Penetrate science: Gendered descriptions of reproductive biology in online resources

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Textbooks on reproduction have been found to be gender-biased in four main ways: (i) Passive voice used for the female reproductive system (e.g., *is swept, is transported, is fertilized*) and active voice used for male reproductive system (e.g., *penetrates, enters, fertilizes*); (ii) The sequence of terms puts the male term first (e.g., *sperm* before *egg*); (iii) Direction of comparison is most often female compared to male, with less information, or misrepresented information, about the female system; and (iv) The usage of metaphors, such as *vestments* for the egg and *quest* for the sperm, mirror gender-biased roles. These representations do not convey the reality: the female reproductive system is more active, and the male system more passive, than has been portrayed (see Lawrence & Bendixen, 1992; Martin, 1991; Metoyer & Rust, 2011). How are descriptions of reproductive systems represented in different online resources? This question was explored in three online sites: Wikipedia, the Oxford English Dictionary (OED), and Urban Dictionary (UD). Wikipedia webpages were quantitatively and qualitatively analyzed in a similar way as in textbook studies. UD and OED were analyzed based on a word search of reproductive terms. Collectively, these three online resources complement previous studies by illuminating more evidence about how gender biases within the field of biology via language usage have been pervasive historically, and continue to this day. In sum, the male reproductive system has a longer history of usage, people discuss it more on UD, and Wikipedia provides more information on it as opposed to the female reproductive system.
Keywords: Gender; language; egg; sperm; reproduction; Wikipedia; Urban Dictionary; Oxford English Dictionary

1 Introduction

Scientific research is presented in a factual, authoritative manner, especially in textbooks (Campo-Engelstein & Johnson, 2014). However, it is often reported subjectively, based on dominating paradigms (Kuhn 1996) due to cultural biases and preconceptions (Gould, 1996, pp. 53-54), such as the two-sex model within Western culture (opposed by, e.g., Bem, 1993, pp. 80-81; Bing & Bergvall, 1998; Butler, 1990, pp. 9-10). Gender role biases have been argued to be prevalent throughout reproductive and anatomical descriptions in textbooks. Four main ways in which language has been used for gendered descriptions are as follows:

i "Feminine" language (passive voice, e.g., *is swept, is transported, is fertilized*) has been used for descriptions of the female reproductive system, and "masculine" language (active voice, e.g., *penetrates, enters, fertilizes,* and so on) has been used for descriptions of the male reproductive system (Beldecos et al., 1988; Campo-Engelstein & Johnson, 2014; Martin, 1991; Metoyer & Rust 2011).

ii The sequence of terms favours the male before the female (Campo-Engelstein & Johnson, 2014; Lawrence & Bendixen 1992) such as *sperm* before the *egg*, or, in general, sections of the male reproductive system before the female reproductive system.

iii Female biological systems are presented in comparison to the male systems more often than the reverse, such as *The Perineum* versus *The Female Perineum* (Lawrence & Bendixen, 1992, p. 930) or sperm "production" versus egg "degeneration" processes (Martin, 1991, pp. 487-488), with the amount of information disproportionally favouring the male system (Lawrence & Bendixen, 1992, pp. 928-930), and/or omission of information, or incorrect information for the female system (Campo-Engelstein & Johnson, 2014, pp. 207-210; Metoyer & Rust, 2011, pp. 188-193).

iv Metaphors and/or similes reflecting gender biases have been used (Beldecos et al. 1988; Campo-Engelstein & Johnson 2014; Martin 1991), such as the eggs "vestments", "corona" (crown), and the sperm's "quest" to "rescue" the egg before it dies (Martin, 1991, p. 490).

A range of textbooks has been analyzed in the studies just mentioned, yet, to my knowledge, no study has explored how this information is conveyed on the internet. Thus, the research question presented is this: How are descriptions of reproductive systems represented in different online resources?

