

Gender Identity: Friedrich Ziegler (1850-1920), Wax Models.

My article considers biological explanations of gender, and in it I explain the reason why medical wax models from the 19th Century still matter today when we think about intersex and transgender identities.

Jayde Martin

Collection: University of Birmingham Research and Cultural Collections, Medical School Collection

Keywords: Intersex, Sex Development, Gender and Sexuality, Ziegler, Wax Models

In this paper, I analyse nine objects that form part of the extensive wax model collections that are part of the Medical School Collection at the University of Birmingham's Research and Cultural Collections. The nine objects are related to one another: they form a series of wax models on wood, representing the different stages of the biological sex development of a human foetus, and were produced in the 1880s by the German modeller Friedrich Ziegler (1860-1936).¹ These models were originally made for medical study, but by analysing them as sculptural objects, I show how they helped to shape cultural standards of gender normality within their own historical context. In this sense, I build on medical historian Nick Hopwood's research into the legacy of Ziegler's models, and reflect on their contribution to the development of modern bioscience.²

The nine Ziegler models in the University's collection depict the different stages of human biological sex development in the womb. They were used at the University to teach medical students about the development of two different (and therefore binary) kinds of biological sex development. These models, in their sequential order, depict a seemingly standard process or 'typical' process of sexual differentiation in the womb. On the one hand, they mark a revolution in medical imaging, but on the other and despite their intended scientific purpose, they became embroiled in contemporary debates about social constructions of gender in the late nineteenth century.³ Knowing this, I came to the models to investigate how such objects, primarily used in anatomical pedagogy, could impact wider socio-political discourses. In this article, I argue that it was their existence as three-dimensional sculptures, and the narrative view of development they depicted, that entangled them within socio-political debate.

These models were the closest visual replica of human development in the womb produced during the period.⁴ The visual representation of sex difference in a naturalistic manner sharpens their significance for contemporary socio-political debate about gender norms: because the models presented sex organs as discrete and reducible parts of a whole being, they became easy objects to focus on and utilise within ongoing political discourse about women's social and biological purpose. The presentation of these scientific models of sex development in the womb served to foster a form of [biological determinism](#) as an explanation for the social construction of gender identities.⁵

My approach in this article draws on the methodology of Gender and Sexuality Studies, analysing the

Jayde Martin, 'Gender Identity: Friedrich Ziegler (1850-1920), Wax Models', *Midlands Art Papers Special Issue: Inclusion, Disability and Access in the Arts* (2019/20)

social construction of identity within culture, investigating how identities are read onto the human body, and exploring the extent to which this is used to 'Other' them.⁶ 'Othering' is a term used in this paper to mean a process whereby a body is judged to be non-normative (i.e. 'other' than that which is considered normal). In this context, the 'other' is associated with difference and, potentially, deviancy. For example, if a person's body and identity deviates from a cultural standard of normality, they are then 'othered'. This can lead to oppression because the prioritisation of socio-cultural standards (norms) within both social structures and institutions form systems of oppression.⁷ In relation to gender, cisgender people (a term that means identifying with the gender associated to your biological sex) and heterosexual people have come to represent a long history of cultural standards of normality within western European culture.⁸

This cultural standard of 'normality' is largely determined by historical and cultural context. What is considered a standard of normality in contemporary western culture differs from other standards of normality found across the globe and throughout history. 'Normal' I use here to describe culturally and socially accepted identities, and my specific focus will be on the way gender was seen in late nineteenth-century Europe. Deviant or different is used in my analysis to describe identities that are often regarded as culturally and socially intolerable, again with a focus on the late nineteenth-century context. The aspect of my analysis that engages with these fields is intersectional in the sense that I situate the wax models in relation to sociological constructions of gender and raise the implications this has for queer identities, and how they were and are constructed. Queer in the context of this article is defined as a relational identity, one that encompasses any gender identity and/or sexual identity that diverges from cultural hetero-normative standards.⁹ This definition (or rather lack of specific definition) of what queer means is central to my reading of the Ziegler wax models. I suggest that the production and contemporary reception of these wax models involved conversations about gender that parallel current arguments about the legitimacy of transgender and intersex individuals. Key to this is the notion of sexual dimorphism: where the two sexes of the same species exhibit different characteristics beyond the differences in their sexual organs.¹⁰

Ziegler's models of sex development: a gender binary

Prior to the work of Ziegler, medical imaging in [embryology](#) was based on two-dimensional drawings.¹¹ The Ziegler wax models changed this, as they represented, naturalistically, the development of human embryos in three-dimensions.¹² By replicating the development of the external sex organs of the human embryo, these objects embodied a liminal space between scientific imaging, sculpture, and sociological perceptions of the body. While there are important distinctions between anatomical modelling and sculpture as an art form, they both engage in three-dimensional renderings of the body, and as such are accompanied by similar ideological implications. Every model captures a specific moment during sex development in the womb.

