeared to be the counterpart of the ovaries. The female uterus, however, more closely corresponds to the male prostate as the uterus sinks into a mere gland within the man, thus into irrelevant commonness. Ackermann has proved that fact very well through his hermaphrodite who possessed a uterus together with all other male features [...] As the uterus degenerates in a male to a mere gland, the male testicle is locked into the female ovaries and does not present itself in any counterpart [...] Because of this fact, the man is thus the active part in this difference, the female, however, the receiving one as she remains in her unadvanced unity« (Hegel 1983 [1830]: 518 et seq.).

Hegel had presented this assumption as early as 1805/06, albeit in a less elaborate way. Presenting the matter in such a way makes it clear that it was possible (and in what way) to consider the differences of the sexes under the light of theories of development. The conceptions of »advancement« and »activity« essentially dictated the individuality – and thus also sexuality. The individual apparently moved away from the species through advancement – and only returned to it through procreation. In order to find their way back to the species, human men and women required one another, and their differences levelled. Hegel's natural philosophical considerations found their way into his social writings when discussing the cohabitation of women and men in society. Here, too, they depended on one another while acquiring different functions – women had to confine themselves to the realm of family and morality, men to that of science and politics.

While Hegel remained a little fuzzy as to which of both sexes (and in what feature) developed away from a condition of commonness –

therefore *advanced* – the work of others established a remarkable and consequential characteristic of the differentiation of the sexes. The male one is presented as the more initiative and active sex. Therefore he advanced away from the species toward more individuality. The female sex, as it was perceived, presented less of an advancement and was therefore tied closer to the species. She possessed less opportunity for individual maturity. »The female sex« and »woman« was, in comparison to the »male sex« and »man«, considered an »inferior stage of development.«

Dietrich Wilhelm Heinrich Busch (1788–1858) was a German gynecologist. In his first volume of *Das Geschlechtsleben des Weibes in physiologischer, pathologischer und therapeutischer Hinsicht [The Female Sexual Life in Matters of Physiology, Pathology, and Therapy]* (1839) he concluded a sexually indifferent embryonic disposition. He saw the reasons for the extensive differences of the sexes in the woman's developmental lag when compared to the man. Busch wrote that

> »the body of the woman therefore appears less sturdy than the man's. His outer features are more pronounced and indicate a meaningful prowess. Because woman lags behind man in matters of the body and all of her tissue remain on a lower level of development, she cannot produce the same manifestations of strength man can. Yet, she demonstrates a higher degree of endurance in the exertions her constitution allows, and more easily replaces all suffered losses. In this, she resembles lower animals« (Busch 1839: 46 et seq.; emphasis by HV).

In their development, according to Busch, women were on a lower level than men. When considering genitalia, some scholars interpret such understanding as proof that the originally undifferentiated dispositions of the sex actually must be female ones. Male genitalia would develop from this – female – basis. Friedrich Tiedemann (1781–1861), the German anatomist, zoologist and physician, wrote in his *Anatomie der kopflosen Missgeburten [The Anatomy of Headless Miss-Formed Neonates]* (1813): »that all human embryos only possess female genitalia during the first months« (Tiedemann 1813: 80). He added: »When comparing the physique of men and women with those of fetuses, it is apparent that

women resemble the fetus more closely than men. Therefore, women are on a lower level of development than men« (Tiedemann 1813: 87).

Such assumptions were not unique to Tiedemann, though. Other scholars shared them as did Johann Friedrich Meckel (the younger), Lorenz Oken, and Johannes Japetus Smith Steenstrup. Heinrich Rathke and Rudolf Leuckart, whose stance we discussed above, argued against it.

Theirs were voices of a minority, though. The theory of women's limited evolution in comparison to men's found more and more supporters. It became rather common in brain research, for instance, to emphasize the similarities between the brains and skulls of children and women. The brain and skull of a man apparently developed significantly further away from those of children. Charles Darwin outlines in his theory of evolution, which is based on the constant change of the species, that it is the male individuals who constantly compete in order to mate with the female ones. Therefore, certain features had evolved: more muscles, stronger tusks or fangs, more and more colorfulness.

Such understanding is most poignant in the works of the Italian »father« of criminal anthropology Cesare Lombroso (1835–1909), and his later son-in-law, legal historian and Socialist Guglielmo Ferrero (1871–1942). In their co-authored *La donna delinquente* (1893, Engl. *The Female Offender*),[24] they wrote that »the male thus is little more than a female which has become perfect and more variable through a special development of the secondary characteristics of the sex.«[25] In respect to the development of physical and physiological features, Lambroso and Ferrero concluded that »it is this inferiority, i. e., the woman's remaining on a childlike stage of development, which we proved for height, weight, the developments of the skull and brains, that we also find in other bodily functions such as pulse [...]« (Lombroso 1894 [1893]: 40) At the end, they also discuss the »female inferiority in matters of intelligence« and defend themselves against any assumption those were society-made (Lombroso 1894 [1893]: 170 et seq.).