Previous studies build upon cultural preconceptions of gender roles being mirrored in scientific descriptions. They thus serve to reinforce a social discourse of stereotypical gender roles through biological essentialism (Bem, 1993, pp. 9-13; Gilbert & Fausto-Sterling, 2003, p. 238). Gilbert and Fausto-Sterling argued that developmental biology informs us about how we are created, born, and become "sexed". In other words, developmental biology plays a critical role in our self-definition. Therefore, it is important to provide descriptions that are neutral, balanced, and objective, as best as possible. This is especially pertinent regarding educational materials. With the advent of the internet, there are various online resources to discuss and read about on these topics. This offers a rich area of potential research using these previous studies as the groundwork laying out a methodological framework to explore online resources. To answer the research question, I investigated three online resources: Wikipedia, Oxford English

Dictionary (OED), and Urban Dictionary (UD). My three hypotheses are as follows:

i. Wikipedia will contain balanced and neutral language because it is continually updated, meant to be used for educational purposes by the public, and aims to have a neutral point of view. It has also been suggested that medical schools allow their students to make edits by removing lower quality information in exchange for higher level information (Azzam et al., 2017).

ii. The OED will have a longer history of male terms, and a shorter history of female terms, based on the historical one-sex model which situated female anatomy in relation to the existing male terminology (Laqueur, 1990), (e.g., *female penis*, p. 64).

iii. UD will emphasis male biology over female biology because the website's audience is predominantly males aged 15 to 24 (Wortham, 2014).

These online resources offer a contemporary viewpoint of descriptions, and a historical perspective of word origins. Additionally, Wikipedia and UD can be accessed by anyone who has an internet connection, and the online OED can only be accessed with affiliation to an educational institution or by subscription. Basically, these online resources have the potential to reach wide audiences, they are continually updated, two are edited against verifiable information (Wikipedia and OED), and one (UD) offers a perspective from a certain sector of the public.

In section 2, I briefly describe each of these online resources, the type of contents they contain, and how they are edited. Then, I provide background information and findings from some previous studies on gendered language in biological descriptions in section 3. Next, in section 4, I outline my methodology for collecting data from Wikipedia, OED, and UD. In section 5, results are provided alongside discussion of each online resource individually. In section 6, I discuss the overall findings from the results, how they complement previous studies, some research suggestions for the future, and the limitations of this study. Lastly, I conclude with the notion that subjective gendered descriptions are still present, even in online resources, and that they are reinforced by cultural paradigms, in section 7. Wikipedia is not shown to be balanced and neutral. OED is shown to have an androcentric emphasis in the history of English, and UD is shown to emphasize male biology over female biology.

2 Description of Wikipedia, OED, and UD

Wikipedia is a multilingual, web-based, free-content encyclopedia that was created in 2001. It currently has 5,564,897 content articles in English (as of the latest edit to Wikipedia's *About* page on January 20, 2018). There are 1,231 administrators (for English Wikipedia) and roughly 71,000 active contributors working on articles in 299 languages. The volunteers that write and edit are mostly anonymous and are not paid; contributors can use a pseudonym or their real identity. The edited information must be within Wikipedia's policy guidelines and be verifiable against a reliable published source. Articles are called "extra-linear" because they incorporate hypertext in the form of wikilinks. This makes more in-depth information accessible on other pages.

The online OED was launched in 2000 and currently contains more than 600,000 words over a period of about a thousand years. The website claims that OED is the "accepted authority" on the English language, and people find the meaning, history, quotes, pronunciation, categories, timelines, sources, and related terms (via the historical thesaurus) of words and phrases. Quotations are selected to show how a given word (i.e., lexeme) has been used for a given time period and how it has changed. The historical thesaurus allows people to find out the historical synonyms of lexical items; in other words, words that are or were related to ones used today. There are over 70 editors and the OED database is updated online every three months. These updates can include changes to existing words and the addition of new words. The OED can be accessed by using a library membership from a university, college, school, and/or other institution, or by personal subscription to it. The OED can be used to approximately track when certain lexical items, such as *vagina* and *penis*, first appeared in print.

UD is a "crowdsourced" free online dictionary of words and phrases, which was created by Aaron Peckman in 1999. At the start of 2014, there were over seven million definitions and the audience was largely made up of males aged 15 to 24 (Wortham, 2014). The website states that "Urban Dictionary is written by you". Anyone can participate, compile, and edit as long as they have a Facebook or Gmail account. Entries are reviewed by volunteers. The definitions on the website are not necessarily objective or factual. Instead, they can be subjective, incorrect (in a prescriptive way), and the website as a whole shifts away from traditional lexicography (Smith, 2011). UD allows people to define their world, be satirical or humorous, and allows the users to be the contributors of definitions. Visitors to the website can agree or disagree with the definitions using an up or down voting system. Therefore, UD can be used as a tool to gauge which words people discuss the most based on the number of entries, and the number of likes or dislikes (the votes) a definition has received.