As individual pieces of medical modelling and as sculptural objects, these works construct a visual narrative of two developmental pathways: vaginal development and penile development. The snapshot effect of the series is then amplified by the framing of each model on a wooden plaque. Each wax model is integral to understanding the next and the narrative focus of the series is on

Jayde Martin, 'Gender Identity: Friedrich Ziegler (1850-1920), Wax Models', *Midlands Art Papers Special Issue: Inclusion, Disability and Access in the Arts* (2019/20)

visualising a progression from one stage of organ growth to another. These objects tell a story of biological development, but they also represent an ideological tendency towards associating anatomy with human identity: what is ungendered and unsexed becomes sexed within this binary of vaginal and penile development, and identified as male or female. While only three models in the collection depict the ungendered foetus and its developmental trajectory, the majority of the models focus around the anatomical difference between the two pathways (vaginal and penile) rather than displaying equal interest in all phases of their development. This emphasis on binary sexual difference is therefore inherent to the Zieglers' depiction of the embryonic sex development.

Furthermore, the development of the male sex organ appears to be the focus of this anatomical progression. The biological development of the vagina is explored in less detail, captured only within two snapshots of development. This seems to cast it as 'other', present purely for an illustrative comparison. Intersexed anatomy is omitted entirely. The implication, then, is that both intersex development and vaginal development are not as important because of their difference to the cultural standard of normality: masculinity and all its biological associations.¹³ The extra attention given to the penis is evident in the models that demonstrate minute changes in the growth and size of the penis and testes (figs. 7-9). Conversely, we see a profound jump in the narrative of vaginal development in terms of shape and labial development (figs. 6-8). Research conducted by the Department of Physiology, Anatomy, and Genetics at Oxford University has shown that there is an additional early stage of 'urogenital development' represented in the original series of Ziegler Wax models, which is missing from Birmingham's collection.¹⁴ Despite this, the organisation of the models within the series still indicates that Ziegler placed a greater focus on penile development, with only two later-stage vaginal development models produced, in comparison to three for the 'male' development.¹⁵ Comparing the Birmingham set of models with the research done at Oxford, we can see that fig 4 appears to be listed both under 'female' and 'male' as 'early development' in the latter case.¹⁶ This shows that the organisation of these models, then, appears to some extent to be a matter of interpretation. At the same time, however, it is clear that unequal treatment of the development of the vagina compared to the penis is an importance point of difference in these models.

Gender and historical context:

For centuries, both women and intersex patients were subjected to invasive medical treatments for ailments which were (often erroneously) based on their gender.¹⁷ Their sex organs were seen to be the leading cause of any perceived dysfunction or defect- the condition 'hysteria' is a notable example of this- and treatment for such conditions was often, at least in part, directed to sex organs.¹⁸ During the Zieglers' life-time hysteria was perceived as a gendered ailment referring to women's 'madness'.¹⁹ Notions of women's sociological identities along with their health and wellbeing were thus constructed in relation to their 'faulty' sex organs. This coincided with the development of scientific arguments that used women's biology as an excuse to determine their social gender role – that of the mother.²⁰ The production of the Ziegler models, and their later legacy, became part of a heated debate between conservatives and liberals about women's role in society.²¹ One interpretation of the developmental narrative that the Ziegler models create is that

Jayde Martin, 'Gender Identity: Friedrich Ziegler (1850-1920), Wax Models', *Midlands Art Papers Special Issue: Inclusion, Disability and Access in the Arts* (2019/20)

women's sexual development is inferior to men's based on the additional attention to detail that the models place on the development of the penis and the testes. This suggests that contemporary arguments about women's societal roles, particularly those which focused on the perceived biological inferiority of women, seem to also parallel the inferior, or simplified, representation of female biological sex development in medical imaging, as epitomised by the Ziegler models.²²