24 The German title is more revealing: *Das Weib als Verbrecherin und Prostituierte [Woman as Criminal and Prostitute]*. The translator.

25 The English translation follows the German one.

Such argumentation was not merely misogynous. They were equally employed when presenting the racist idea of an inferiority of people from other continents or countries. They were most often attributed with inferiority when originating elsewhere than the own, European country of the authors. Cultures were classified as »progressed« ones, »civilized«, »retrogressive«, or »uncivilized.« The more advanced a culture was perceived, the more pronounced were the differences of the sexes. A closer similarity between men and women of one culture was taken as a sign of savagery. European peoples – men and women – were characterized as »developed«, »advanced«, and »civilized.« People of a different background – men and women alike – were presented as backward and therefore inferior.

It is virtually impossible to do justice to a critical discussion of racist diminishment here. May it suffice to point out those excellent and critical works of Gould (1981), Becker (2005) and – with a keen eye on the current racism in biology – *AG gegen Rassismus in den Lebenswissenschaften* (2009, Project Group against Racism in the Life Sciences). Thomas Becker (2005) also clearly indicates that the discriminating assumptions on the basis of sex were not comparable to those based on race. In the nineteenth century, for instance, »European women«, too, were granted an evolutionary and hierarchically higher standing than »non-European men and women.«

Typically, participants in the debates assigned to women a developmental lag which corresponded to their »natural function«, meaning parity. She was supposed to take care of the offspring and everything else within the family.

People who lacked a clear sex (so-called »hermaphrodites«) were considered under the idea of a basic and pathological deficiency. Following developmental theories, they were diagnosed with an »abnormal development« preventing them from turning into fully male or fully female. People without a distinctive sex were subjected to special examination, their pictures were taken. They were subjected to surgery and used – or better abused – for biological and medical research. They were (and are) considered as breathing research objects in the quest for the »normal« development of the sexes – their »disorders« supposedly help(ed) identifying crucial factors in the »normal« process of developing the female and male sexes.

This problematic consideration of people as »objects to study« and »proof« for research, for instance, foresaw simple rules of development which were to be understood as all humans (and even all living organisms, respectively) apparently conformed to them. Those rules have proven considerably more complex since, by the way. Yet, bearing in mind such an approach makes it clearer that epigenesis was also crucial in the formation of the »science of congenital malformations« (See, among others, Zürcher 2004).

Detailed Descriptions of Differences

Scholars of the nineteenth century described in detail the differences of the sexes. Their findings have been repeated in the more recent decades – see Honegger, for instance (1991). It is important to consider them in more detail, too, in order to facilitate an argumentation closer to the texts and to emphasize references to developmental considerations.

Pierre Roussel (1742–1802) is one of the protagonists Claudia Honegger presents for her discussion of far-reaching descriptions of differences. A philosopher and physician, he earned his doctorate in medicine and his money with sporadic publications. His *Système physique et moral de la femme [Physiology and Morality of Women]* (1775, 1786 in the German translation as *Physiologie des weiblichen Geschlechts*) presents him as a supporter of the developmental historical considerations. He rejected theories of preformation and referred to the Hippocratic Corpus and Buffon when re-affirming that there was indeed a female seed. According to Roussel, women thus also contributed a seed to procreation (Roussel 1786 [1775]: 175–205). He did, at the same time, also believed in an utter dissimilarity of women and men in all parts of their bodies. Yet, his closeness to developmental historical considerations presents itself once more: Roussel sees no or hardly any differences between girls and boys in childhood. Those differences would only manifest themselves at a more progressed age. For this, Roussel concludes that the female sex was closer to the stage of children than the male was – which in turn would develop (Roussel 1786 [1775]: 3–7, 57–72).

He saw differences in all parts of the body: veins, nerves, bones, muscles: »All of these [...] parts are thinner, smaller, more delicate, and less flex-

ible [in a female body, HV] than they are in a male body« (Roussel 1786 [1775]: 14, the English translation follows the German one).

Yet he did not stop with this observation. Roussel rather drew conclusions about morality. He based them on his understanding of physical and other differences and connected them to the theory of humorism/the temperaments. Women were supposedly »more gentle«, »more passionate«, and »emotionally more irritable« than men. They were »volatile« and incapable of any activity which would require prolonged concentration. Women apparently possessed a mind, but it was more accurate to describe their minds through »sensitivity« and »passion« – a fact enlightenment itself could not change (Roussel 1786 [1775]: 21–41).