3 Research on Descriptions of Reproductive Biology

Gender-biased language has been found in other disciplines and sub-disciplines, such as linguistics (e.g., Macaulay & Brice, 1997; Pabst et al., 2018), social studies (e.g., Naseem, 2006), and language learning (e.g., Foroutan, 2012; Lee, 2014). In the field of biology, researchers have found gender-biased language in textbooks containing information about developmental biology (e.g., Beldecos et al., 1988; Campo-Engelstein & Johnson 2014; Lawrence & Bendixen 1992; Martin 1991; Metoyer & Rust, 2011). This current study uses methods from various studies that have investigated the language used in descriptions of reproductive biology in textbooks. Three studies are summarized in this section: Martin (1991), Lawrence and Bendixen (1992), and Metoyer and Rust (2011), with the aim of building a coherent and clear picture of how language usage in a scientific field can reflect gendered biases.

Martin (1991) qualitatively analyzed descriptions in textbooks about reproductive biology for undergraduate premedical or medical students and provided in-depth information about how new biological research did not match the old imagery being depicted. For instance, the sperm was described to "penetrate" or "burrow into" the egg (p. 489). However, the forward thrust on the sperm is weak. The motion of the tail is sideways. The egg's surface is designed to adhere to the sperm if they make contact, and the head of the sperm ends up lying flat. Therefore, the sperm would not be able to penetrate the egg mechanically. Instead, enzymes (the acrosome reaction) chemically break down the zona, which is the egg's outer layer (pp. 493-494). Additionally, research on mice and sea urchins has shown a more active role for the egg, and a less agentive role for the sperm (p. 497). The reproductive processes are similar in humans. Nevertheless, Martin still found that gender roles are prevalent in the descriptions of the egg (passive descriptions: *is transported, is swept,* or *drifts*) and the sperm (active descriptions: *penetrates, enters, burrows,* has a *strong tail*). The use of metaphors was also found in some of the textbooks, such as the egg's "vestments" and "corona" while sperm have a "mission" to "move through the female genital tract in quest of the ovum" or where the sperm are on journey and the "survivors" "assault" the egg "surrounding the prize" (p. 490). Even though Martin's analysis was qualitative, she provided essential scientific detail with new research at the time, and how reproductive descriptions were still presented with gender biases.

Lawrence and Bendixen (1992) quantitatively analyzed thirty-one anatomical textbooks, for medical students, ranging from 1890-1989. They found that female bodies are primarily presented as variations on the male body. Up until the seventeenth century, female organs were described using modified male ones. Ovaries were "female testicles", for example. Would this depiction remain similar a few hundred years later in anatomy textbooks? They had four main findings. First, chapters and sections were organized with male or human (but presented as male) first, then female (e.g., "The Perineum and Genitals" versus "Female Genital Organs"; "The Perineum" versus "The Female Perineum", p.930). Second, female terms and structures were sometimes omitted. Third, females were compared to

males and not vice versa. Finally, visual depictions always started with the male as the template: "Imagine the bulb in the male perineum is divider [sic] longitudinally so as to form the bilateral bulb of the vestibule […] as we described in the male but the bulb is not split in two halves." (p. 932). Furthermore, the amount of text provided for the male reproductive system did decrease over time, but was consistently higher than the amount provided for the female system. Thus, they concluded that male anatomy was presented as the standard or norm, and female anatomy as being marked.

