Hypatia (2024), 1–24
doi:10.1017/hyp.2023.121

CAMBRIDGE UNIVERSITY PRESS

ARTICLE

Androcentrism in Biological Typing

Aja Watkins

Department of Philosophy, University of Wisconsin-Madison, Boston, US
Email: aja.watkins@wisc.edu

(Received 8 July 2021; revised 3 August 2022; accepted 3 September 2022)

Abstract

Biological types, including holotypes and reference genomes, are particular biological entities that represent an entire class of biological entities. This paper presents a feminist analysis of biological typing by asking whether we have reason to criticize the practices of selecting holotypes and reference genomes for being androcentric. I offer three distinct reasons why androcentrism can be objectionable: androcentric practices may inadequately account for traits or experiences of women/females, reinforce male/female dichotomies, or overgeneralize from particulars. I then evaluate whether the practices of selecting holotypes and genomes are objectionably androcentric in these three ways. These typing practices, especially as applied to the case of humans, are objectionably androcentric in some ways but not others. Whether a typing practice problematically ignores the traits or experiences of women depends on whether the typing practice involves non-accidentally taking the traits or experiences of male humans as typical, which, I argue, is true both in the case of holotypes and genomes. Neither holotypes nor genomes reinforce male/female dichotomies, although some features of these practices may appear to do so. Finally, both holotypes and genomes are criticizable for overgeneralizing from particulars, although this criticism does not depend on these practices being androcentric.

Introduction

Biological typing occurs when particular biological entities exemplify an entire class of biological entities. Holotyping sets the standard for species membership by resemblance to a holotype, literally the first described individual member of that species. Developing a reference genome, similarly, can involve standardizing species membership, but this time by reference to a particular genome. Biological typing is a special case of scientific typing, a technical term for using "a concrete individual object that serves as a standard of reference for, and realization of, the definition or taxon category that it names" (Bokulich 2020, 2).

This paper presents a feminist analysis of biological typing practices, especially as applied to humans. Specifically, I evaluate whether and to what extent we should criticize holotypes and reference genomes for being *androcentric*. The charge of androcentrism is, roughly, to point out that biologists have taken the traits or experiences of male members of a species as characteristic of a whole species. Feminist theorists, including feminist philosophers of science, have historically criticized various practices in biology, especially characterizations of humans or human nature, for being androcentric. However, my analysis differs from these in that it explicitly focuses on biological typing, in the technical sense described above. The next section reviews past feminist critiques of androcentrism in science, and lays out three general reasons for criticizing androcentric practices.

The subsequent two sections apply these reasons to the practices of selecting holotypes and reference genomes, respectively. In each case, I give a description of the typing practice, followed by an application of the three reasons for criticizing androcentrism in these practices. The human type specimen (the remains of famous taxonomist Carl Linnaeus) is a male, and the official human reference genome has one X and one Y chromosome, so, ostensibly, these look like instances of objectionable androcentrism. In both cases, though, criticizing the typing practice for being androcentric turns out to be not so straightforward. However, as will become clear, just because these practices are not easily criticizable for being androcentric does not mean that they are not criticizable on feminist grounds. These arguments provide guidance to future researchers regarding the nuances involved in criticizing androcentrism in scientific practice.

As with many feminist philosophy of science papers, this paper attempts to speak simultaneously to two main philosophical audiences: feminist philosophers and philosophers of science. My hope is that while the discussion of androcentrism in science in general may be familiar to the former audience, and some of the scientific details in later sections may be familiar to the latter, an integration of these two literatures will nevertheless be useful to both groups.

Androcentrism in science

Androcentrism, at least in the context of biology, involves taking the traits or experiences of male members of a species as typical of that species as a whole. Doing so may involve vicious, sexist intentions or consequences, or it may just involve a form of idealization common in science where some members of a category are taken to represent a whole category. On this characterization of androcentrism, at least, androcentrism itself is merely descriptive, and not inherently objectionable. However, feminist philosophers have a history of criticizing scientific practices for being androcentric. After first reviewing some of the most influential literature on androcentrism in feminist philosophy of science, this section explicates three distinct reasons for which an androcentric scientific practice might be objected to.

Feminist criticisms of androcentric science

Androcentrism was famously pointed out by Beauvoir (1949) in *The second sex*. Beauvoir criticizes alleged biological and psychological sex differences (especially in chapters 1 and 2) and uses these to demonstrate the ways in which "the man represents both the positive and the neuter" (25). The man representing the *positive* involves a normative claim, that maleness is superior to femaleness, a common point of contention within feminism in general. However, for the man to also represent the *neuter*, Beauvoir argues, is for the male standpoint to be seen as general, objective, or all-encompassing, whereas the female is seen as particular or subjective. Beauvoir's attention to the centering of maleness, including in scientific research, has had lasting impacts in feminist philosophy. Outside of the context of feminist philosophy of

https://doi.org/10.1017/hyp.2023.121 Published online by Cambridge University Press

science, for example, Beauvoir's description of the female as "the Other" (26) has subsequently been used to describe the social position of women and other marginalized groups. For instance, Gornick (1972) calls this the "essential outsidedness of woman" (128), and Schutte (1998) refers to it as "alerity." Additionally, androcentrism has been seen to have ethical or legal consequences; for example, MacKinnon (1983) says, "As male is the implicit reference for human, maleness will be the measure of equality in sex discrimination law" (644).[1]

Several feminist philosophers have investigated androcentrism in explicitly scientific terms.[2] Longino (1987), for example, says androcentric biases occur "in the assumption that there are just two sexes and two genders (us and them), in the designation of appropriate and inappropriate behaviors for male and female children, in the caricature of lesbianism, in the assumptions of male mathematical superiority" (58). She argues that, although one could criticize androcentrism in science "from the vantage point of commitment to a value-free science," which would make such biased science automatically "bad," a better approach involves acknowledging the value-ladenness of science and incorporating feminist values into science (60). Feminist philosophers of science largely agree that science should not and cannot be value-neutral, in part because science has social/political as well as epistemic goals, and that therefore it's the substance rather than the presence of bias that makes scientific practice objectionable (for a helpful review, see Kourany 2010, although cf. BGSG 1988). Such a position indicates that androcentrism, for instance, isn't criticizable just for being an instance of bias; rather, we have to show that it's a pernicious bias.

Feminist writers have analyzed androcentrism according to different classifications. For example, Anderson (1995) argues that feminist epistemology allows us to see and point out androcentrism in science, which comes in different forms. First, androcentrism occurs "when theories take males, men's lives, or 'masculinity' to set the norm for humans or animals generally" (57). Anderson thinks that the framing of gender differences has, historically, taken maleness to be normal and femaleness to be deviant (70; see also Wittig 1992, 29). Second, androcentrism occurs when we "describ[e] or defin[e] phenomena from the perspective of men or typically male lives" (71). Third, a theory is androcentric when it "assum[es] that male activity or predicaments are the sole or primary sources of important changes or events" (72).

Another way to taxonomize androcentrism has been developed in the context of archaeology. Wylie (2007) identifies five types of feminist critique of androcentric practices: critiques of erasure, critiques of distortion, critiques of political resonance, critiques of objectivism, and explanatory critiques. Critiques of erasure involve claims that research has "systematically direct[ed] attention away from certain kinds of subjects—namely those that might challenge the tenets of a dominant ideology or might be particularly relevant to the self-understanding of subordinate and oppressed groups" (98). Critiques of distortion point out that marginalized subjects have been studied in a way which legitimizes systems of oppression (99). Critiques of political resonance emphasize the "congruence … between the interests of large-scale geopolitical elites and entrenched archaeological research programs" (100). Critiques of objectivism are critiques of an entire discipline, arguing that its untenable commitment to objectivity is misplaced and likely to "reinforce, rather than counter, the partiality of its makers" (100). Finally, explanatory critiques include "analyses of how the internal conditions of archaeological practice … shape the direction and results of enquiry" (101).

Here are two influential critiques of androcentric science. First, Tavris (1993a, 1993b) tackles a range of cases in which women have been "forgotten" by scientists.

https://doi.org/10.1017/hyp.2023.121 Published online by Cambridge University Press

In her analysis of androcentrism, Tavris agrees with Beauvoir *inter alia* that "it is normal for women to feel abnormal" (1993b, 149) due to constantly being measured against maleness. Tavris suggests that "the only way for Man to no longer be the center of the defining universe is for Woman to be in the center ring with him" (1993b, 164).

Second, Lloyd (2006) reviews 21 explanations for the evolutionary origins of the human female orgasm, rejecting all but one of them for being biased by adaptationism (the assumption that traits are primarily shaped by natural selection) or androcentrism. For Lloyd, androcentrism is objectionable for producing empirically inadequate theories. For example, she criticizes as androcentric the view that the female orgasm evolved in order to facilitate the *male* orgasm (78). Lloyd concludes that the best explanation is that the female orgasm occurs as a byproduct of the male orgasm, given anatomical and developmental homology between male and female sex organs (chapter 5). She does not discard *this* explanation for being objectionably androcentric, despite the fact that it appears to take the male orgasm as primary and the female orgasm as secondary; Lloyd suggests that any argument that the byproduct account was androcentric relies on a conflation of "naturally selected" with "important" (142). Like me, then, Lloyd distinguishes between androcentrism in the merely descriptive sense (whether male features are taken to be central) from the normative sense (whether male features are incorrectly or objectionably taken to be central), although Lloyd focuses on whether an androcentric theory is empirically justified rather than whether it's predicated on problematic values.[3] Both practices of biological typing I discuss in the later sections also involve practices which appear objectionably androcentric but then turn out not to be.

This subsection has reviewed some important past feminist literature on androcentrism, including criticisms of it in science. I now turn to my own taxonomy of three reasons why androcentrism might be objectionable.