Most investigations of biological sex and gender were carried out by men, and as a result these investigations were detached from the embodied experience of being a woman.²³ A lack of attention to female sex development in this developmental narrative could, to an extent, be read as evidence of women's biological inferiority or a unworthiness of sustained scientific attention. However, as Hopwood states, Ziegler's studies actually facilitated some liberal campaigners to advocate for women's right to abortion.²⁴ The range of possible interpretations of these models, positioned on opposite ends of the political spectrum, demonstrates the adaptability of the objects as evidence for and contributors to socio-political debates. This adaptability in turn demonstrates the arbitrary use of scientific evidence to support conservative and liberal political agendas in the period.

Intersex: sex development beyond the binary

The narrative of sex development presented by the Ziegler models does not acknowledge the alternative development of intersexual genitalia. The developmental separation of the foetus into one of two possible pathways (vaginal/penile, female/male) also mirrors and reinforces the cultural standard of normality established in nineteenth-century society: that of the gender binary. Those who conform to the binary were given a secure biological explanation for their normality, one that relates to their embodied experience within society, providing a biological validation for personal gender identity. Intersexual sex development was outside of cultural norms during this period. By providing a biological representation that only concentrated on the perceived 'normal' stages of sexual development and reinforced the notion of the gender binary, the models omit intersex development even as a possibility.

The use of these models as teaching aids to educate medical professionals about human anatomy thus creates a problem. Intersexual sex development becomes 'othered' when contrasted to the well-documented development of the two binary sexes. Focusing only on the two 'normative' developmental narratives as teaching aides further perpetuates the omission of intersex development, and reinforced its designation as 'other' or as an anomaly. Sustained medical conversation about intersexuality had begun twenty years before the models' production.²⁵ During the period in which Ziegler was working, patients were beginning to be sexed later in life and these decisions were made based on how similar their sex organs were in comparison to a vagina or a penis, a decision supported by further analysis of their secondary sexual differences. Medical decisions about a person's gender identity were thus being made on 'sex difference' alone, without consideration for the patients' preferred gender identity.²⁶

In 1877 '[a bearded woman](#)' and her case of ambiguous gender was popularised in a national periodical. It was reported that doctors examined her skull, hands, feet, and the coarseness of her

Jayde Martin, 'Gender Identity: Friedrich Ziegler (1850-1920), Wax Models', *Midlands Art Papers Special Issue: Inclusion, Disability and Access in the Arts* (2019/20)

hair as secondary sex characteristics to make a final decision on her gender identity.²⁷ The hair on her head was 'fine' and her 'hands feminine' so she could still define as a woman; no reassignment practice was needed.²⁸ [Alice Dreger](#) states that medical knowledge of intersexuality in the West can be dated back to the seventeenth century.²⁹ There is an acknowledgement of this within the 1877 report on the 'bearded woman': a lecture given by Dr Chowne on the medical case of the anonymous 'bearded lady' included an example of another recorded case in 1656, in which it reported that the patient's marriage was only arranged so 'she could be shown for money'.³⁰ This comparison hints towards an element of abnormality or othering that occurred when professionals encountered a patient whose anatomy diverged from socially-constructed gender boundaries. The societal policing of the gender binary within public places is also explained by a statement from the bearded lady saying she often covered her face in public spaces for fear of being mistaken as a man wearing women's clothes by the police.³¹ Dreger also describes a far more severe case in the 1888.³² An unnamed patient, despite appearing in a widely circulated photograph of intersex sexual development, was presented to the annual meeting of the British Gynaecological Association. Frances Barnes of the Chelsea Hospital for Women and Lawson Tait, an expert surgeon working with 'hermaphrodites' from the Birmingham and West Midlands Hospital for Women, argued to diagnose the patient's sex and associated gender identity as male, different to the gender she was socialised as.³³ Arguments ensued when objections to this diagnosis were made based on secondary sex characteristics.³⁴ The question of which binary category the patient should be placed in divided the entire Association, leaving the patient without medical treatment or an answer to the question of their gender. The accounts of this anonymous patient are lost, so the effect of this situation on their gender identity remains unknown, but this clearly illustrates the difficulties and challenges posed by a binary and purely anatomical approach to gender assignment.