Metoyer and Rust (2011) qualitatively and quantitatively analyzed the descriptions of reproduction in the contraception chapters of ten gynecology textbooks and handbooks for medical students. They examined how these textbooks described the egg, cervix, and cervical mucus; and sperm and semen. They searched the terms *egg*, *ovum*, *ova*, *oocyte*, *cervical mucus*, *cervix*, *sperm*, *spermatozoa*, *semen*, *seminal*, and *ejaculate* (verb). Updated information since Martin (1991) was also provided in regards to how the egg, as well as the cervix and cervical mucus, play an active role in fertilization. The egg can send signals to control the development of follicles around it, its shells (plasma membrane and zona pellucida) alter themselves to prevent more than one sperm in the fertilization process, and the egg rotates after sperm attachment (pp. 185-186). The cervix protects spermatozoa, with protective mucus, from cells that ingest harmful particles (called phagocytes). The cervix can also store sperm after ejaculation and gradually release them into the uterus. Furthermore, the cervix is able to select sperm with a filtering mechanism (separating abnormal and healthy sperm from each other), which was discovered by JR Beck in 1874 (p. 189). However, they found that female reproduction is still presented in a passive voice more often than male reproduction. The cervix was passive (as a location, destination, object to be felt, and a route/opening for physicians, p. 189), and the egg was also passive (e.g., *being fertilized*, *released*, p. 186), in the majority of descriptions, whereas the sperm is described as being active (*reach*, *go into*, *enter*, *are motile*, p. 186) the majority of the time. The sperm is presented as passive in the fewest contexts (*transport of*, p. 188). The mutual findings included words such as *unite*, *between*, and *meet* (p. 188). They concluded that there was still a "gendered lens" being used in the descriptions.

In sum, the main findings from the background articles consisted of four main components reflecting gender biases: (1) Passive and active voice; (2) The sequence of terms favouring males; (3) Comparisons of the female system to the male system, while providing less information; and (4) The usage of metaphors. With this in mind, my goal is to now present a new study based on three online resources to determine how reproductive systems are represented. I used these criteria for the text analysis of Wikipedia. For OED, I analyzed the attested years and related terms. For UD, I analyzed the number of entries and votes. The methods for each are described in the next section.

4 Methodology

4.1 Wikipedia

The information on Wikipedia is not laid out in a straight-forward chronological manner or contained within a single webpage because it is extra-linear. In order to cover enough information, I searched these Wikipedia pages within the categories of human reproduction: *Human Reproduction, Human Reproductive System, Female Reproductive System, Male Reproductive System, Human Fertilization, Egg Cell,* and *Sperm*. Since Wikipedia is subject to change, I copied the text, and took screenshots of the web pages on January 30, 2018.

First, I did a text analysis of phrases containing either *egg/ova/ovum/oocyte* and *sperm/spermatozoa/spermatozoon* and quantified them into three categories: passive, active, and mutual. Examples of each category are shown in Table 1. Each verb in the presence of the egg or sperm counted as a token. For instance, "… a single sperm can enter and merge with the egg, fertilizing it", was counted as two active tokens (*enter, fertilize it*) and one mutual token (*merge*) for the sperm, whereas it counted as two passive tokens and one mutual token for the egg (cf. Metoyer & Rust, 2011).

Table 1. Categories of quantification with examples

Category	Examples
Passive (anything that removes agency)	*is/are captured, released, fertilized, shed; sent, transit, carry, deliver,* and *becomes shed*
Active (anything that creates agency)	*burrow, penetrate, enter, encounter, travel, fertilizes it, pierce, reach, journey, propel, moves, produce, embed, absorb, travel, will admit, attaches,* and *traverse*
Mutual (a sense of mutual engagement or interaction)	*merge, unite, meet, join* and *fuse*

Second, I analysed the structural sequence of the information. In other words, the placement of male and female terms in phrases that contain both (cf. Campo-Engelstein & Johnson, 2014). Third, I analyzed for the direction of the comparisons. Fourth, I analysed the text for information that was not present, based on previous studies (cf. Martin, 1991; Metoyer & Rust, 2011), and the general amount of information given. Finally, I analyzed for metaphorical use. The term *cervix* was also analyzed qualitatively in the same Wikipedia pages that were mentioned above, based on the amount and type of information provided (cf. Metoyer & Rust, 2011). The results are given in Table 2 in section 5.1.

4.2 Oxford English Dictionary

The first attested date in print was provided for the following thirteen words on reproduction: *sperm, semen, testicle(s), penis, scrotum, prostate, clitoris, uterus, labia, ovary, ovum, vagina,* and *cervix*. The historical thesaurus was also used to determine the number of related terms for each of these words. This proved to be too challenging to include in the results because some related terms were used as "slang" (e.g., *childbed* for *uterus* dating back to 1863), were contemporary to the time period and are either no longer used (e.g., *pillock* for *penis* dating back to 1568), or have a different meaning (e.g., *purse* for *scrotum* dating back to c1395). The majority of the definitions for these words were strictly anatomical in regards to function and placement within the body. In order to provide succinct and relevant information for the purposes of this analysis, only definitions or quotes that compared male and female biology were illustrated. The OED uses a convention of symbols before the year of some of the definitions; the symbol 'c' means 'circa' (around), 'a' means 'ante' (before), and '?' indicates an uncertain date. The results of the word search are shown in Table 3.