As drastic as these differences may appear, it is worthwhile considering them. Roussel begins by assuming two, largely equal contributions to conception. While, as described, he does not consider any (or only a few) differences of the sexes in childhood, he does so for a later age in classifications of »more« and »less.« This ties in very well with the previous theories of development as described above: at this point, he does not see *fundamental* differences, but rather presents *relative* ones. His assumptions for the physical/outward features of the sexes diverges from this fact drastically. Roussel explicitly rejected the idea of the sexes' genitalia being similar to one another, and only turned inwards in one case (women) and outwards in the other (men). He emphasized a fundamental difference in whether something is »given in« or »taken in«, whether something is at the providing or receiving end. Therefore, such features had to be different, and uterus as well as breasts were the most significant sexual features of females (Roussel 1786 [1775]: 108 et seq.).

In her own discussion, Honnegger refers to Jacob Fidelis Ackermann (1765–1815), whom we met above, as another representative when outlining just how the considerations of differences were established. As mentioned, Ackermann did not describe genitalia to be as different from one another the way Roussel did. He rather emphasized the common disposition for the genitalia of the female and male sexes. Moroever he characterized their features through terms of similarity and correspondence. Yet his dissertation is more telling when it comes to differences.

Ackermann in detail turned to the differences of the male and female sexes in his *Ueber die körperliche Verschiedenheit des Mannes vom Weibe*

außer den Geschlechtstheilen [On the Physical Differences of Man and Woman Beyond their Genitalia] (1788). He particularly focused on the skeleton as it had hitherto been rather neglected for the discussion of the differences of the sexes, but also because this »internal basic framework« would determine the shape – and thus also the differences – of the features building upon it.

Ackermann did find differences in almost all parts of the skeleton indeed although he stood in opposition to other discussions of the differences at the same time. Most fundamentaly he observed that »even at first glance, the male skeleton differs from the female one: the latter is indeed constructed more delicately, less strongly, and even the combination of the bones seems to be marked by female features« (Ackermann 1788: 20). The bones of male skeletons were »heavier«, »larger«, and »rougher« than those of female ones. Besides the differences of the bones, Ackermann also concluded women to have »more tissue«, a »softer skin« than men, and differences in their body hair.

Thus, there are many differences to be observed. Yet, delving a little deeper into Ackermann's work might shed some additional light. Right at the beginning, Ackermann himself limited the applicability of his observations and emphasized that all human beings differ more or less from others from others in their own individual and variegated ways. His discussion was intended to refer only to women who had a »perfect female shape.« Just how women could conform to such »perfection« was something Ackermann also described at the beginning of his discussion – thus he presupposed it as the basis for his work. He wrote,

> »*§III. The Perfect Female Shape*. Although it is true (and important to remember that it is) that even the single features of all sexes differ from others; well, yes, there are male bodies which correspond to female ones in their shape, and the other way around: female bodies which are closer to male ones. Yet there are also people of the fair sex whose perfection of their specific shape can be referred to as completely female. The completely harmonize everything I will present in the course of this discussion. Yes, this specific shape is most perfect in those female bodies in which the parts dedicated to executing the main duties of the female sex are most perfectly shaped. I have observed, for instance, that those female bodies in all their

> parts are built most beautifully, most female when their pelvises were in a greater relation to the rest of the bodies than in others« (Ackermann 1788: 5–7, emphasis in the original).

Ackermann did not consider those differences of the sexes as fundamentally »predetermined by nature« at all. He rather (also) understood the importance of the lifestyle for the women's and men's aptitude for different activities:

> »The female sex largely leads a sitting-down lifestyle and does not occupy herself with those tasks requiring ongoing strength of the body and the muscles. Besides, her bones (§8.) and muscles are weaker (§50.) and the nerve fibers are thinner (§67.). It is no wonder that she is, on the average, more apt for intellectual endeavors than men who, in the majority, are more so for bodily work« (Ackermann 1788: 148 et seq.).

This understandings, which Ackermann shared with his own doctoral advisor, Samuel Thomas von Soemmerring (1755–1830), was the basis for one side of the scholarly discussion then. It was influential enough not to be disregarded in the general scholarly debate over skull and/or brain and the sexes in the nineteenth century. They emphasized, for instance, that the skulls of women generally were smaller than those of men when seen for themselves, comparatively, however they were were equally larger than male skulls when seen in relation to the body as a whole. Ackermann and Soemmerring concluded the same for the brain.

Ackermann as well a Roussel made clear that they described *relative* differences between men and women, not *absolute* ones. The former also presents the opportunity to argue for women's aptitude for study as based on biological-medical findings then. Some of those biological-medical theories were apparently inviting enough to connect with the demand of women's education.