Three reasons to criticize androcentric practices in science

It should now be reasonably clear what androcentrism is, as well as how feminists have criticized androcentrism in science. Establishing that androcentrism has occurred merely involves showing that scientists have taken the traits or experiences of males as typical; *objecting* to androcentrism requires more. For the purposes of this paper, I say that androcentrism can be problematic for (at least) three reasons. First, androcentric practices fail to account for distinctively female traits or women's experiences. Second, androcentric practices encourage viewing sex/gender as dichotomous, or male and female as dualistic and opposed natural kinds.[4] Third, androcentric practices involve taking something particular—namely, maleness—and generalizing from it. I now elaborate on each of these reasons, with examples. Please note that these three *reasons to object* to androcentrism should not be construed as *types* of androcentrism; indeed, as we will see in the later sections, a practice may be objectionable for these reasons without thereby being androcentric.

First, some criticize androcentric theories for failing to adequately account for female traits or experiences. An example comes from Scott (1982), who criticizes the social sciences for "the tendency to use [exclusively] male subjects in studies of a nonfamilial nature" because such a tendency implicitly assumes that "'the women's place is in the home'; therefore, there is no reason to investigate the experiences of women who are not in the family setting" (89). Scott would presumably advocate for more nonfamilial studies which include (or even focus on) women. Rosser (1989) elaborates on

https://doi.org/10.1017/hyp.2023.121 Published online by Cambridge University Press

several ways in which androcentrism has negatively impacted medical research, including in framing research questions, formulating hypotheses, and defining particular medical conditions. Similarly, Lloyd (1995) points out a classic case in which "it turned out that [a] very large, well-designed (and very expensive) longitudinal study [on the benefits of taking aspirin for reducing risk of heart disease and stroke] was done exclusively on men" (195). Lloyd argues that "It is precisely this sort of 'standard research practice' that has led to the dearth of even basic clinical research on women's health and disease" (196), suggesting the need for clinical studies which involve female subjects.[5] Ways in which science or technology have historically failed to consider the traits or experiences of women continues to be documented today (e.g., Noble 2018; Criado Perez 2019; Cleghorn 2021).

One response is to insist that the female perspective be highlighted more. Anderson (1995, 74) calls this argumentative strategy "tableturning," a strategy employed regularly in contemporary feminist criticisms of scientific practice. Tavris (1993b) criticizes this response for perpetuating the idea that there are, in fact, differences between sexes/genders (but that perhaps these differences are value-neutral or even to the advantage of women). Nevertheless, "tableturning" is rhetorically powerful, and ample examples of it can be found in the literature criticizing androcentric science. Hrdy (1981), for example, argues that female primates share many of the traits typically attributed to males, such as competitiveness and sexual assertiveness; for more recent, similar criticisms of science, especially neuroscience and endocrinology, see Fine (2011, 2018).

As I argue in the following two sections, establishing that androcentrism is criticizable for failing to take female traits or experiences into account often involves showing that a scientific practice which centers males or maleness does so *non-accidentally*. In particular, there are some scientific practices (namely, biological typing practices) which require taking *some* individual or small set of individuals as representative of a whole species or other group. If the standard individual is male, but might have easily been female, then I say that the individual chosen is only accidentally male. If the individual's maleness is part of why he was chosen as the standard, then the choice was non-accidental. Criticizable neglect of female traits or experiences mainly comes from non-accidental selection of males as standard, or so I argue.

The failure to take female traits or experiences into consideration is tied closely to androcentrism in the merely descriptive sense. Androcentrism itself involves centering males, which one might think automatically or inherently leads to ignorance of whatever is characteristically female. Certainly, identifying androcentrism in science and determining that it's criticizable for this reason are very closely related. However, conceptually the two are distinct. For example, say that there was very little difference between males and females (rosy-faced lovebirds, for instance, need to be dissected in order to tell their sex). In cases such as these, taking males as standard or typical isn't necessarily objectionable for having ignored female traits, because no or very few female traits were ignored. Therefore, it's important to distinguish identification of androcentrism from criticism of it on these grounds.

The second and third reasons to object to androcentrism are less obviously tied to the identification of androcentrism itself. The second way in which an androcentric theory or practice can be problematic is that androcentrism reinforces male/female dichotomies, with the male serving as reference and the female serving as the Other. Beauvoir (1949)'s analysis most easily fits in here, as she takes femaleness to be defined as the opposite of maleness, a consequence of taking maleness to constitute the norm. Harding (1987) makes a similar point: "once we realized that there is no universal *man*, but only culturally different men and women, then 'man's' eternal companion —'woman'—also disappeared" (7). Additionally, P. H. Collins (1990) argues that "Maintaining images of U.S. Black women as the Other provides ideological justification for race, gender, and class oppression," in part because "each term in the binaries white/black, male/female, reason/emotion, culture/nature, fact/opinion, mind/body, and subject/object gains meaning only in relation to its counterpart" (70). Finally, Hekman (1997) notes that it's "difficult to retain the concept of 'center' … without a corresponding concept of periphery" (350). Beauvoir, Harding, Collins, and Hekman are each pointing out the relationship between androcentrism and dichotomous thought.

Historically, feminists' rejection of male/female (among other) dichotomies is related to their rejection of sex/gender categories as constituting natural kinds. As Haslanger (2000) says, "an unmistakable pattern of projecting onto women and people of colour, as their 'nature' or as 'natural', features that are instead (if manifested at all) a product of social forces … has led feminists to be extremely suspicious of natural kinds" (116). Apparent male/female binaries are plausibly a product of such social forces, and are therefore easily mistaken for natural kinds. Androcentric practices are mistaken insofar as they reify or essentialize these sex/gender categories.

Feminist commentaries have used this criticism in a variety of ways. For example, Keller (1985) criticizes the social sciences for upholding dichotomies associated with the male/female one: objective/subjective, public/private, power/love, impersonal/personal (7–8). Martin (1991) says that our scientific beliefs about male and female gametes are actually rooted in our preconceptions about males and females, including the various dichotomies which supposedly characterize these groups. Although Fausto-Sterling (1993) used the incidence of intersex conditions as evidence that there are actually at least five human sexes, not two, she later (2000, 2020) argues for "an even wider assortment of sexual identities and characteristics than mere genitals can distinguish" (2000, 22). In particular, she adopts a continuum view of sex in order to better capture the breadth of sexual diversity in nature, including in humans.

Third, a theory or practice may be criticized for being androcentric insofar as androcentrism involves an inference from the particular to the general. Feminist scholars have objected to this as "hushing the manyness," or ignoring the heterogeneity characteristic of the real world (Lugones 2003, 18). This reason goes hand in hand with the two previous reasons to object to androcentrism, and, indeed, may be the underlying justification for them. For instance, androcentrism may be objectionable because of its relationship to upholding indefensible dichotomies (the second reason given above) in virtue of the fact that androcentrism is a case of problematic inference from particular to general. Additionally, one tactical reason to use the "table-turning" strategy involved in the first reason may be to highlight the particularity of maleness, by putting it on par with the already-granted particularity of femaleness.

Several theorists have advanced similar criticisms, starting with Beauvoir (1949). In responding to an argument based on the thought that women, as well as men, should merely be treated as "human," (i.e., an argument in line with the first reason provided above), Beauvoir says, "Certainly woman like man is human being; but such an assertion is abstract; the fact is that every concrete human being is uniquely situated" (24). Along these lines, Wittig (1992) criticizes dominant discourse for "produc[ing] a scientific reading of the social reality in which human beings are given as invariants" (22). Anderson (1995) also objects to such practices, claiming that "Theories that tailor concepts to the activities or positions specific to or typical of one gender only and then

https://doi.org/10.1017/hyp.2023.121 Published online by Cambridge University Press

apply them to everyone are straightforwardly empirically inadequate" because they "overgeneralize from the typical situation of one gender to that of both" (74). Bar On (1993) provides a more general version of this argument against overgeneralization:

> The kind of idealization that is entailed by valorization is problematic because rather than working from a conception of practices as heterogeneous, it includes some while excluding others, presupposing that there are practices that in one way or another are more authentically expressive. (92)

Along similar lines, contemporary philosophers of science have fruitfully explored ways in which generalization, abstraction, and idealization can help or hinder scientific practice, especially following Cartwright's (1983, 1999) arguments that many of the claims of science are only "true" in very specific, highly contrived settings like laboratories. While Cartwright focused mostly on physics and economics, philosophers of science whose work focuses more on the life sciences have extended her arguments. For example, Potochnik (2017) has recently argued that many of the false (idealized) claims in science are useful because they help to further our understanding of complex systems. Mitchell (2003) has also provided an influential argument in favor of pluralism, taking the biological sciences to be exemplary. Overall, examining the purpose and function of generalizations (including overgeneralizations) in science is an active philosophical research program.

These arguments are related to the feminist rejection of biological essentialism, especially sex/gender essentialism. Heyes (2000) summarizes the typical feminist argument against biological essentialism: "The wealth of anthropological and sociological data on the variety of models of femininity … challenges the assumption of a universal and unchanging biological basis for both sex and gender" (31). In other words, pluralism about sex/gender (i.e., "particularity") apparently invalidates sex/gender essentialism. Yoder (1999), for instance, targets biological essentialism directly, including instances where it has been androcentric (see also Bem 1993).[6] More recently, van Anders (2015) has provided an influential analysis of sexuality, called Sexual Configurations Theory, that seeks to replace essentialist conceptions thereof.