4.3 Urban Dictionary

The following twelve words were looked up: *penis, testicles, scrotum, semen, sperm, prostate, vagina, clitoris, labia, uterus, ovary,* and *cervix*, on January 30, 2018. The words *ova* and *ovum* were not found, and *egg* was too general to include. I counted the number of total definitions and votes (the likes and dislikes summed together) on the first page of search results for each word. The first page of each word contained seven definitions of that word, provided by anonymous users. The main results are shown in Table 4. The top definition, which is the very first definition to appear, is subject to change, and I could not find any literature that explained why. Therefore, I included the results from the entire first page of search results in order to maintain more consistency. The entry years of the definitions range from 2003 to 2017. The definitions were analyzed for use of scientific descriptions, but there was an overall lack of consistency across the lexical items, and, thus, I have selected a few non-scientific definitions which I discuss in section 5.3.

5 Results and Discussion

5.1 Wikipedia

Quantified results of the passive, active, and mutual contexts of the sperm and the egg are shown in Table 2, along with corresponding examples that appeared in the text. The percentage and number of tokens out of the total are shown, along with examples of the voice category contexts. *Sperm* is depicted as being active the majority of the time, whereas the *egg* is shown to be passive the majority of the time. The egg is presented as active in some of the contexts, whereas this was rarely

found in previous studies on textbooks (cf. Metoyer & Rust, 2011; p.187). The number of mutual contexts for the sperm and egg are equal because they are mutually dependent on each other as the *egg* and *sperm* need to *unite, join, fuse*, and so on, together. Overall, the egg is spread out more evenly among the contexts, with passive contexts being the highest, followed by active, and mutual being the lowest. The sperm, on the other hand, is depicted as being active about five times more than in passive contexts, and more than twice in mutual contexts.

Table 2. Descriptions of Sperm and Egg in a Wikipedia text analysis

	Sperm, Spermatazoa, Spermatazoon		Egg, Ova, Ovum, Oocyte	
	Total % (n)	Examples	Total % (n)	Examples
Passive	12.2% (9)	*sent, transit, carry, deliver, release,*	46.0% (40)	*is/are captured, released, fertilized, shed; becomes implanted*
Active	60.8% (45)	*burrow, penetrate, enter, encounter, travel, fertilizes, pierce, reach, journey, propel*	31.0% (27)	*moves, produce, embed, absorb, travel, will admit, attaches, traverse*
Mutual	27.0% (20)	*merge, unite, meet, join, fuse*	23.0% (20)	*merge, unite, meet, join, fuse*
Total occurrences	n=74		n=87	

The term c*ervix* was not analyzed quantitatively because it only occurred eight times, seven of which related to dilation during birth. It was stated once that the uterus "produces vaginal uterine secretions which help the transit of sperm to the Fallopian tubes" on the *Female Reproduction System* page. Additionally, the storage and gradual release of sperm by the cervix was never mentioned. This information is on the *Cervix* page, but not on the pages I analysed.

The sequential placement of the sperm before the egg is slightly favoured at ratio of 20 occurrences to 14 occurrences, respectively. The female system is compared to the male system (4 occurrences), whereas the male system is never compared to the female system. On March 25, 2017, on the *Human Reproduction* Wikipedia page, the male system section was presented first, and on the *Human Reproductive System* page the reverse was true. As of January 30, 2018, the order on the *Human Reproductive System* page has been changed such that the male system is now placed before the female system. There are mutual phrases used, such as "The ovum **meets** with Spermatozoon", "**union** of a human egg and sperm", and "The process of fertilization involves a sperm **fusing** with an ovum".

The sperm is mentioned in passive contexts nine times, two examples are shown in (1) and (2)

(1) "… immature spermatozoon or sperm are then **sent** to the epididymis where they gain a tail and motility"

(2) "…uterine secretions which help **the transit** of the sperm…".