The omission of intersex development within anatomical guides for students who aspired to become medical professionals in the early twentieth century promotes the interpretation that all intersexual development is a severe illness or abnormality. However, this does not hold true for every kind of intersexuality.³⁵ In a society that privileges normative anatomical sex development as an explanation for the gender binary, the social othering of intersex individuals stems from the omission of their existence in medical discourse. With the binary dominating social perceptions of gender in the nineteenth century, it is likely that there was a selection bias working behind this method of recreating sex development in the womb: intersex development may have been overlooked as non-normative development and thus was not considered a useful subject of representation for a series of objects with a standard pedagogic function.³⁶

Current relevance of the Ziegler wax models

Situating scientific artefacts, such as the Ziegler wax models, within a wider social context exposes the ways in which scientific evidence can be used to support and perpetuate sociological power dynamics.³⁷ This occurs in part through the sort of interactions that viewers have with these artefacts. In the case of the Ziegler models, the representation of only a small part of the body

Jayde Martin, 'Gender Identity: Friedrich Ziegler (1850-1920), Wax Models', *Midlands Art Papers Special Issue: Inclusion, Disability and Access in the Arts* (2019/20)

prompts an imaginative interaction between the model and the viewer: the isolation of the organ prompts the viewer to immediately imagine these models as part of a whole human body and draw assumptions about its identity. This in turn creates a dual objective-subjective gaze towards biological sex development because the minute detail of the models also seems to promise an objective view, allowing the viewer to observe technical differences in developmental progression. The upshot is that the viewer comes to associate the assumed development of human identity with the biological development of a sex organ. The models' depiction of a single point of human anatomy, rather than on the whole body, dehumanises that organ, simultaneously distancing it from the wider human identity as well as prompting assumptions about this identity. This focuses the viewers' attention solely on sex difference as the point of reference for associating a human identity with these organs. This in turn allows a projection of dominant cultural narratives of normality to be read onto the models.

This analysis offers a means to reflect on the different ways in which gender binary and homosexuality have been policed.³⁸ Today, popular opinion is changing but there is still a resistance to non-binary identities based on a belief that the only way to determine gender is the biological sex of a person. The construction of social identities as biologically ingrained, or even biologically pre-determined, perpetuates dominant cultural standards of normativity. Opinion on the relation to biological sex and sociological gender identity is similar to popular beliefs in the late nineteenth century and early twentieth century when the Ziegler models were made and used.

In today's society, the idea that gender is based on biological sex alone is used to invalidate transgender, and ignore intersex, identities.³⁹ Intersex development is often deemed a disability or a biological abnormality that requires cosmetic intervention.⁴⁰ Although some intersex development is a sign of various genetic conditions and bodily complications which require medical intervention, a significant amount of intersex development cases do not require such severe or frequent life-long interventions.⁴¹ Despite treating illness, however, the ethical question of conducting cosmetic surgery around the time of birth still presides.

It is important to note that the papers I now refer to are a small sample size of research within the field of biological sciences, therefore, it would be extremely reductive to generalise all scientific research papers [that specialise in gender and sexuality](#) as insensitive.⁴² There is also the possibility of selective bias, perhaps, but it is nevertheless still important to acknowledge the existence of these studies within contemporary debate.

While some cases of Disorders of Sex Development (DSD) require intensive medical intervention upon birth, like most disabilities, this condition is part of a spectrum, rather than a clear binary of normal and abnormal.⁴³ Yordan et al's [research](#) uses sex organs to discuss intersex people. Instead of calling the patients 'he' or 'she', they do not attach a gender identity to their intersex patient's biological sex at first. Their separation from sociological constructions of gender helps the readers of the paper to undo the association usually made between biological sex and gender identity. Yordan et al's study even describes a wide range of intersex patients including a 'rare' type of intersexuality not usually represented in medical papers. However, when they discuss the gender reassignment of