Busch, the gynecologist we met above, saw the necessity to limit the validity of his generalizations as they otherwise might have contradicted the individual differences among women which he found: »*The perfect and normally built* woman differs in her outer shape and body from the man, but also by her different organization and structure of the internal

organs« (Busch 1839: 46; emphasis by HV). He particularly added *(relative)* descriptions of the differences:

> »The physical character of the female sex consists of a reduced height of the body, in lesser-defined outer parts – which are generally shaped differently – in heightened delicacy and softness of the firmer parts, in a stronger development of the lower organic tissue, such as the cellular one, in a larger looseness of the body in general, and a peculiar formation of the genitalia which are more pushed back than a man's. The female body in general seems less strongly shaped as the man's whose outer features are more pronounced and refer to a significant strength« (Busch 1839: 46).

A few more pages into his discussion, Busch outlines that the woman's outer appearance is more in accordance with »the laws of beauty« than the man's. She is, supposedly, more »pleasant«, »pleasing«, »gracious«, and »better-rounded« in comparison to a man. He is described in terms like »edgy« and »repelling.« The female head was »rounder«, and presented »less protrusions«, with a forehead »less high«, a »smaller« nose, and a »less pointy« chin. The larynx was less prominent as were its muscles (like those of the torso) than the man's.

Busch continues making similar observations for several body parts. Eventually, he identifies in women cellular tissue to exist in »greater quantity« than in male bodies and relative differences in the blood vessel system – although he did so in a less pronounced way than other authors. In matters of the brain, Busch follows the conclusions of Ackermann and Soemmerring. In relation to her body, and compared with a man, the size of a woman's brain was »remarkable.« Yet, he draws another conclusion which is based less in a peculiar female talent for study, than the way the other two researchers did.

For Busch (and in a true Rousseauian fashion), the female brain size supported the woman's duty to care for the family and other aspects of domestic life:

> »[The] brain of a woman is more independent in matters of the system of blood vessels as well as the nervous system, autarchic, and more inde-

> pendent in general. Changes in the blood have less an effect on her brain than on the male one. The brain functions are less variegated and less pronounced, but rather directed to the inside. Her thought is, as we discussed in our presentation of the psychological nature of women, less subjected to change, too. In matters of mind, women present a more pronounced calmness and self-compliance; for this, their lives are more harmonious. The remaining nervous system, however, is weaker, more fragile and delicate. Woman therefore is more sensible and presents a greater susceptibility toward outer influences …« (Busch 1839: 53).

There are greater differences between women and men in the genitalia for Busch.

> »There is a direct opposition as it took thorough anatomical and physiological knowledge to identify matches and explanations for the opposites that are rooted in variations during development. There are differences according to sex until well into the embryo's sixth week of existence. The formation of all human embryos is therefore based on one common type« (Busch 1839: 63).

It is important to understand that Busch vehemently argues against any assumption that the original state of genitalia was a female one – the way Tiedemann for instance had assumed.

Following Busch and others, the descriptions of the differences were continued. They found their way into the developing specialized disciplines of biology. Ever more subjects were discussed for their differences in an individual and detailed way – and the social discussions over those differences became intense. The hypothesis of the women's limited brawn when compared to men was countered by referring to examples of women who worked hard in the field or in the factory. There, women presented considerable brawn. Scholars intensely debated the skulls and brains, and they often drew conclusions for the capacities of mind based on them. Such debates revolved around the following aspects: does the *absolute* size of skulls and brains determine intelligence (size matters)? Or could intelligence be the result of the *relative size of the skull and brain in relations to the size of the body (or even its weight)*?

In the first case, an elephant is extremely smart, for example, whereas a human being or a mouse should be embarrassingly stupid. In the latter case, if the relation to the overall body size or weight, a simple diet would diminish a human's intelligence ... Or was intelligence rather the result of the brain's structure and furrows? Is that an important sign of intelligence? If so, the circle was concluded whether present differences were »natural« or the outcome of social impact. Helen Bradford Thompson Wooley (1874–1947) as a psychologist presented with her dissertation an empiric emancipatory discussion of the matter. It was published as *The Mental Traits of Sex: An Experimental Investigation of the Normal Mind in Men and Women*[26] (see Thompson 1903).

There were important questions to be solved not only in matters of content. As the writings show they were impulsively discussed anyway. No, even the choice of methodology was debated: how to take a photograph of a human skull the right way in order to thoroughly research the flattening of the forehead (as an indicator for an individual's intelligence and psychological condition)? Was it possible to plaster cast the head of a living person in order to represent their faces and dimensions of the skull? Or would the long period of drying invalidate any meaningful preservation? Lastly: how to measure the skull and identify its inner volume? Was it possible to use millet to identify that volume – provided the moisture of the millet would not vary too much in between measures and mess up the comparability. Or why not use the grist of grains – yet, how finely cut should it be? And, of course, was it possible to make assumptions for the brain and its size based on identifying the inner volume of a skull? The scholars Paul Broca and Carl Vogt were dedicated to measuring brains, for instance. They debated such questions as much as Helen Bradford Thompson did discuss the methodology for measuring intelligence (see, for instance, Gould 1981).