Four active context examples of the sperm are shown in (3) and (4). In (3), *penetrate* and *fertilizing it* count as an active context each, whereas *merge* was counted as a mutual context.

(3) "A sperm may **penetrate** and merge with the egg **fertilizing it**…"

(4) "The sperm … **travels** through the vagina and cervix …", and "…immature sperm then **travel** to the epididymis".

The egg (or female system) is presented in both passive and active phrases (40 occurrences to 27 occurrences), but more so in passive contexts. Two passive context examples are shown (5) and (6). In (5), *is released* is a passive context, whereas *it passes* is an active context.

(5) "One ovum **is released** and it passes through the fallopian tube into the uterus"

(6) "If the ovum **is fertilized** by the sperm…"

Two active examples for the egg are shown in (7) and (8).

(7) "…the ovaries which **produce** the female's ova"

(8) "There it [the ovum] **travels** toward the uterus, pushed along by movements of cilia…".

The *Egg Cell* Wikipedia page contains just over half of the word count that the *Sperm* page does, (approximately a ratio of 1100 words to 1700 words, respectively). Information on the *Sperm* page also provides a section on quality, but the same is not true for the *Egg Cell* page. The section on *Testes* on the *Male Reproductive System* page contains 372 words, and provides three links (one to development on gonads, two on ducts), whereas the section on *Ovaries* on the *Female Reproductive System* page contains 151 words and provides a link to *Ovary*. I did not find any metaphors being used to the extent that Beldecos et al. (1988), Martin (1991) or Campo-Engelstein and Johnson (2014) found. However, I did find one usage of *journey* (9) on the *Sperm* page.

(9) "…for the **journey** through the female cervix, uterus and uterine tubes"

Finally, the verb *penetrate* was found six times, as illustrated in (10).

(10) "One of the sperm encounters, **penetrates**, and fertilizes the ovum."

The data from Wikipedia does not support my first hypothesis that the language being used would be balanced and neutral. Wikipedia has a unique set up that may have lessened structural sequences and comparisons. Unlike there being chapter headings and sections in a strict chronological order, Wikipedia has access to more detailed information via links to other sub-websites (i.e., is extra-linear). This allows the user to determine the order in which they access the information. In the text analysis, there is an overall gendered effect where the sperm is presented as active and the egg is presented as passive the majority of the time. That being said, there were instances of mutual language being used, such as *fuse*, *meet*, and *join*. Furthermore, the use of *penetrate*, and active voice regarding sperm, could be lessened. Campo-Engelstein and Johnson (2014) suggest that when describing fertilization, "the egg experiences fertilization", or "undergoes fertilization", could be used instead of "the egg is fertilized" (p. 215). These suggestions still present the egg as being non-agentive experiencers undergoing the action, but may be an overall improvement.

5.2 Oxford English Dictionary

Generally, male reproductive terms came into the English language before female reproductive terms did (Laqueur, 1990). This is shown in Table 3 with the words and the earliest date found in print. The dates are in chronological order according to the male terms, with the most similar female terms lining up next to the male terms. This shows that all of the male words, with the exception of *prostate*, came into the language before all of the female ones did. It should be noted that *prostate* was a borrowing from Middle French (*prostate*, dating back to 1555) and/or Latin (*prostata*, dating back to 1625).

Table 3. First attested dates in print of male and female reproductive terms from the OED

Male Term	Year		Female Term	Year
Sperm	c1386		Ovum	1672
Semen	1398			
Testicle	c1425		Ovary	1653
Penis	1578		Clitoris	1615
Scrotum	1598		Labia	1634
Prostate	1638		Uterus	1615
			Cervix	1741
			Vagina	1682

There is an imbalance of terms; for instance, according to Wikipedia, *prostate* actually corresponds to *skene's gland* in females, and *uterus, cervix,* and *vagina* corresponds to the *prostatic urticle* in males. These organs are considered homologous, which means they share ancestry in a pair of structures or genes. That does not mean that they are necessarily analogous. After development, their functions are different. Hence, in Table 3, even though *prostate* and *uterus, cervix,* and *vagina* do not fully correspond, it is shown as such for simplification. This is the same with *ovum* across from *sperm* and *semem*: An equivalent scientific female term does not exist for *semen*, as far as I am aware (except perhaps "female ejaculation", which was not found in the OED).