Jayde Martin, 'Gender Identity: Friedrich Ziegler (1850-1920), Wax Models', *Midlands Art Papers Special Issue: Inclusion, Disability and Access in the Arts* (2019/20)

their patients, it is gendered as a choice between 'male' and 'female' when changing the biological sex of the patients to best fit one of the binary genders. Therefore, they make an association between masculinity and the presence of a penis and femininity with the presence of a vagina. Here Yordan et al suggest that intersex people must suit the current binary understanding of gender. Gender identity then is read onto formations of sex development here. Such an association then is similar to the separation of 'typical' biological sex development seen in the Ziegler models because there is no physical option to be or to remain biologically gender neutral – a middle ground between both 'typical' pathways of biological sex development. Corsello et al's [paper](#) on biological aspects of gender disorders makes a similar move.⁴⁴ The paper considers both homosexuality and transgender gender identities as both a 'disturbance' and 'condition'.⁴⁵ They interpret homosexuality and non-conforming gender identities as a illness and suggest there could be a cure. Use of the word 'condition' is strongly associated with the invention of a curative practice, and through such terms they deny the queer community illegitimacy. Their treatment of non-confirming gender identities and homosexuality as a biological imbalance relies on the assumption that non-binary gender and homosexuality are biologically deviant and that heterosexuality and a cisgendered identity are biologically correct. The assumptions made here are similar to the assumptions made by the Ziegler models: influenced by current sociological 'norms' (heterosexuality and cisgendered identity), these investigations are affected by an unconscious cultural bias that privileges these supposedly 'normal' identities and sexuality. It is in reaction to this medical tendency and its pervasiveness that the Born this Way campaign started by Lady Gaga found success among the LGBTQIA community, even heralded by Elton John as 'the new gay anthem'.⁴⁶ To be 'born this way' normalises the identity of the LGBTQIA community as biologically valid, a direct response to the medical perspectives explored above.⁴⁷

Recently, some medical professionals have worked with intersex patients to change the medical rhetoric around intersex and its common clinical diagnosis of DSD (Disorders of Sex Development).⁴⁸ The attempt at combining medical practice with patient perspective is proposed as a drastically needed intervention in DSD treatment.⁴⁹ The combination of medical practice and patient identity seems a promising change in the bias perspectives seen in the papers above. Fisher et al [argue](#) that the relegation of intersex as a disorder dismisses patients' gender identity.⁵⁰ They advocate for a change of medical nomenclature to validate non-binary gender identity and to support patients who do not feel as if their intersexuality must be fixed to conform to the gender binary.

Conclusion

The medicalisation of gender identity, analysed in some of the cases here, seems to be just one aspect of the contemporary medical enforcement of cultural standards of normality. It appears that the identification of non-binary gender and homosexuality with the physical anatomy of the body invites medical practitioners to attempt to cure what is deemed to be a biological dysfunction. In some cases, then, the prioritisation of the cultural standard of normality within scientific investigations appears inevitable.

Seen through this lens, the history of the use Ziegler wax models as medical objects is bound up with their historical and political context. On the surface, they may be regarded as anatomical replicas designed for teaching purposes. When their history is uncovered, however, they exemplify how objective scientific inquiry is subject to standards of cultural normality, how it can be used as evidence to support these standards, and in some cases to perpetuate their dominance. The relevance of these models and their historical context today derives from the resurgent use of biological sex development as a means to invalidate transgender identity and intersexual individuals.⁵¹ The reduction of identity to a biological manifestation, 'dysfunction' or 'abnormality', begs the question as to whether standards of cultural normality can still skew scientific investigations. In ways similar to the Zeigler model's construction of two biological pathways for sex development in the womb, historical, political and medical conversations around normality still seem to dismiss biological and sociological difference.

Jayde Martin is a doctoral researcher at the University of Birmingham. She is completing her PhD in English Literature, 'Contemporary science-fiction literature and the representation of genetic engineering'.

Acknowledgements: A thank you to [Dr Kate Nichols](#) for facilitating this research, [Professor John Holmes](#) for supporting my interest in Victorian medical science, the [Guild of Students LGBTQIA Association](#) for their hard work on campus, and finally, the anonymous Intersex advocates who inspired this work.

¹ Nick Hopwood, [Embryos in Wax: Models from the Ziegler studio](#) (Cambridge, 2002), p.22.

² Hopwood (2002), p.2.

³ Hopwood (2002), pp. 72-75.

⁴ Hopwood (2002), p.59; pp. 72-75

⁵ I define essentialism and determinism interchangeably. Essentialism means that biology is seen as the essential core of an animal or person's existence. Determinism means that biology determines behaviour and it is usually supported by an essentialist perspective, therefore, I find them intrinsically linked to one another. So much so that I see fit to use them as synonyms for each other. Examples of this thinking and a biologist's reactions to it can be seen in: Pedro Martinez, ['The Comparative Method in Biology and the Essentialist Trap'](#) *Front. Ecol. Evol.* 6, 130, (2018).