It was not uncommon to disregard the findings of competing scientists based on their methodological approach. Other authors, such as the neurologist Paul Julius Möbius (1853–1907) from Leipzig were less concerned with the question of how to measure correctly (he is still of

26 Helen Bradford Thompson, The Mental Traits of Sex: An Experimental Investigation of the Normal Mind in Men and Women (Chicago: University of Chicago Press, 1903).

mild interest for his rather slim *Ueber den physiologischen Schwachsinn des Weibes [On the Physiological Idiocy of Women]*, 1900). Möbius wrote:

> »When measuring the circumference [of a head, HV] hatters have their own method which they do not understand – and which I have neither. You add the length and width of the reduction, then half the sum, and look up the resulting number in a table which shows you another number that presents the circumference in centimeters. I am not blessed with much experience in mathematics and rather approach the matter as a handyman. Yet the results are correct« (Möbius 1903: 18).

Hatters used a tool to take the circumference of a head (the so-called »conformateur«). It could only measure circumferences of at least 53 centimeters/20.8 inches on male heads – for which clientele the hatters worked. Möbius concluded the fact that there simply were no male heads with a smaller circumference of 53 centimeters/20.8 inches.

Figure 6: Measuring the Circumference of a Head with a »Conformateur« (taken from Möbius 1903: 17).

»Newer« Evolutionary Theories After Charles Dawin – Differences of the Sexes and Emancipatory »Romanticizing Darwin«

The term »evolution« did not always have the meaning it is connected to it today. At the beginning of the nineteenth century, people understood it to be something different. The term was used in the understanding of the preformists: individuals are preformed and simply have to reach their adult size – »God« had created everything at a certain point in time. In this sense, »evolution« was meant to be stagnation inasmuch as »development« merely meant the »maturation« of already existing matter. There was no room for considering the new formation of organs or species.

Following Charles Darwin, however, the meaning of »evolution« has shifted. For us, »evolution« means that the features of a species (or the development of new species) take place over a long period. Today, scholars are also considering the exacerbations of development. What made Darwin's assumptions so provocative for his contemporaries was the fact that his *Descent of Man, and Selection in Relation to Sex* (1871) placed human beings among other animals. Then, Darwin described the common ancestors of humans alongside some other primates. Humans were thus dethroned as the »crown of creation.« Darwin did face much opposition, but also biting media representations and ridiculing caricatures (see, for instance, Darwin: Voß 2008).

In 1859, Darwin had published his *On the Origin of Species* in which he thoroughly outlined their evolution (in the modern sense). He was able to tie in with previous discussions such as those sparked by the botanist and zoologist Jean-Baptiste Lamarck (1744–1829) and the physician Lorenz Oken (1779–1851). Those scholars had described the possibility of an evolutionary development of organs and organism as well as the new development of species at the turn of the nineteenth century. Oken had even concluded that the embryonic development of animals went through stages resembling lower species. Ernst Haeckel (1834–1919) continued the work when he presented his – what we call today – »biogenic basic rules« in 1866: the development of the embryo is a quick-motion evolution of the species. Evolutionary »higher organisms« allegedly experience in their embryonic developments the stages on which »lower species« were stuck.

In his *Descent of Man, and Selection in Relation to Sex*, Darwin saw exactly that in the center of the mechanism behind evolution: the selection in relation to sex. By choosing the sexual partners, certain peculiarities and features of a species might be spread whereas others would diminish over the course of several generations – until those peculiarities and features would simply become extinct in a species. Both the female and male sexes might determine the »choice« of the sexual partner:

> »The sexual struggle is of two kinds ; in the one it is between the individuals of the same sex, generally the male sex, in order to drive away or kill their rivals, the females remaining passive; whilst in the other, the struggle is likewise between the individuals of the same sex, in order to excite or charm those of the opposite sex, generally the females, which no longer remain passive, but select the more agreeable partners.«[27]

In both cases, evolution apparently was a male endeavor for Darwin. When following him, the first scenario (the struggle for the female) sees the stronger and more untiring male as victor. Therefore, they enjoyed a more pronounced success in procreation and their features spread – and eventually prevail – among the entire population over time. The second scenario presents the necessity for males to be particularly attractive, colorful, and generally presenting a most handsome and attractive figure to lure in females for mating. Thus, the more handsome, attractive, and likely stronger males, again, enjoyed a more pronounced success in procreation – and their features were evolutionarily speaking an advantage. They would spread among the population.