One particularly sophisticated version of the feminist argument against biological essentialism is explicated in Frost (2011). Frost notes that feminists may be suspicious of attempts to naturalize social categories like sex and gender, because they "have argued that there is no 'matter' in general, no 'human body' in general, nor even 'women's bodies' in general," and that to "misrepresent *as* biological, physiological, or natural what is actually social and historical" is to "essentialize gender and race" (75). However, Frost shows that some feminists (those who she calls the "new materialists," including especially Grosz 1994; Oyama 1985; Fausto-Sterling 2020; but see also Keller 1985, 2010, and Jordan-Young 2011) have provided the "key insight … that biology and culture, organisms and contexts, are co-emergent" by arguing that biological and cultural causation are not in opposition and are, in fact, both required to produce all traits. The "new materialist" can thereby continue to reject biological essentialism and its propensity to overgeneralize, without at once rejecting the biological sciences overall. The important point is that biology *per se* is not always objectionable for overgeneralizing, in which case it's a genuine question whether particular biological theories and practices are objectionable on these grounds.

Evidently, these three reasons for which androcentrism may be criticizable are not at odds, nor does the presence of one in a given case imply the presence of another. The

https://doi.org/10.1017/hyp.2023.121 Published online by Cambridge University Press

reasons for being objectionable do increase in scope of applicability, however; there are many practices besides androcentric ones which can be criticized for upholding a male–female dichotomy, for instance, and many more still which can be criticized for overgeneralizing. Nonetheless, these three reasons for criticizing androcentric biological theories or practices are independent, and so could apply to theories or practices in any combination. In the next two sections I adjudicate whether each of these reasons can be used to claim that selecting holotypes and reference genomes are objectionably androcentric. In both cases, it turns out that the practices of biological typing are criticizable for being androcentric on some but not all of these grounds.

Androcentrism in holotyping

Biological typing might be androcentric, because typing literally involves using a subset of instances of a category to set the standard for that category as a whole.

Recall that Bokulich (2020) defines a scientific type as "a concrete individual object that serves as a standard of reference for, and realization of, the definition or taxon category that it names" (2). One scientific typing practice that Bokulich considers is holotyping. Holotypes are specimens of a species which provide a reference standard for the species—if there is doubt about the species membership of future specimens, this doubt is resolved by comparing the specimens to the holotype. Holotypes are chosen when a species is first described and are typically preserved in museums and labeled with a red marker.

Holotypes are officially set according to the International Code of Zoological Nomenclature (ICZN).[7] The "name-bearing" specimen, the holotype, serves as a reference for the species. However, as Bokulich emphasizes, the specimen which serves as a holotype for a given species can change, and the species membership of a specimen previously identified as a holotype for that species can change; thus, holotypes do not immutably set standards for species membership, exactly, as would a definitional standard, but are used as a reference nonetheless.[8] The revision of a holotype may happen, for instance, if what was once thought to be a single species is then found to be two species, in which case the holotype specimen for the original single species may turn out to be a member of the newly discovered species.

One complication for holotyping is that many species have different morphs: visually (or behaviorally) distinct subpopulations of the same species. One example of this is sexual dimorphism: in some species, specimens of different sexes appear very differently. If the holotype were a specimen of one sex, members of the opposite sex would be unidentifiable as members of the same species. This, of course, is biological nonsense: given a species concept which *requires* that members of the same species be able to reproduce together, it will have to be the case that females and males which reproduce together are part of the same species, regardless of their differences.[9] The solution is to select another specimen, called the allotype, from the sex opposite that of the holotype.[10] So, if the holotype were female, and males are morphologically distinct from females, one could select a male allotype. The addition of more type specimens results in some species having several specimens used in the species description. These additional type specimens are called paratypes. Thus, although the presence of distinct morphs complicates the practice of holotyping, the complication is largely resolved by assigning paratypes to give a more representative view of a species, a view which a single holotype may not be able to provide.[11]

In order to identify and diagnose androcentrism in the practice of holotyping, we need data on allotypes, because we want to compare cases where males are holotypes

https://doi.org/10.1017/hyp.2023.121 Published online by Cambridge University Press

and females are allotypes with cases where females are holotypes and males are allotypes. Allotypes are not regulated by the ICZN, though, and allotypes have "no name-bearing function" (ICZN 1999, article 72, glossary). Accordingly, Gloyd (1982) recommends that allotypes only be used by researchers when it's useful for them, and therefore that allotypes need not be paratypes. As Santiago-Blay et al. (2008) point out, though, the wording of the Code "allows designation of allotypes subsequently to the original description and even from non-type material" (261). Thus, the ICZN allows allotypes which are not paratypes—allotypes which are not type specimens at all. Given that the ICZN recommends that "neotypes" (new holotypes, in case of need for replacement) be chosen from among the paratypes, this reduces the likelihood that allotypes are chosen as a neotype. Santiago-Blay et al. recommend that the ICZN define an allotype as a paratype of the opposite sex from the holotype, which "would clarify its status as a paratype and, thus, as reserve name-bearer" (2008, 261). An earlier edition of the ICZN did include this language, but it was removed in 1999.[12] The current edition of the ICZN does not require that allotypes be designated as paratypes and specifies that allotypes do not function as name-bearers.

Regarding androcentrism, one might wonder whether holotypes or allotypes were more frequently male or female (not least because the prefix "allo" literally means "other"). In order to evaluate the practice of holotyping overall, we might look at a "population level" analysis of holotyping and use the frequency with which male as opposed to female specimens are chosen as holotypes to indicate whether holotypes are *accidentally* male. In any given species, at least for species that have male and female individuals, the holotype is either male or female. Accidental selection of male holotypes is evidenced by equal proportions of male and female holotypes, since male and female specimens occur in (roughly) equal proportions.[13] Non-accidental selection of male holotypes may indicate bias towards using male specimens as "standard," a paradigmatic case of androcentrism. In other words, if proportions of male and female holotypes are significantly unequal, then we might wonder whether the choice was really random (accidental) or if being male contributes to being selected as a holotype (non-accidental).

The London Natural History Museum maintains a database of over five million type specimens.[14] I have analyzed the data on holotypes and paratypes for trends with respect to sex categories (to access the data, see Natural History Museum 2020a, 2020b). Of the 18,721 holotypes which are unambiguously sexed (labeled as "F," "female," "M," or "male"; and not counting the specimens which are not sexed or are labeled as "other"), 58.5 percent are male and 41.5 percent are female. On the contrary, of the 23,225 paratype records with these same sex labels, 46.0 percent are male and 54.0 percent are female.[15]

Is the practice of holotyping therefore objectionably androcentric? Not necessarily. First, none of these data are on allotypes—allotypes are unofficial and not included in the database. Ideally, we would look at species with both a holotype and an allotype and see whether the holotypes were more often male or female. Many of the species for which a male holotype is selected probably do not have any allotype at all, in which case the sex of the holotype isn't necessarily remarkable. Second, one should really examine individual cases of holotyping to determine why a male holotype was selected. Nonetheless, I do think that the trend in favor of male holotypes and female paratypes at least indicates that we should take a closer look at holotype selection from a feminist perspective. In general, an individual case of androcentrism—using males as typical—isn't necessarily objectionable; it may have been the result of random selection of a type

https://doi.org/10.1017/hyp.2023.121 Published online by Cambridge University Press

specimen, or for some other reason unrelated to sex. However, the data strongly indicate a potentially problematic bias here.[16]

We can also evaluate whether the selection of any given holotype is objectionably androcentric, namely in the human context. *Homo sapiens* doesn't actually have a holotype, which would have to have been chosen at the same time as the original "description" of our species—but we do have a lectotype, a name-bearing specimen which differs from a holotype in that it's chosen retroactively, after the species has already been described, rather than being chosen simultaneous with the species' description. The human lectotype is Carl Linnaeus. Linnaeus is famous for his work on biological taxonomy and wrote the official description of our species. The official reason for selecting him as the lectotype is that he most likely used himself as a model for his species description (for the official decision to designate Linnaeus as the lectotype, see Stearn 1959).[17]

Linnaeus' remains are not in a museum, though, and, as far as I know, they have never been used to "check" if a new specimen was a human or not.[18] This might, then, be a case where the letter of the ICZN is being followed, but where its spirit is inapplicable. Nonetheless, it seems objectionable—given the history of androcentric practices, in science and in general—to designate a (white, socially prominent) male as the name bearer of the human species. Additionally, there is no female type specimen for *H. sapiens* at all. Selecting a male as the human lectotype literally involves using maleness to set the standard for humanness, which is androcentric. In order to determine whether it's objectionable androcentrism, though, we can ask whether the human type specimen is accidentally or non-accidentally male.

Unlike in the above discussion of holotyping as an entire practice, we cannot perform any statistical analysis to see if Linnaeus was chosen accidentally. Instead, we could object to the maleness of the human lectotype by noticing that it's most likely not the result of random choice; Linnaeus was chosen *because* of his social and scientific position, a position which has historically been denied to most women (although for a summary of the contributions of women to science around this time, see Schiebinger 1989), and so the human lectotype could not have easily been female. These same processes which have caused men rather than women to monopolize prestigious scientific roles are part of the reason why the single human type specimen is male. I noted above that the practice of holotyping as a whole might be androcentric if holotypes are more likely to be male, and allotypes female. In that case, I utilized a statistical argument to show that we should be suspicious of how many more male holotypes there are than female holotypes. In the case of Linnaeus, the non-randomness of his status as a name-bearing type specimen instead is evidenced by the fact that we can reconstruct the reasons for his selection as the human lectotype. As these reasons are not independent of patriarchal systems of oppression (namely, those that prevent women from holding positions of intellectual esteem), we can infer that the human type specimen is non-accidentally male. This indicates androcentrism.