⁶ Mimi Marinucci *Feminism is Queer* (London, 2016), p.7.

⁷ Marinucci (2016), p.102.

⁸ Anne Fausto-Sterling *Sexing the Body* (New York, 2000), p.7.

⁹ Susanna Mary Chewning 'Queer Desire and Heterosexual Consummation in the Anchoritic Mystical Tradition' *Straight Writ Queer* ed. by Richard Fantina (London, 2006), pp. 68-69; Steven Angelides 'Historicising (Bi)Sexuality A Rejoinder of Gay/Lesbian Studies, Feminism, and Queer Theory' in Karen Lovaas' (eds) *LGBT and Queer Studies: Conflicts, Collaborations, and Contested Terrains* (New York, 2006), p. 135-136; Annamarie Jagose 'Queer' *Queer Theory An Introduction*, (Melbourne, 2001), p. 96; Alice Jones ['Redefining Gender'](#) *National Geographic*, (2017), <<https://www.nationalgeographic.com/magazine/2017/01/explore-gender-glossary-terminology/>>.

¹⁰ Vigo 'Evil Womxn: The Silencing of Biological Reality and the Technology of Obfuscation,' *Forbes*, <<https://www.forbes.com/sites/julianvigo/2018/10/26/evil-womxn-the-silencing-of-biological-reality-and-the-technology-of-obfuscation/#392dc56018fd>>; [Anonymous Editorial] 'US proposal for defining gender has no basis in science' *Nature* 563 5 (2018) some sophisticated arguments attacking populism, the far right, and their illegitimate critiques of scientific authority do not give credit to or support the populist rise of identity politics and its relationship to the advancement of civil rights. The ignorance of these arguments and their valid critiques of scientific authority often leads to the dismissal of these human rights as non-scientific or invalid. Such an argument subject to this interpretation, as one example of many, can be found in Ece Temelkuran, 'Remove the Shame: Immortality is 'Hot' in the Post-Truth World' *How to Lose a Country The Seven Steps From Democracy to Dictatorship* (London, 2019), pp. 88-89; Sara Reardon, 'The spectrum of sex development: Eric Vilan and the Intersex controversy' *Nature* 533 (2016), pp. 160–163 <<https://www.nature.com/news/the-spectrum-of-sex-development-eric-vilain-and-the-intersex-controversy-1.19873><<https://www.nature.com/articles/d41586-018-07238-8>> ; Claire Ainsworth, 'Sex Redefined', *Nature*, 518, (2015), pp. 288-291.

¹¹ Hopwood (2002), p.18.

¹² Hopwood (2002), p.72.

¹³ Dreger (2000), p.25.

¹⁴ Female stages; [History of Medical Sciences Project, Physiology, Anatomy, and Genetics](https://history.medsci.ox.ac.uk/360objects/wax-models-of-embryos/urogenital-development/female/) <<https://history.medsci.ox.ac.uk/360objects/wax-models-of-embryos/urogenital-development/female/>>; Male stages, [History of Medical Sciences Project, Physiology, Anatomy, and Genetics](https://history.medsci.ox.ac.uk/360objects/wax-models-of-embryos/urogenital-development/male/), <<https://history.medsci.ox.ac.uk/360objects/wax-models-of-embryos/urogenital-development/male/>>.

¹⁵ Ibid.

¹⁶ Ibid.

¹⁷ Definition of Embryology: Charles Darwin, [*On The Origins of Species by the Means of Natural Selection*](#), 418-419, (1859). References for hysteria and mental health: Tuke, p.136. Celia Tasca, Mariangela Rapetti, Mauro Giovanni Carta, Bianca Fadder, 'Women and Hysteria In The History of Mental Health' *Clinical Practice Epidemiol Mental Health* 8 (2012) pp.110-119.

¹⁸ Ibid.

¹⁹ Tuke (1877), p.136.

²⁰ Tuke, pp. 135-136

²¹ Hopwood (2002), pp.72-75.