There were exceptions of that rule. In humans, males apparently were stronger, yet females had developed as well and have been chosen on the basis of their beauty (Darwin 1871: 399) Yet Darwin also concludes that the male sex – human males included – always present a greater variability, and its features have developed. Generally speaking, however the female sex, does not present such a development. Such understanding is most present in Darwin's conclusions which can be found in a similar

27 Charles Darwin, *Descent of Man, and Selection in Relation to Sex,* vol. II (London: Clowes and Sons, 1871), 398.

way with Tiedemann, Ferrero, and Lombroso: individuals of the female sex are closer to a more childlike stage of development than their male counterparts. Darwin writes that »Hence in most cases the young of both sexes resemble each other; and the female resembles her young offspring through-out life« (Darwin 1871: 397).

Darwin summarizes the idea when writing:

> »There can be little doubt that the greater size and strength of man, in comparison with woman, together with his broader shoulders, more developed muscles, rugged outline of body, his greater courage and pugnacity, are all due in chief part to inheritance from some early male progenitor, who, like the existing anthropoid apes, was thus characterized. However, these characteristics will have been preserved or even augmented during the long ages whilst man was still in a barbarous condition, by the strongest and boldest men having succeeded best in the general struggle for life, as well as in securing wives, and thus having left a large number of offspring. It is not probable that the greater strength of man was primarily acquired through the inherited effects of his having worked harder than woman for his own subsistence and that of his family; for the women in all barbarous nations are compelled to work at least as hard as the men. With civilized people the arbitrament of battle for the possession of the women has long ceased; on the other hand, the men, as a general rule, have to work harder than the women for their mutual subsistence; and thus their greater strength will have been kept up« (Darwin 1871: 325–26).

What is striking in Darwin's considerations, of course, is the clear racism he professes. In contrast to Blumenbach's discussion, Darwin clearly voices his understanding of some societies being on a higher level of evolution than others (see also, for instance, Darwin 1871: 338, 363).

The differences of the sexes are, according to Darwin, the outcome of struggling for survival and especially procreation. He outlines the differences as such:

> »Man on an average is considerably taller, heavier, and stronger than woman, with squarer shoulders and more plainly-pronounced muscles. Owing to the relation which exists between muscular development and the projec-

> tion of the brows, the superciliary ridge is generally more strongly marked in man than in woman. His body, and especially his face, is hairier, and his voice has a different and more powerful tone ... Man is more courageous, pugnacious, and energetic than woman, and has a more inventive genius. His brain is absolutely larger, but whether relatively or compared to the larger size of his body, in comparison with that of woman, has not, I believe been fully ascertained. In woman the face is rounder; the jaws and the base of the skull smaller; the outlines of her body rounder, in parts more prominent; and her pelvis is broader than in man ...« (Darwin 1871: 316–17).

It seems likely that Darwin based his conside1rations on the character, too, which is clearer elsewhere. Women, for instance, are characterized by a »greater tenderness«, and »less selfishness.« She directs her »maternal instincts ... towards her infants [but also] towards her fellow-creatures.« Man, however, »is the rival of other men; he delights in competition, and this leads to ambition which passes too easily into selfishness« (Darwin 1871: 326).

As to the mental capacities of the sexes, Darwin concluded:

> »The chief distinction in the intellectual powers of the two sexes is shewn by man attaining to a higher eminence, in whatever he takes up, than woman can attain – whether requiring deep thought, reason, or imagination, or merely the use of the senses and hands« (Darwin 1871: 326).

Those understandings in Darwin's work are not exactly ambivalent: women are clearly set behind men. In light of this, it is the more striking that some authors who strove for the emancipation of women referred to Darwin's theories. Others, who argued against such emancipation, refused »to romanticize Darwin.« Several aspects are indeed striking.

1. Darwin also professed to the leitmotiv of a common sexual disposition which we have addressed throughout the entire chapter on biological theories. Differences were thus rather the result of developments. Darwin also outlines the possibility that features were inherited differently: features acquired by the male sex would go on to their male descendants. Considering this, Darwin's common sexual disposition might be understood as divergent after all. But ...

2. Darwin neither professes to an absolute distinction between the sexes when it comes to heritage. He repeatedly discussed the fact that features which are passed down from one sex did at least rudimentarily affect children even if they are of the other sex (Darwin 1871: 327–29). When referring to the mental capacities, Darwin assured the reader:

   »It is, indeed, fortunate that the law of the equal transmission of characters to both sexes has commonly prevailed throughout the whole class of mammals; otherwise, it is probable that man would have become as superior in mental endowment to woman, as the peacock is in ornamental plumage to the peahen« (Darwin 1871: 328–29).