The non-randomness of Linnaeus' selection might be twofold: we might complain both about societal factors at play during his lifetime which contributed to his prestigious position when a similar position was denied to women, and we might also complain about societal factors at play in 1959 when he was selected as the lectotype which made it more likely for a male rather than a female type specimen to be designated.[19] Recall, though, that the reported reason for selecting Linnaeus as a lectotype was that he likely used his own body for reference when describing *H. sapiens*. This is the process used to designate lectotypes in general: we hope to identify which specimens were used when the species description was originally written. There is, thus, a principled reason

https://doi.org/10.1017/hyp.2023.121 Published online by Cambridge University Press

to designate Linnaeus as the human lectotype, and I prefer to err on the side of charity rather than assume that the reasons given in Stearn (1959) are *post hoc* justifications for implicit sexism. Nevertheless, the fact that Linnaeus, rather than a woman, was the first to describe our species is non-accidental, and we can still say that his status as the human type specimen is androcentric.

Having established that androcentrism is occurring, I investigate whether it's objectionable on feminist grounds, using the three reasons previously discussed. The first reason for which androcentrism is objectionable is that it involves ignoring the traits or experiences of women. The designation of Linnaeus as the human lectotype is straightforwardly objectionable on these grounds—the traits of human females, insofar as they are perhaps distinct from those of males, are not included in the *official* definition of our species, and non-accidentally so. The practice of allotyping would also be objectionable on these grounds, if it is the case that allotypes are more likely to be female specimens; the ICZN regulations specifically relegate allotypes to a status below that of other paratypes. In the human case, this would mean that if we were to have a non-paratype allotype for *Homo sapiens*—a female human specimen—that she potentially would be unable to serve as the human holotype should Linnaeus stop being a viable lectotype (e.g., if his remains were destroyed).

The fact that we never *use* Linnaeus' body as a reference does not negate the concern. The practice under evaluation here is not the practice of using holotypes to identify the species membership of further specimens, but the practice of selecting type specimens at all. The concern, then, is about the fact that the human lectotype, a male, is supposed to be significant for setting the standard of our species. This standard explicitly does not include human traits unique to human females (if there are any) and is therefore guilty of objectionable androcentrism for this reason.

The second reason to object to androcentrism is that it reinforces sex/gender dichotomies. Linnaeus as a lectotype *per se* does not reinforce sex as dichotomous; having a male holotype and a female allotype reinforces the dichotomy more than merely having a male holotype does. The practice of assigning allotypes at all emphasizes sex categories and sex differences.[20]

The third reason for which androcentrism can be problematic is that it encourages making universal generalizations from particulars. Here, both Linnaeus as a lectotype, as well as the practice of allotyping, are objectionable, as a result of the fact that holotyping at all is objectionable. The practice of holotyping assumes that a *single individual member* of a species can be taken to set the standard for the species as a whole. Surely there are pragmatic reasons for choosing small numbers of type specimens, but doing so masks naturally occurring biological variation. Again, these pragmatic reasons should not be able to outweigh the criticism of the practice of establishing definitions. Defining groups by their similarity to particular members is objectionable on feminist grounds, even if it is not androcentric.

In summary:

1. There is strong evidence that holotypes are more likely to be male specimens than female specimens, although there is not definitive evidence that this is the result of objectionable androcentrism. The human lectotype, Linnaeus, is non-accidentally male, however, which is objectionable on feminist grounds for centering the traits of males over those of females.
2. Holotyping in general, and having a male human lectotype, does not itself reinforce a sex/gender binary, although the practice of assigning allotypes does.

3. Holotyping is objectionable for overgeneralizing from particulars, because it involves defining a category by the traits of one of its members. The human lectotype, while never actually used in this way, is objectionable for the same reason. However, this objection applies to holotyping whether or not it is an androcentric practice.

In the case of holotyping, we have seen a typing practice that can be objected to for being androcentric. We have also seen that the practice of typing was objectionable on feminist grounds even when it isn't specifically androcentric. This same situation emerges in the context of reference genomes.

Androcentrism in genoming

It's difficult to give a precise definition of the term "genotype" and "genome"; Mahner and Kary (1997) found no less than seven and five different candidate definitions of these terms, respectively. For the purposes of this paper, I use the term "genome" (or "genoming") to refer to the practice of having one reference set of DNA for a whole group (such as a species). "Genotype" and "genotyping" is more often associated with the practice of sequencing the DNA of a single individual. A reference genome, then, is similar to a holotype insofar as it can serve as a reference standard for a group. It would be nice if the "-type" suffix was used consistently between these two areas—i.e., it would be nice if holo*types* and geno*types* were similar—but this is not the case. In keeping with scientific practice, I refer to the biological types as "genomes" and the typing practice as "genoming" (a word I made up).

Do reference genomes constitute scientific types, in the technical sense? Unlike holotypes, there is no overarching regulatory body in charge of designating official genomes. Additionally, genomes are seldom comprised of a single individual's genotype; rather, multiple individuals are used to complete the entire genome. Nevertheless, Ballouz et al. (2019) argue that reference genomes closely resemble type specimens in their idiosyncrasy: while they are not based on single individuals, they are hardly representative of entire populations, and often contain very rare alleles. Furthermore, the use of multiple individuals to construct the reference genome parallels the use of a holotype and a set of paratypes; even in the context of holotyping, multiple type specimens are used to describe a species, even though only one of them is name-bearing. I therefore submit that reference genomes should be viewed as a sort of scientific type, like the holotypes, measurement standards, and stratotypes discussed by Bokulich (2020).

Researchers also often use reference genomes to set the standard for a species; in the human case, for example, ancient DNA is used to compare the discovery of a new hominid species to ours (e.g., Krause et al. 2010). The idea behind reference genomes is that one can make claims about the genetic makeup of all members of a species based on one (or a few) genotypes. As with holotypes, one could use the reference genome to test whether a specimen of unknown species fits into a given species category.[21] Genoming is also used to define phylogenetic relationships.[22]

The Human Genome Project, drafted in 2001 and completed in 2003, is particularly relevant in the context of androcentrism. The definitive human genome—called the "reference genome"—might have been male, female, or neither. It's common knowledge that, for humans, in addition to the 22 pairs of autosomes, a male genome has one X and one Y sex chromosome, whereas a female genome has two X sex chromosomes. The human reference genome also could have had any number of other combinations of sex chromosomes, including neither; the human reference genome could be

https://doi.org/10.1017/hyp.2023.121 Published online by Cambridge University Press

incomplete. Unlike in the case of holotyping, which requires an actual specimen to serve as the type, there is no requirement that the human reference genome be instantiated in any actual human, nor that it be possible for an actual human to have that genome. (Indeed, the official genome has one of each of autosomes, whereas most actual humans have two.) Nonetheless, it is the case that the human reference genome has one X and one Y sex chromosome (Figure 1). Insofar as this combination of chromosomes is associated with maleness, the human reference genome, like the official human lectotype, is male. Human genoming might, then, be seen as androcentric.

I now investigate whether the maleness of the human reference genome is objectionable for the three reasons detailed. First, does the human reference genome ignore the traits or experiences of women? Any combination of sex chromosomes is, unfortunately, going to ignore the traits of *some* humans: not including sex chromosomes precludes any research on traits the development of which involves genes on the sex chromosomes; using two X chromosomes (the gynocentric solution) has this same problem with respect to Y-linked traits; and other combinations of the sex chromosomes such as XXY or XYY are associated with specific intersex conditions.[23] There are potential reasons for the human reference genome having any combination of sex chromosomes—the point here is that they each leave *someone* out. In fact, the current human reference genome apparently has one X and one Y sex chromosome because this means that the human reference genome has one of *each* chromosome, thereby finding a balance between parsimony (i.e., minimizing duplicates, as would be the problem with an XX reference genome) and completeness (i.e., maximizing coverage, as would be the failure of a genome without sex chromosomes). Likely, this decision is a consequence of the fact that the Human Genome Project is oriented towards describing the functions of different genes, rather than setting a standard for what

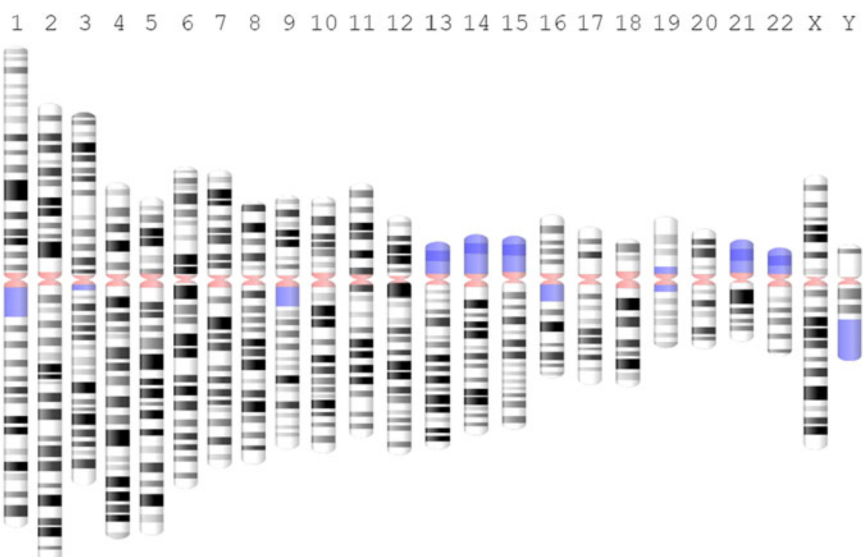

Figure 1. A visual depiction of the human reference genome (Genome Reference Consortium, 2019). For the purposes of this paper, it is only important that the human genome has one of each autosome (chromosome 1-22) and one X and one Y chromosome.

https://doi.org/10.1017/hyp.2023.121 Published online by Cambridge University Press

makes an organism a human. For example, the National Research Council Committee on Mapping and Sequencing the Human Genome (1988) references facility in "biochemistry, physiology, cell biology, and medicine," not species identification, as the aims of sequencing the human genome.