²² Hopwood, (2002), p 71. Here Hopwood statement that the wax human embryos were related to 'sex' therefore kept to 'institutions' is unclear whether he means biological sex and by association sexual intercourse, or just biological sex and its associations with gender roles. Despite the lack of clarity in this use of 'sex', they were kept from lay knowledge for fear of political disturbance, this reveals that biological explanations of human anatomy were conflated with sociological relationships within this time period.

²³ For example, Hopwood remarks that recent feminist scholars have investigated the models and their displacement and disassociation of the embryos from the female body. Hopwood, (2002), p. 71.

²⁴ Ibid.

²⁵ Dreger (2000), p.16. [Anonymous], 'The Woman with A Beard' *Reynolds Miscellany* 205, 8 (1852) p.333. Fausto-Sterling (2000), p.32; pp.37-40.

²⁶ Dreger (2000), p.2.

Jayde Martin, 'Gender Identity: Friedrich Ziegler (1850-1920), Wax Models', *Midlands Art Papers Special Issue: Inclusion, Disability and Access in the Arts* (2019/20)

²⁷ 'The Woman With a Beard', p.333.

²⁸ Ibid.

²⁹ Dreger (2000), p.33.

³⁰ Ibid.

³¹ Ibid.

³² Dreger (2000), p. 21.

³³ Ibid.

³⁴ Dreger (2002), p. 22-23.

³⁵ Alice Dreger, 'Twenty Years of Working Toward Intersex Rights', in Alice Dreger and Françoise Baylis (eds), *Bioethics in Action* (Cambridge, 2018), pp.55-73; pp.55-57.

³⁶ However, the models themselves were taken from miscarried or aborted fetuses, and the various spectrum of intersex development may have been interpreted as a defect of human sexual development rather than as a frequent occurrence, there is also a chance that the Zieglers never came across an intersex foetus because their sample size was so small due to the taboo nature of their work.

³⁷ Hopwood (2002), p.72-75.

³⁸

³⁹ Vigo (2018), [Anonymous Editorial] *Nature* (2018), p.5; Reardon (2016), pp. 160-163; Ainsworth, (2015), pp. 288-291.

⁴⁰ Dreger

⁴¹ Dreger

⁴² This link will take you to a PubMed search for DSD and Gender, however, for examples of studies on homosexuality, [this link](#) will take you to a PubMed search for homosexuality and genetics. To find insensitive studies, multiple search combinations were needed this demonstrates that the bias studies are marginal but they clearly still exist.

⁴³ A.D. Fisher, J. Ristori, E. Fanni, G. Castellini, G. Forti, M. Maggi, '[Gender identity, gender assignment, and reassignment in individuals with disorders of sex development: a major of dilemma](#)'

Italian Society for Endocrinology 39 (2016), pp.1207-1224; p.1207). Academic Staff, '[Our Gender Issue Prompted Many Comments. Here We Respond](#)' *National Geographic* (2017)

<<https://www.nationalgeographic.com/magazine/2017/01/gender-issue-reader-comments-faq/>>

⁴⁴ S. M. Corsello, V. Di Donna, P. Senes, V. Luotto, M. P. Ricciato, R. M. Paragliola, A. Pontecorvi, '[Biological aspects of gender disorders](#)' *Minerva Endocrinologica* 4, 36 (2011), pp.325-339; p.325.

⁴⁵ Ibid.

⁴⁶ Lynne Neary, '[How Born This Way Was Born: An LGBT Anthem's Pedigree](#)', *Nation Public Radio*,

2019, <https://www.npr.org/2019/01/30/687683804/lady-gaga-born-this-way-lgbt-american-anthem?t=1562838179361>;

Even some transgender activists still seek to offer a binary understanding of biology which omits intersex development and identity, one example of many, can be seen in Karissa Sanbonmatsu '[The biology of gender from dna to the brain](#)' *Tedtalk*, (2018).

⁴⁷ Ibid;

⁴⁸ Fisher et al (2016) p.1207.

⁴⁹ Ibid.

⁵⁰ Fisher et al,

⁵¹ Vigo (2018); [Anonymous Editorial] *Nature*, (2018), p.5. Through the equation of gender identity with biology, there are studies that are now investigating the biological origin of homosexuality, a slippery slope when combined with the medical need to cure or change biological divergence.

Jayde Martin, 'Gender Identity: Friedrich Ziegler (1850-1920), Wax Models', *Midlands Art Papers Special Issue: Inclusion, Disability and Access in the Arts* (2019/20)