3. A third aspect is equally noteworthy. Today, Darwin's theory is often contrasted to Lamarck's as if Darwin rejected the notion that once acquired features were not passed on to the next generation. Yet, he clearly wrote when referring to intelligence:

   »In order that woman should reach the same standard as man, she ought, when nearly adult, to be trained to energy and perseverance, and to have her reason and imagination exercised to the highest point; and then she would probably transmit these qualities chiefly to her adult daughters. The whole body of women, however, could not be thus raised, unless during many generations the women who excelled in the above robust virtues were married, and produced offspring in larger numbers than other women« (Darwin 1871: 329).

Darwin clearly accepted social influence and described passing on acquired features onto the next generation as a possibility. The social aspect is something Darwin considered further for his theory of evolution. »Attractiveness«, for instance, differed for him according to regions, thus different features of »attractiveness« would be passed on in the different societies (Darwin 1871: 339–40).

It is a very social aspect Darwin described in the conclusion of his Descent of Man, and Selection in Relation to Sex: the development of language has had an enormous effect on the development of the brain. He wrote that

> »[a] great stride in the development of the intellect will have followed, as soon as, through a previous considerable advance, the half-art and half-instinct of language came into use; for the continued use of language abilities have reacted on the brain and produced an inherited effect; and this again will have reacted on the improvement of language ... The higher intellectual powers of man, such as those of ratiocination, abstraction, self-consciousness, & c., will have followed from the continued improvement of other mental faculties ...« (Darwin 1871: 390–91).

A few pages later, he continued:

> »The moral nature of man has reached the highest standard as yet attained, partly through the advancement of the reasoning powers and consequently of a just public opinion, but especially through the sympathies being rendered more tender and widely diffused through the effects of habit, example, instruction, and reflection. It is not improbable that virtuous tendencies may through long practice be inherited« (Darwin 1871: 394).

According to Darwin, society has indeed affected the limitation of an individual. It has thus also affected the transmission and evolutionary development of features. And, referring to the proverbial »Survival of the Fittest«, allow me one remark: Darwin did not understand it as a call for all humans to fight one another and crush their skulls as a result. He rather understood a situation of competition leading to better chances for some, perhaps a longer lifespan but especially more »success in procreation« than others. In essence, humans as well as other »[s]ocial animals are partly impelled by a wish to aid the members of the same community in a general manner, but more commonly to perform certain definite actions« (Darwin 1871: 392).

People, who strive for the emancipation of women, often (and foremost) argue for equal opportunities in education for women/girls and men/boys. Mental faculties, it is emphasized, are developed through education. If this stimulation is lacking, the mental faculties simply wither away. In this sense, Hedwig Dohm (1831–1919), a literary scholar and publicist, argued for *Die wissenschaftliche Emancipation der Frau [The Scholarly Emancipation of Woman]* (1874). When discussing the theses

of Theodor Ludwig Wilhelm von Bischoff (see above), she saw the overwhelming success of men in the sciences as an outcome of the seclusion of women, among others.

The German pillar of Socialism, August Bebel, concurred with this contemporary of his, and combined this view with the theories of Darwin in an explicit and detailed way. His *Die Frau und der Sozialismus [Woman and Socialism]* (1879) had initially been banned but then found a broad audience (1910 saw its 50th edition). In his book, he described that

> »Darwin is likely correct when stating that a list of the most remarkable men in poetry, painting, sculpturing, music, the sciences and philosophy would utterly trump a comparable list of women in the same fields. But how could it be any other way? It would be remarkable if it were otherwise. For this reason, Dr. Dodel-Zürich replies to the idea that it was different indeed, if over the course of several generations women and men had enjoyed equal opportunities of education and instructions in the arts and disciplines. The female physiology, speaking on the average, is generally inferior to than of her male counterpart. This is not the case in many savage peoples. The example of women working at the circus (also as acrobats) prove the degree of courage, daring, skill, and physical strength if having exercised and been educated from the earliest childhood onward.
>
> As such a development is a matter of the living conditions and education (or, phrased scientifically crass, of breeding) it might be accepted that the people's physical and intellectual lives will present the most beautiful outcomes as soon as society interferes in their developments with a keen eye on purpose and aim« (Bebel 1950 [1879]: 336 et seq.; emphasis in the original; detailed footnotes are omitted).