Despite this goal of the Human Genome Project, though, there is still a sense in which the human reference genome is the *male* human genome. Some genes on the human Y chromosome, together with other genes on the autosomes, are involved in male sex determination, specifically testes development (Berta et al. 1990) and spermatogenesis (Tiepolo and Zuffardi 1976). The human reference genome does have the genes for these distinctively male traits and so, in a sense, is a distinctively male genome because it has genes which prevent the development of distinctively female traits such as oogenesis.

However, I argue that the human genome is only accidentally male. In the context of holotypes, I argued that having a male name-bearing type for humans was not accidental: Linnaeus was chosen as a lectotype because of his position, and the chances that someone in that position was male (and white, etc.) is relatively high. Non-accidental selection of a male as the stand-in for an entire group reeks of problematic androcentrism. However, in the case of genomes, I instead argue that it *is* accidental that the human reference genome is XY. That is because I think that it's (biologically) accidental that human males have an XY karyotype, while human females have an XX karyotype. Human males and females easily could have had opposite karyotypes, and there is some evidence that if they did then the human reference genome would have had the female set of chromosomes rather than the male. In other words, the human reference genome isn't XY because the relevant scientists thought it important that the reference genome be male; rather, it's incidentally male as a consequence of the fact that it's XY, and it's XY because the relevant scientists thought it important to include one of each chromosome in the human karyotype.

Consider birds: birds have chromosomal sex determination, but the female is heterogametic (ZW) whereas the male is homogametic (ZZ).[24] The reference genome of a chicken, the first non-mammalian amniote with a complete gene sequence, contains one Z and one W sex chromosome, effectively making it "female" in much the same way that the official human reference genome is "male" (Hillier et al. 2004). In both cases, the reference genome contains one of each chromosome. The human reference genome could have had the female combination of sex chromosomes, then, if human females had been heterogametic and human males homogametic, like birds. Of course, this relies on thinking that the heterogameticity of human males isn't a biological necessity.[25]

On the other hand, one may think that sexism would have prevented the human reference genome from being female, regardless of which sex was heterogametic. Indeed, there is reason to not be so optimistic in thinking that the principles of the Human Genome Project have dictated the karyotype of the reference genome: although the donors to the Human Genome Project were originally supposed to be anonymous, it has surfaced that Craig Venter (a white, male scientist who led the sequencing effort[26]) is the primary donor (Wade 2002). Around 70 percent of the human reference genome is based on his DNA. So, just as in the case of the human lectotype, we find a prominent male scientist selected (or, in this case, self-selected) to represent humanity. As I argued in the previous section, then, there is an important sense in which the human reference genome is *non*-accidentally male: sexism in science is part of the reason why the human reference genome has the karyotype it has.

Another, related line of feminist criticism of the human reference genome is to say that the human reference genome overly focuses on the *nuclear*, as opposed to mitochondrial, genome. Mitochondria are essential organelles, each with their own genome. In sexually reproducing species, the mitochondrial DNA is inherited exclusively from the egg. Chadwick (2009) advances this argument, saying:

> when the "human genome" is discussed it is normally the nuclear genome that is at issue, rather than the mitochondrial genome, which was sequenced much earlier, without the publicity that accompanied the Human Genome Project of the 1990s. Debates about genetic reductionism and the relationship between genes and identity also tend to be carried out in relation to the nuclear genome rather than the mitochondrial. The mitochondrial genome is particularly significant in relation to gender issues because if a woman suffers from a disorder caused by mitochondrial DNA, all her children will inherit it, as mitochondrial DNA is passed down the maternal line, while nuclear DNA is inherited from both parents. From the start, then, the mitochondrial genome gives rise to issues of gender, and provides a focal point for discussion in the context of ancestry tracing. So the fact that it is the nuclear genome that has attracted most of the publicity might itself have gender implications.

Indeed, the mitochondria and the Y-chromosome, which is inherited exclusively down the male line, are often used in analogous ways in research—for example, in dating the Mitochondrial Eve (Cann et al. 1987) and Y-chromosomal Adam (Poznik et al. 2013).[27] So one could argue that, if the Y chromosome is to be included in the human reference genome, then the human mitochondrial genes should be as well.

Where does this leave us with respect to evaluating androcentrism in the human reference genome? On the one hand, the reference genome is accidentally male in the sense that it's accidentally XY; it could have been ZW (and therefore female) if it were a bird reference genome. However, the reference genome is non-accidentally male in the sense that it's not an accident that the prominent scientist whose DNA was used is a male. Furthermore, we could criticize the absence of mitochondrial DNA from the reference genome, and mitochondrial DNA is inherited exclusively from maternal ancestors (unlike, for instance, Y chromosomes). Admittedly, it's difficult to weigh these factors and reach a definitive conclusion about whether the human reference genome is ultimately criticizable for ignoring female traits or experiences. However, overall I think that there is certainly *something* criticizable about how the human reference genome was constructed, on these grounds. Future philosophical, historical, or sociological work may be needed to say anything more conclusive.

Second, we might ask whether the human genome reinforces a sex/gender binary. To address this question, I draw heavily on the work of Richardson (2013). Richardson uses episodes in the history of genetics research to demonstrate that our preconceptions about sex categories have influenced the trajectory of sex chromosome research. First, Richardson reviews the controversy near the beginning of the twentieth century over what to call the X and the Y chromosomes: "sex chromosomes" was only one candidate, and was resisted on the grounds that this terminology was inconsistent with current practices for chromosome description, which emphasized chromosomes' pairing behavior during meiosis rather than putative function in development (44). Other candidate terms included "accessory chromosomes," "heterochromosomes," and "idiochromosomes," which Richardson argues are preferable to "sex chromosomes" as a label,

https://doi.org/10.1017/hyp.2023.121 Published online by Cambridge University Press

even today (42, 207). Second, Richardson argues that the emerging terminology of "sex hormones" for androgens and estrogen aided in the acceptance of "sex chromosomes" as a term for the X and Y chromosomes, as both terms constituted a cultural acceptance of (dichotomous) biological explanations for sex (70–71). Third, Richardson reviews particularly troubling claims of the Y chromosome as somehow adding maleness; XYY individuals were presumed to be more male than XY individuals (chapter 5). Similarly, the X chromosome—although included in the karyotype of all humans, male and female—became associated with female traits (chapter 6). These associations, between Y and maleness and X and femaleness, led to "a hyperbinary view of the X and Y" (104). Fourth, Richardson reviews contemporary debates which rely on this view of chromosomal sex, including the controversy over whether males are going extinct as a result of gradual Y chromosome disintegration (chapter 8), the claim that men and women are as genetically different as humans and chimpanzees (chapter 9; see also Richardson 2010), and a recent push by feminist advocates for sex-based biology, especially with respect to sex differences in medical conditions or responsiveness to treatment (chapter 10). Overall, these cases demonstrate the extent to which gender binary thinking influences how we perceive and study the genome.

One implication of Richardson's argument is that it's not our focus on reference genomes *per se* which reinforces a sex/gender binary. In fact, our cultural insistence on a sex/gender binary causes us to see the human reference genome as confirmation of this binary, which can in turn reinforce how we study genomes. One reason, then, why we may be prone to see the human reference genome—with one X and one Y chromosome—as biologically male is because we have developed an unjustified association between XY karyotype and maleness. If, as an extension of Richardson's recommendations, we didn't think of the X and Y chromosomes as sex chromosomes at all, we are hard pressed to say that the human reference genome is male. It's the conflation of karyotype with sex which causes us to think that the human genome reinforces a sex/gender binary.

Third, and finally, the human reference genome may be a case of unjustifiably generalizing from particulars. Although the reference genome for humans was compiled from a set of humans, rather than just one, around 70 percent of the reference genome comes from a single individual (Tuzun et al. 2005).[28] Subsequent research after the advent of personal genome sequencing has revealed that such a genome could not serve as a "universal" or "gold standard" genome for the species (Ballouz et al. 2019). Nor can the reference genome be considered a "normal" or "disease free" genome, because the individual from which 70 percent of the reference genome was sequenced turned out to have contributed genes associated with type 1 diabetes and hypertension (Chen and Butte 2011); indeed, one might criticize the idea that the reference genome *should* be "normal" or "disease free" on anti-ableist grounds. Ballouz et al. (2019) therefore argue that the human reference genome is idiosyncratic, and thus closer to a type specimen (like a holotype) than a representative reference. If so, human genoming is subject to the same feminist criticism: it involves generalizing across the species from a single individual.

Ballouz et al. recommend that we instead use "consensus genomes," genomes which use the most frequent alleles from a given population. Consensus genomes are useful for studying subpopulations within our species but may also be used for the whole species. Even within subpopulations, though, a feminist would object that diversity within groups is as important as diversity between them (for a review of such arguments, see Christensen 1997). One alternative to consensus genomes is a "pangenome," which is a genome that includes variation among individuals, rather than eliminating it.[29] The Human Pangenome Reference Consortium (n.d.) is attempting to compile a pangenome for the human species, specifically in order to address issues of racial diversity in the human genome, so there is some hope for developing a human reference genome which recognizes intraspecific diversity. Another suggestion is to eliminate the use of a reference genome and replace it with individual genotyping.