My second hypothesis was supported because OED illustrates that there is a longer history of male reproductive terms. Essentially, English has an androcentric history regarding reproductive terms based on the earliest dates in print, ranging from 1386-1638, with *sperm* being the oldest word. This is not a surprising finding because English has historically been male-biased due to the usage of generic nouns (e.g., *man, mankind*) and generic *he*, which has been interpreted as "male" being the "norm", whereas the female is marked (Spender, 1985). Female terms were not found in print until at least 1615 (*clitoris* and *uterus*). Furthermore, the female terms, which range from 1615-1741, probably came into usage due to the transition from a one-sex model to a two-sex model around the eighteenth century (Laqueur, 1990). Further emphasis on the male as norm is through *ovary* originally being referred to as *testicle*, as one OED definition of *testicle* illustrates, "The ovary in females. *Obs*. [(obsolete)]", alongside a quote dated in 1560, "The right stone or testicle in a woman". This would mark it as a [female] *testicle*. Moreover, *clitoris* was defined in the OED as "a homologue of the male penis…" without the same comparison being made about the definition of *penis*. Laqueur (1990) found similar comparisons as well when the one-sex model was prevalent (e.g., the clitoris as "a female penis", p. 64).

5.3 Urban Dictionary

The twelve words (identified in section 4.3) in Table 4 were hierarchically ordered in descending order based on the total number of definitions they had. The total number of definitions for the male reproductive system is more than twice that of the female reproductive system, and the total votes for the male system is about one-third more than the female system. *Penis* and *vagina* are the top two most discussed definitions, respectively, out of the entire set. *Clitoris* is the third top most discussed definition. However, *testicles, scrotum, semen,* and *sperm* are all discussed more evenly among each other, and in higher amounts than the rest of the female reproductive system.

Table 4. The number of definitions and votes for biological terms on UD, as of January 30, 2018

Male Term	Number of definitions	Total votes		Male Term	Number of definitions	Total votes
Penis	514	160,757		Vagina	205	99,666
Testicles	40	7,211		Clitoris	65	16,929
Semen	37	15,000		Labia	17	8,281
Scrotum	36	9,653		Uterus	9	1,193
Sperm	27	13,065		Ovary	8	1,244
Prostate	7	3,677		Cervix	1	247
Total	661	209,363		Total	305	127,560

The data from UD is the most striking because it is immediately apparent that *penis* is the most discussed topic having 514 definitions, with 160,757 votes total on the first page of definitions. Both the number of definitions and votes are more than the entirety of the selected female reproductive words combined. Some definitions are misogynistic, for example, one for *penis* is "One of two things men keep after a divorce; *She got the house and the kids. I kept my penis and my soul.*". This was written in 2004, and is currently the second definition on the page.

In general, the terms for the male reproductive system are voted on most compared to ones for the female reproductive system, which supports my third hypothesis. The top definition for *vagina* has remained the same since March 25, 2017, and it is also misogynistic, referring to how a woman is used to pleasure a man, "The best friend a penis will ever have.", and was written in 2003. *Vagina* has 205 definitions, which is less than half of what *penis* has. Overall, it is difficult to get a consensus of the types of definitions and to gauge how serious or satirical they are. The seven definitions of each word, which appear on the first page search results, can vary widely amongst themselves. Definitions generally seem to range from sarcastic, satirical, intended humorous, and derogatory statements. It is of interest that users are more inclined to vote and provide definitions for anything

relating to the male reproductive system more so than compared to the female. Aaron Peckman, the creator of UD, has stated that the majority of the audience is made up of young males (Wortham, 2014), which could be the reason as to why the male reproductive system is favoured. As the provided quoted definitions and the emphasis on the male body illustrate, UD is androcentric, and often misogynistic.