Bebel refers to Arnold Dodel-Port (1843–1908), a botanist from Zurich, Switzerland. He was one of the most important authors to promote Darwin's findings. In his own *Die Neuere Schöpfungsgeschichte nach dem gegenwärtigen Stande der Naturwissenschaften [The Recent Creation Story in Regards to the Present State of Science]* (1875), Dodel-Port set Darwinism into the focus of his considerations. Therefore, his conclusions as to the mental facilities of women and men were Darwinist indeed:

> »It is supposed that, since the historic times, the capacity of skull and the volume of the brain, respectively, among civilized nations have grown. If that holds true, we might expect – with close to mathematical certainty – the greater growth in the capacity of the female skull the more we enable our female sex to enter the arena of the mind and compete her intellectual powers with those of the supposedly superior mental faculties of men ... Therefore, if the women's emancipation of the mind becomes a reality, it greatly benefits the future male generations as well. We may congratulate them for having intellectually more advanced mothers than previous generations« (Dodel 1875: 186).

Dodel-Port, just like Darwin, professed to an understanding of some ever-evolving societies while others were declassified as »un-cultivated« and »un-civilized.« It is equally apparent, that Darwin's theories were employed for promoting the emancipation of women (and similarly of workers). In essence, some scholars understood Darwin's ideas in such a way that the brains of women could reach a similar volume (and quality) as of men, provided the correct social conditions existed for them.

Such »romanticizing Darwin« caused opposition, as it did in Paul Julius Möbius. He emphatically argued against the emancipation of women, for instance. Suppositions of women merely lacking mental exercises, he argued, were a sign of

> »common Darwinist romanticism. Seeing an acquired atrophy of the brain as hereditary (and the other way around) but also expecting women to have large brained granddaughters if they exercise their own brain, is romanticisim. It could only make any sense if we talked about parthenogenesis. There is hardly any less brash way to strike truth in the face than those ›feminists‹ do« (Möbius 1903: 24).

Thomas Henry Huxley (1825–95) was a natural historian from London and equally active in promoting Darwinism. He championed the education of women in general and women workers, but also doubted whether the (artistically and intellectually) best women could acquire the same skills as the best men. He did assure his contemporary readers, though, that women would find their new position in society. But it would be their

own, not man's as men would always prevail in a struggle with women over importance if they set their minds to it. The physiological advances of men would simply see to it (Huxley 1877: 24 et seq.).

In essence, Darwin's theories could be employed for and against the struggle for women's emancipation – and it was done so with gusto. Darwinism did explain for one side that social conditions had hitherto crippled the women's abilities to develop mental facilities which were similar or equal to that of men. The adapted upbringing and education could facilitate reaching male standards – and such strengthened faculties of the mind could be inherited by (and thus expanded upon) by the following generations. The other side argued that the »inferior« intellectualism of women was not the outcome of dissimilar opportunities of the sexes. Women had merely taken a position in society »their nature« assigned them to take (Möbius, Bischoff). Huxley presented a third option to read Darwin under the lens of the sexes: women did not have equal opportunities to shape their minds in the past but should have now. Yet, according to Huxley, the »best men« would also always trump the »best women.« In other words, in Huxley's understanding, women could merely narrow the intellectual margin to men. Nature, however, prevented them from outrunning their husbands.

Conclusions

As demonstrated, experts in biology and medicine have struggled between the several positions in respect to sex for quite a while. Thus, it is plain false that they had almost exclusively argued for a difference of the sexes since the end of the eighteenth century. It rather holds true that their descriptions – often based on the understanding of development of the embryo as well as the human species as a whole – have to be understood as a separation of »perfection«, i. e., the ideal state of development, from something »imperfect«, meaning the consideration of reality playing into assumptions. This was already visible in Laqueur's findings for the ancient period.

Biology and medicine present a discussion over sameness and difference of two sexes. Some theories even considered every human being male

and female at the same time, thus understanding »male« and »female« as socially ideal constructs which simply do not exist in reality. Following Karl Heinrich Ulrichs, Johanna Elberskirchen and August Bebel (whose contemplations on the matter we met above) factually political writings dedicated to the emancipation of women, too, argued substantially – not merely passingly – in the understanding of biology. They referred to a common sexual disposition, the female-and-male-being of every human individual, as well as Darwin's theories of evolution. It seems worthwhile, from a modern perspective, to do research into the plurality of biological-medical theories of the sexes but also just how they were employed in more politically oriented writings on the emancipation of women.

When turning to the current biological-medical theories of the sexes on the following pages, it is of essence to recognize the debates between several positions. The controversies between theories of development and those of preformation are most important. Separating those two approaches in an analytical way (as was done in our historical chapter) may provide a better understanding for possible paths of the current debates. Those current debates may – or may not – emphasize the (socially predetermined) concept of binary sexes which rests on preformation and/or determination. Said concept often pathologizes the formation of non-standard genitalia. Other concepts we discuss, do rest on the same foundation of preformation and/or determination when taking into account the variety of individually dissimilar formations of the genitalia into their theories. They follow an evolutionary theoretical approach.