The practice of genoming might be objectionable to feminists for an additional reason: gene-centrism itself has been criticized for feminist reasons (e.g., Oyama 1985, 2002). There is no principled distinction between genetic and nongenetic causes of traits, the argument goes, in which case it's strange to focus on the causal efficacy of genes.[30] Interestingly, proponents of so-called "developmental systems theory" such as Oyama may need to provide an alternative means of species identification that doesn't focus on using genetic information to do so; it's an open question whether there is a developmentally friendly species concept or species identification methodology.[31]

In summary:

1. The human reference genome is accidentally male in the sense that it's accidentally XY. However, the human reference genome is non-accidentally male in the sense that the individual whose DNA was used is a prominent male scientist. One possible further objection is that the human genome should include our mitochondrial DNA, which is inherited exclusively through the maternal line. Therefore, the human reference genome is at least criticizable for ignoring some traits of human females, although the fact that the reference genome is XY is not the main issue.
2. The human reference genome does not commit us to a sex/gender binary. Rather, we only see the reference genome as sexed because we think of the X and Y chromosomes as sex chromosomes, and associate XY karyotypes with maleness. These are the product, not the cause, of binary thinking.
3. The human reference genome *is* objectionable for overgeneralizing from particulars. Consensus genomes, a pangenome, or personal genome sequencing would all do better at recognizing diversity within our species. However, as in the case of holotypes, this objection has little to do with androcentrism, and can be levied more generally against the practice of creating reference genomes.

How do these arguments compare with those given in the context of holotyping? First, in both cases we saw that the human holotype and the human genome are based non-accidentally on prominent scientists, which, due to pervasive sexism in science, are both male. This indicates that the androcentrism at play may be objectionable for ignoring the traits and experiences of women. Second, we found that in neither case did the biological typing practice itself reinforce sex/gender binaries. Third, both holotyping and genoming involve overgeneralization, although in neither case does this objection have much to do with whether the practice is androcentric. There are also notable differences between holotyping and genoming, though. For example, while consensus genomes or pangenomes are a viable alternative to reference genomes, it's unclear what an analogous strategy is in the case of holotypes.

Conclusion

This paper applies a tradition in feminist philosophy—criticizing scientific practices for being androcentric—to biological typing. I explained that androcentrism can be

https://doi.org/10.1017/hyp.2023.121 Published online by Cambridge University Press

objectionable for (at least) three reasons: ignoring the traits or experiences of women, reinforcing a sex/gender binary, and overgeneralizing from particulars. I asked whether the practices of holotyping and genoming were objectionable for these three reasons, both in general and as applied to humans. I argued that typing ignores the traits or experiences of women if the type was non-accidentally male. Both the human holotype and the human reference genome are, arguably, objectionable for this reason, with some added complications in the genoming case. In both cases, I argued that the practice of typing itself does *not* reinforce a sex/gender binary, although, in the case of holotyping, the unofficial practice of assigning an allotype does reinforce a sex/gender binary. In the case of genoming, it's our perception of the X and Y chromosomes as *sex* chromosomes that causes us to see the inclusion of these chromosomes as part of binary thinking about sex, not the other way around. Finally, I argued that both holotyping and genoming are subject to criticism for overgeneralization, as both practices involve taking single individuals (or, small groups of individuals) as representative of an entire species. However, this objection to biological typing isn't the result of typing being androcentric and is rather directed towards the typing practices as a whole.

As stated in the introduction, I imagine this paper to have two audiences: feminist philosophers and philosophers of science. To the feminist philosophers, I hope to have contributed to a tradition that demonstrates the utility of applying feminist principles and arguments to cases in science. Many feminist philosophers of science have demonstrated exactly this, but I think that usually there is a focus on applying feminist critiques to science about sex/gender; neither case of biological typing investigated in this paper fits that mold. Additionally, the distinction herein between descriptive androcentrism and problematic androcentrism may be useful in further feminist projects, including outside of feminist philosophy of science. To philosophers of science, I hope to have contributed to a literature which demonstrates the utility of looking to feminist philosophy as a source of scientific scrutiny, even in cases where, again, sex/gender are not the object of scientific study. More specifically, I have analyzed standard practices in biology—holotyping and genoming—through a critical lens, and future work on typological practices in biology may benefit from incorporating these lessons, especially regarding demarcating permissible and impermissible uses of values in science, into their analysis.

In a broader context than that of biological typing, the discussion of androcentrism herein should be useful in a number of ways. First, I have argued that it's important to distinguish between androcentrism in the descriptive sense (taking maleness as typical) and objectionable androcentrism. I have provided a framework by which to evaluate androcentric scientific practices, consisting of three reasons why androcentrism may be criticizable, but there may be more reasons and it would be fruitful in future research to examine these. Furthermore, for future work which seeks to criticize androcentric scientific practices, I hope to have emphasized the importance of spelling out exactly the reasons for the critique. As many feminist philosophers of science before me have argued, bias or the influence of values in science isn't necessarily objectionable; what is objectionable is pernicious bias or values, and further work needs to be done to identify these in theory and in practice.

Acknowledgments. This paper greatly benefitted from feedback by Samia Hesni, Alisa Bokulich, Federica Bocchi, and Leticia Castillo-Brache, as well as two anonymous referees. This material is based upon work supported by the National Science Foundation Graduate Research Fellowship Program under Grant No. DGE-1840990. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation.

https://doi.org/10.1017/hyp.2023.121 Published online by Cambridge University Press

Notes

1 Thanks to two anonymous referees for encouraging me to clarify my thinking about the role of Beauvoir's work.
2 Note that many feminist scholars responding to scientists are operating in a context in which it's taken as a given that sex (if not gender) is binary. I do not think that any of the authors cited in this paper are committed to such a view, explicitly or implicitly, and would like to explicitly distance myself from such a view. Thus the terms "man," "woman," "male," and "female" used throughout this paper should be taken to be more like heuristic categories than real ones.
3 See Wakil (2020) for further discussion of whether the byproduct hypothesis is androcentric.
4 For the purposes of this paper, I will be using "natural kinds" rather loosely, to just mean something like "metaphysically real categories." Of course, the philosophical literature on natural kinds is vast and different accounts have been provided. For a helpful overview, see McOuat (2009); thanks to an anonymous referee for suggesting this reference.
5 Interestingly, this has recently evolved into an NIH requirement that sex as a biological variable also be included in preclinical trials (Clayton and Collins 2014). For a discussion of some of the shortcomings of this policy, see Richardson et al. (2015), Richardson (2022).
6 Debates concerning essentialism within feminist philosophy are also helpfully reviewed in Witt (1995) and Stone (2004).
7 There is also an International Code of Botanical Nomenclature (ICBN). I will focus in this paper on the zoological context, as this is the most likely area in which androcentrism would crop up.
8 Bokulich likens this to other practices of scientific typing, such as the setting of measurement standards by the International Bureau of Weights and Measures and the setting of stratigraphic "definitions" for geologic time periods by the International Commission on Stratigraphy.
9 Of course, the biological species concept itself is up for debate, but no one (to my knowledge) has seriously proposed a species concept where different sexes are different species.
10 For a helpful glossary of type nomenclature, see Evenhuis (2008).
11 It would be interesting in future work to compare the practice of holotyping to other practices in science involving abstraction and idealization. Thanks to an anonymous referee for this suggestion.
12 Nothing ever came of Santiago-Blay et al.'s recommendation; the report was "given a Case number by mistake," and the case was then closed (Closure of Cases, 2018). The Executive Secretary of the ICZN has informed me that the original language, recommending that allotypes be included in the type series, will most likely be in the next edition of the Code, although the ICZN still has no intention of regulating allotypes more explicitly (Lim, personal correspondence, September 2020).
13 There are some notable exceptions to a 1:1 sex ratio in nature, including all-female parthenogenic species and species with nonreproductive castes such as eusocial insects. The theory governing sex ratios is called Fisher's (1930) Principle; for an influential discussion, see Hamilton (1967).
14 The ICZN does maintain an official database, at Zoobank.org, with the official publications of all new species designations. However, this is really a database of publications, not of type specimens, so I have opted to use the Natural History Museum database instead.
15 In case the reader is tempted to think that these percentages are pretty close to 50%, just think about tossing a coin tens of thousands of times and finding that nearly 60 percent of the results were "heads." Alternatively, one could calculate the p-values (hint: they are much, much lower than 0.001).
16 For a related analysis of museum specimens' sexes, see Cooper et al. (2019).
17 This justification helps to explain why another individual, perhaps one more famous or powerful than Linnaeus, wasn't chosen. Additionally, there may be additional, implicit reasons for having chosen Linnaeus as the human lectotype; for example, as a way to commend the "father of taxonomy." Thanks to an anonymous referee for helping me to clarify this point.
18 Some attribute this to our ability to tell intuitively whether any given specimen is a human or not; having a human holotype is thought to be "utterly superfluous to an understanding of human identity" (Ohl 2019, 120; see also Spamer 1999). I am not particularly satisfied with this answer; especially in the case of other members of the genus Homo, there has historically been some dispute over which species a given specimen belongs to (e.g., Tucci et al. 2018). Having a human holotype might also be useful in the future; lack of past utility should not rule out potential utility. I thus do not think we should rule out needing a human holotype for identification purposes.

https://doi.org/10.1017/hyp.2023.121 Published online by Cambridge University Press

19 We might also complain that Linnaeus was selected despite having himself propounded several sexist views; see Schiebinger (2004).
20 Indeed, this might be one good reason for the ICZN to continue to refrain from regulating allotypes.
21 Indeed, some taxonomists think that we should go this route, especially in the context of microorganisms; for discussion, see Ward (1998), Achtman and Wagner (2008), Rosselló-Mora and Kämpfer (2014), and Ereshefsky (2010).
22 See Quammen (2018) for a detailed account of the history of genome sequencing techniques as used in phylogenetic analyses.
23 For a comprehensive overview of intersex conditions from a feminist perspective, see Fausto-Sterling (2020).
24 See Bachtrog et al. (2014) for an overview of the variety of sex determination mechanisms found in nature, including non-genetic mechanisms.
25 It also relies on accepting the assumption that fuller "coverage" of the human genome is a desideratum; at least some early attempts to sequence the human genome, such as that by the Centre d'etude du polymorphisme humain (CEPH) only focused on the autosomes and X chromosomes (e.g., Dausset et al. 1990).
26 Actually, Venter led the efforts by the private corporation Celera that "tied" with the Human Genome Project in their efforts to sequence the human genome for the first time.
27 For philosophical discussion, see DiMarco (2020).
28 Only a handful of other individuals were used in the remaining 30 percent, 10 individuals for 23 percent, and over 50 individuals for the remaining 7 percent. This practice of using one individual as the primary source and other individuals as secondary sources of information is reminiscent of the practice of holotyping and paratyping.
29 See Doolittle and Brunet (2016) for a discussion of pangenomics in a prokaryotic context.
30 For some other feminist science critics who argue along similar lines, see Fausto-Sterling (1992, 2020), and Jordan-Young (2011).
31 Thanks to an anonymous referee for pointing this out.

References

Closure of cases (3451, 3459, 3564, 3691, 3755). 2018. *Bulletin of Zoological Nomenclature* 75 (1): 302. https://doi.org/10.21805/bzn.v75.a069

Achtman, M., and Wagner, M. 2008. Microbial diversity and the genetic nature of microbial species. *Nature Reviews Microbiology* 6 (6): 431–40. https://doi.org/10.1038/nrmicro1872

Anderson, E. 1995. Feminist epistemology: An interpretation and a defense. *Hypatia* 10 (3): 50–84. https://doi.org/10.1111/j.1527-2001.1995.tb00737.x

Bachtrog, D., J. E. Mank, C. L. Peichel, M. Kirkpatrick, S. P. Otto, T.-L. Ashman …J. C. Vamosi. 2014. Sex determination: Why so many ways of doing it? *PLoS Biology* 12 (7). https://doi.org/10.1371/journal.pbio.1001899

Ballouz, S., A. Dobin, and J. A. Gillis. 2019. Is it time to change the reference genome? *Genome Biology* 20 (1): 159. https://doi.org/10.1186/s13059-019-1774-4

Bar On, B.-A. 1993. Marginality and epistemic privilege. In *Feminist epistemologies*, ed. L. Alcoff and E. Potter. New York: Routledge.

Beauvoir, S. de. 1949. *The second sex*, trans. C. Borde and S. Malovany-Chevallier. New York: Knopf Doubleday Publishing Group.

Biology and Gender Study Group, A. Beldecos, S. Bailey, S. Gilbert, K. Hicks, L. Kenschaft, … A. Wedel. 1988. The importance of feminist critique for contemporary cell biology. *Hypatia* 3 (1): 61–76.

Bem, S. L. 1993. *The lenses of gender: Transforming the debate on sexual inequality*. New Haven: Yale University Press.

Berta, P., J. B. Hawkins, A. H. Sinclair, A. Taylor, B. L. Griffiths, P. N. Goodfellow, and M. Fellous. 1990. Genetic evidence equating SRY and the testis-determining factor. *Nature* 348 (6300): 448–50. https://doi.org/10.1038/348448a0

Bokulich, A. 2020. Understanding scientific types: Holotypes, stratotypes, and measurement prototypes. *Biology and Philosophy* 35 (5). https://doi.org/10.1007/s10539-020-09771-1

Cann, R. L., M. Stoneking, and A.C. Wilson. 1987. Mitochondrial DNA and human evolution. *Nature* 325 (6099): 31–36. https://doi.org/10.1038/325031a0

Cartwright, N. 1983. *How the laws of physics lie*. New York: Oxford University Press.

https://doi.org/10.1017/hyp.2023.121 Published online by Cambridge University Press

Cartwright, N. 1999. *The dappled world: A study of the boundaries of science*. Cambridge: Cambridge University Press.
Chadwick, R. 2009. Gender and the human genome. *Mens Sana Monographs* 7 (1): 10–19. https://doi.org/10.4103/0973-1229.44075
Chen, R., and A. J. Butte. 2011. The reference human genome demonstrates high risk of type 1 diabetes and other disorders. *Pacific Symposium on Biocomputing* 2011: 231–42. https://doi.org/10.1142/9789814335058 0025
Christensen, K. 1997. "With whom do you believe your lot is cast?" White feminists and racism. *Signs* 22 (3): 617–48.
Clayton, J. A., and F. S. Collins. 2014. NIH to balance sex in cell and animal studies. *Nature* 509: 282–83.
Cleghorn, E. 2021. *Unwell women: Misdiagnosis and myth in a man-made world*. London: Penguin.
Collins, P. H. 1990. *Black feminist thought: Knowledge, consciousness, and the politics of empowerment*. New York: Routledge.
Cooper, N., A. L. Bond, J. L. Davis, R. Portela Miguez, L. Tomsett and K. M. Helgen. 2019. Sex biases in bird and mammal natural history collections. *Proceedings of the Royal Society B: Biological Sciences* 286 (1913): 20192025. https://doi.org/10.1098/rspb.2019.2025
Criado Perez, C. 2019. *Invisible women: Data bias in a world designed for men*. New York, NY: Abrams.
Dausset, J., H. Cann, D. Cohen, M. Lathrop, J. M. Lalouel, and R. White. 1990. Centre d'etude du polymorphisme humain (CEPH): collaborative genetic mapping of the human genome. *Genomics* 6 (3): 575–77. https://doi.org/10.1016/0888-7543(90)90491-c
DiMarco, M. 2020. (Re)Producing mtEve. *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* 83: 101290. https://doi.org/10.1016/j.shpsc.2020.101290
Doolittle, W. F., and T. D. P. Brunet. 2016. What is the tree of life? *PLOS Genetics* 12 (4): e1005912. https://doi.org/10.1371/journal.pgen.1005912
Ereshefsky, M. 2010. Microbiology and the species problem. *Biology and Philosophy* 25 (4): 553–68. https://doi.org/10.1007/s10539-010-9211-9
Evenhuis, N. L. 2008. *A compendium of zoological type nomenclature: A reference source* (Bishop Museum Technical Report 41). Honolulu, HI: Bishop Museum.
Fausto-Sterling, A. 1992. *Myths of gender: Biological theories about women and men,* revised edition. New York: Basic Books.
Fausto-Sterling, A. 1993. The five sexes. *The Sciences* 33 (2): 20–24. https://doi.org/10.1002/j.2326-1951.1993.tb03081.x
Fausto-Sterling, A. 2000. The five sexes, revisited. *The Sciences* 40 (4): 18–23. https://doi.org/10.1002/j.2326-1951.2000.tb03504.x
Fausto-Sterling, A. 2020. *Sexing the body: Gender politics and the construction of sexuality,* revised edition. New York: Basic Books.
Fine, C. 2011. *Delusions of gender: How our minds, society, and neurosexism create difference*. New York: W. W. Norton & Co.
Fine, C. 2018. *Testosterone rex: Myths of sex, science, and society*. London: Icon Books.
Fisher, R. A. 1930. *The genetical theory of natural selection: A complete variorum edition*. Oxford: Oxford University Press.
Frost, S. 2011. The implications of the new materialism for feminist epistemology. In *Feminist epistemology and philosophy of science: Power in knowledge*, ed. H. E. Grasswick. Dordrecht: Springer Netherlands. https://doi.org/10.1007/978-1-4020-6835-5
Genome Reference Consortium. 2019. *Genome reference consortium human build* 38 *patch release* 13 (*GRCh*38.*p*13). February. Retrieved from https://www.ncbi.nlm.nih.gov/assembly/GCF000001405.39/
Gloyd, L. K. 1982. The original definition and purpose of the term "allotype." *Systematic Zoology* 31 (3): 334–36. https://doi.org/10.2307/2413240
Gornick, V. 1972. Woman as outsider. In *Woman in sexist society: Studies in power and powerlessness*, ed. B. K. Moran and V. Gornick. New York: New American Library.
Grosz, E. A. 1994. *Volatile bodies: Toward a corporeal feminism*. Bloomington: Indiana University Press.
Hamilton, W. D. 1967. Extraordinary sex ratios. *Science* 156 (3774): 477–88. https://doi.org/10.1126/science.156.3774.477
Harding, S. 1987. *Feminism and methodology: Social science issues*. Bloomington: Indiana University Press.

Haslanger, S. 2000. Feminism in metaphysics: Negotiating the natural. In *The Cambridge companion to feminism in philosophy*, ed. M. Fricker and J. Hornsby. Cambridge: Cambridge University Press.

Hekman, S. 1997. Truth and method: Feminist standpoint theory revisited. *Signs: Journal of Women in Culture and Society* 22 (2): 341–65. https://doi.org/10.1086/495159

Heyes, C. 2000. *Line drawings: Defining women through feminist practice*. Ithaca, NY: Cornell University Press.

Hillier, L. W., W. Miller, E. Birney, W. Warren, R. C. Hardison, C. P. Ponting, … International Chicken Genome Sequencing Consortium. 2004. Sequence and comparative analysis of the chicken genome provide unique perspectives on vertebrate evolution. *Nature* 432 (7018): 695–716. https://doi.org/10.1038/nature03154

Hrdy, S. B. 1981. *The woman that never evolved*. Cambridge, MA: Harvard University Press.

Human Pangenome Reference Consortium. n.d. *The human pangenome project*. Retrieved September 30, 2020, from https://humanpangenome.org/

ICZN. 1999. *International code of zoological nomenclature* (4th ed.). London: International Trust for Zoological Nomenclature.

Jordan-Young, R. M. 2011. *Brain storm: The flaws in the science of sex differences*. Cambridge, MA: Harvard University Press.

Keller, E. F. 1985. *Reflections on gender and science* (10th anniversary ed.). New Haven: Yale University Press.

Keller, E. F. 2010. *The mirage of a space between nature and nurture*. Durham, NC: Duke University Press.

Kourany, J. A. 2010. *Philosophy of science after feminism*. Oxford: Oxford University Press.

Krause, J., Q. Fu, J. M. Good, B. Viola, M. V. Shunkov, A. P. Derevianko, and S. Pääbo. 2010. The complete mitochondrial DNA genome of an unknown hominin from southern Siberia. *Nature* 464 (7290): 894–97. https://doi.org/10.1038/nature08976

Lloyd, E. A. 1995. Feminism as method: What scientists get that philosophers don't. *Philosophical Topics* 23 (2): 189–220. https://doi.org/10.5840/philtopics199523214

Lloyd, E. A. 2006. *The case of the female orgasm: Bias in the science of evolution*. Cambridge, MA: Harvard University Press.

Longino, H. E. 1987. Can there be a feminist science? *Hypatia* 2 (3): 51–64. https://doi.org/10.1111/j.1527-2001.1987.tb01341.x

Lugones, M. 2003. *Pilgrimages/peregrinajes: Theorizing coalition against multiple oppressions*. Lanham, MD: Rowman & Littlefield.

MacKinnon, C. A. 1983. Feminism, Marxism, method, and the state: Toward feminist jurisprudence. *Signs* 8 (4): 635–58.

Mahner, M., and M. Kary. 1997. What exactly are genomes, genotypes and phenotypes? And what about phenomes? *Journal of Theoretical Biology* 186 (1): 55–63. https://doi.org/10.1006/jtbi.1996.0335

Martin, E. 1991. The egg and the sperm: How science has constructed a romance based on stereotypical male- female roles. *Signs* 16 (3): 485–501.

McOuat, G. 2009. The origins of "natural kinds": Keeping "essentialism" at bay in the age of reform. *Intellectual History Review* 19 (2): 211–30. https://doi.org/10.1080/17496970902981694

Mitchell, S. D. 2003. *Biological complexity and integrative pluralism*. Cambridge: Cambridge University Press.

National Research Council Committee on Mapping and Sequencing the Human Genome. 1988. *Mapping and sequencing the human genome*. Washington, DC: National Academies Press.

Natural History Museum. 2020a. Query on the Natural History Museum Data Portal (data.nhm.ac.uk) (49386 records). Natural History Museum. Retrieved from https://data.nhm.ac.uk/doi/10.5519/qd.mxym39wx. https://doi.org/10.5519/QD.MXYM39WX

Natural History Museum. 2020b. Query on the Natural History Museum Data Portal (data.nhm.ac.uk) (65454 records). Natural History Museum. Retrieved from https://data.nhm.ac.uk/doi/10.5519/qd.6l8wl81n (type: dataset) https://doi.org/10.5519/QD.6L8WL81N

Noble, S. U. 2018. *Algorithms of oppression: How search engines reinforce racism*. New York: New York University Press.

Ohl, M. 2019. *The art of naming*. Cambridge, MA: MIT Press.

Oyama, S. 1985. *The ontogeny of information: Developmental systems and evolution*. Durham, NC: Duke University Press.

Oyama, S. 2002. The nurturing of natures. In *On human nature*, ed. A. Grunwald, M. Gutmann, and E. M. Neumann-Held. Berlin and Heidelberg: Springer.

Potochnik, A. 2017. *Idealization and the aims of science*. Chicago: University of Chicago Press.

Poznik, G. D., B. M. Henn, M.-C. Yee, E. Sliwerska, G. M. Euskirchen, A. A. Lin, … C. D. Bustamante. 2013. Sequencing Y chromosomes resolves discrepancy in time to common ancestor of males versus females. *Science* 341 (6145): 562–65. https://doi.org/10.1126/science.1237619

Quammen, D. 2018. *The tangled tree: A radical new history of life*. New York: Simon & Schuster.

Richardson, S. S. 2010. Sexes, species, and genomes: Why males and females are not like humans and chimpanzees. *Biology and Philosophy* 25 (5): 823–41. https://doi.org/10.1007/s10539-010-9207-5

Richardson, S. S. 2013. *Sex itself: The search for male and female in the human genome*. Chicago and London: University of Chicago Press.

Richardson, S. S. 2022. Sex contextualism. *Philosophy, Theory, and Practice in Biology* 14 (0). https://doi.org/10.3998/ptpbio.2096

Richardson, S. S., M. Reiches, H. Shattuck-Heidorn, M. L. LaBonte, and T. Consoli. 2015. Opinion: Focus on preclinical sex differences will not address women's and men's health disparities. *Proceedings of the National Academy of Sciences* 112 (44): 13419–20. https://doi.org/10.1073/pnas.1516958112

Rosselló-Mora, R., and P. Kämpfer. 2014. Defining microbial diversity—the species concept for prokaryotic and eukaryotic microorganisms. In *Microbial diversity and bioprospecting*, ed. A. T. Bull. Hoboken, NJ: John Wiley & Sons.

Rosser, S. V. 1989. Re-visioning clinical research: Gender and the ethics of experimental design. *Hypatia* 4 (2): 125–39. https://doi.org/10.1111/j.1527-2001.1989.tb00577.x

Santiago-Blay, J. A., B. C. Ratcliffe, F. T. Krell, and R. Anderson. 2008. Allotypes should be from the type series: A position paper for reinstating recommendation 72A from the third edition of the Code that defines the term "allotype." *Bulletin of Zoological Nomenclature* 65 (4): 260–64.

Schiebinger, L. L. 1989. *The mind has no sex? Women in the origins of modern science*. Cambridge, MA: Harvard University Press.

Schiebinger, L. L. 2004. *Nature's body: Gender in the making of modern science*. New Brunswick, NJ: Rutgers University Press.

Schutte, O. 1998. Cultural alterity: Cross-cultural communication and feminist theory in north-south contexts. *Hypatia* 13 (2): 53–72.

Scott, P. B. 1982. Debunking sapphire: Toward a non-racist and non-sexist social science. In *All the women are white, all the Blacks are men, but some of us are brave: Black women's studies* (2nd ed.), ed. G. T. Hull, P. B. Scott, and B. Smith. New York: The Feminist Press at the City University of New York.

Spamer, E. E. 1999. Know thyself: Responsible science and the lectotype of Homo sapiens Linnaeus, 1758. *Proceedings of the Academy of Natural Sciences of Philadelphia* 149: 109–14.

Stearn, W. T. 1959. The background of Linnaeus's contributions to the nomenclature and methods of systematic biology. *Systematic Zoology* 8 (1): 4–22. https://doi.org/10.2307/2411603

Stone, A. 2004. Essentialism and anti-essentialism in feminist philosophy. *Journal of Moral Philosophy* 21: 135–153.

Tavris, C. 1993a. *The mismeasure of woman*. New York: Touchstone.

Tavris, C. 1993b. The mismeasure of woman. *Feminism and Psychology* 3 (2), 149–68.

Tiepolo, L., and O. Zuffardi. 1976. Localization of factors controlling spermatogenesis in the nonfluorescent portion of the human Y chromosome long arm. *Human Genetics* 34 (2): 119–24. https://doi.org/10.1007/BF00278879

Tucci, S., S. H. Vohr, R. C. McCoy, B. Vernot, M. R. Robinson, C. Barbieri, … R. E. Green. 2018. Evolutionary history and adaptation of a human pygmy population of Flores Island, Indonesia. *Science* 361 (6401): 511–16. https://doi.org/10.1126/science.aar8486

Tuzun, E., A. J. Sharp, J. A. Bailey, R. Kaul, V. A. Morrison, L. M. Pertz, … E. E. Eichler. 2005. Fine-scale structural variation of the human genome. *Nature Genetics* 37 (7): 727–32. https://doi.org/10.1038/ng1562

van Anders, S. M. 2015. Beyond sexual orientation: Integrating gender/sex and diverse sexualities via sexual configurations theory. *Archives of Sexual Behavior* 44 (5): 1177–1213. https://doi.org/10.1007/s10508-015-0490-8

Wade, N. 2002. Scientist reveals secret of genome: It's his. *New York Times*, April 27. https://www.nytimes.com/2002/04/27/us/scientist-reveals-secret-of-genome-it-s-his.html (Accessed March 10, 2021).

Wakil, S. 2020. Objectivity and orgasm: The perils of imprecise definitions. *Synthese*. https://doi.org/10.1007/s11229-020-02886-8

Ward, D. M. 1998. A natural species concept for prokaryotes. *Current Opinion in Microbiology* 1 (3): 271–77. https://doi.org/10.1016/S1369-5274(98)80029-5

Witt, C. 1995. Anti-essentialism in feminist theory. *Philosophical Topics* 23 (2): 321–44. https://doi.org/10.5840/philtopics19952327

Wittig, M. 1992. *The straight mind and other essays*. Boston: Beacon Press.

Wylie, A. 2007. The constitution of archaeological evidence: Gender politics and science. In *The archaeology of identities*, ed. T. Insoll. London: Routledge.

Yoder, J. D. 1999. Biological essentialism: Our bodies, ourselves? In *Women and gender: transforming psychology*. Englewood Cliffs, NJ: Prentice Hall.

Aja Watkins is an Assistant Professor of Philosophy at the University of Wisconsin-Madison. Her research focuses on philosophy of science, especially philosophy of the geosciences, philosophy of biology, philosophy of the historical sciences, and feminist philosophy of science.

Cite this article: Watkins A (2024). Androcentrism in Biological Typing. *Hypatia* 1–24. https://doi.org/10.1017/hyp.2023.121