6 Overall Discussion

Wikipedia is not balanced and neutral, and therefore does not support my first hypothesis. As with previous studies (cf. Martin, 1991; Lawrence & Bendixen, 1992; Metoyer & Rust, 2011), the general area that needs the most improvement is the type and amount of information provided. That being said, Wikipedia does can be overwhelming because information is broken up among multiple pages which provide a lot of detail in one area, and less in others. On the pages with general information, some more specific information should be added, such as the weak forward movement and sideways motion of sperm (never mentioned), how the cervix can be beneficial to transporting and protecting sperm, and how the egg's cortical reaction prevents it from undergoing fertilization by more than one sperm. In other words, even the general overview pages such as *Human Reproduction* should provide more descriptions that are informative and balanced. Other information needs to be added as well, such as the egg quality, which has been studied in other species (e.g., Bobe & Labbé, 2010; Hunter, 2000; Sotelo & Porter, 1959). More recently, the process of fertilization has been theorized to be selective due to the egg being an active participant (Nadeau 2017), and this information should be added as well. Regarding language choices, Wikipedia can become balanced by using more mutual language, fewer active portrayals of the sperm, fewer passive portrayals of the egg, and essentially providing more information in general about the female reproductive system as having a more active role. More research has been published about the active role of the female reproductive system in other species (cf. Dean, Nakagawa, & Pizzari, 2011; Eberhard, 2010; Orr & Zuk, 2012; Yeates et al., 2013), and should be reflected in contemporary sources such as Wikipedia, especially because these processes may have similarities within humans.

The OED shows that there is an androcentric bias in the history of the English language because male reproductive terms appear earlier in print materials, which supports my second hypothesis. Moreover, the female system is shown as being marked due to the earlier terms such as [female] *testicles*. UD seems to reflect either the amount of information provided to the public regarding the reproductive system and/or the young male dominated demographic (Wortham, 2014) because the emphasis is on the male reproductive system (i.e., androcentric). This supports my third hypothesis. UD is also, at times, misogynistic. It is challenging to assess the level of seriousness, knowledge, and satirical content that users are conveying on UD because of the lack of uniformity among the definitions. In general, Wikipedia is the least androcentric when compared to the

historical accounts of words provided by the OED, and the number of definitions and votes emphasizing males over females on UD.

This study builds upon previous studies on print material (textbooks) by utilizing a mixture of those methodologies to analyze some contemporary online resources. In comparison, Wikipedia is an improvement over the textbooks, and it has the potential to become more balanced through continual updates. The online OED provided further evidence to support Laqueur's (1990) argument of a one-sex model. Bringing in the perspective of UD brought insight into which reproductive terms people (mostly young males) are discussing the most. Collectively, these three online resources complement previous studies by illuminating more evidence about how gender biases within the field of biology have been pervasive historically, and continue to this day.

There are four suggestions for further research. First, the online spaces of social media could be explored, such as Facebook, Reddit, and Twitter, to investigate the types of conversations people are having about anatomy and the reproductive system. Second, these methods can be applied to private and public online textbooks that are used for online courses or general public education. Third, the online OED's historical thesaurus can be used to find the related terms used throughout history, and categorize these into similar groups based on type. Finally, these methods could also be applied to more specific Wikipedia pages, which this study did not analyze, such as the *Cervix* page.

Ironically, this study falls into the binary of the two-sex model because most of the information available about the reproductive system constitutes this model, and is described in terms of "male" and "female". A recent qualitative publication by MacDonald et al. (2016) challenges this rigid notion of sex and gender as transmasculine individuals are able to become pregnant, birth children, and chestfeed. This is just an example of how the boundaries of biology, and cultural notions of reproduction, are being pushed even further. Educational materials will have to be updated with these changes in human biology in order to remain current.

7 Conclusion

This paper provided an analysis of the descriptions of male and female reproductive biology in the online resources Wikipedia, the Oxford English Dictionary, and Urban Dictionary. The focus was on how the egg is passively portrayed though language, such as it being *fertilized, swept,* and *released*, and how the sperm is actively portrayed through language, such as it *penetrating, entering, burrowing,* and *travelling*. The previous research investigated how the female is marked based upon placement of the male terms before the female terms, and the omission or misrepresentation of information about the female system. All of this settles into a story about how sex is a socially constructed concept.

Wikipedia was found to not be balanced and neutral, but it does contain mutual terms (*merge, union, fuse, join, meet*), and active contexts for the egg, even though the majority are passive contexts. There are a few comparisons, and the sequence of terms is more mixed with the male reproductive system being before

the female system slightly more. Improvements to Wikipedia can be made, such as less active portrayals of the sperm, more active portrayal of the egg, more mutual portrayals of both, and more information provided for the female reproductive system. Regarding the OED, English has an androcentric history with male terms being in use longer and, in some cases, being the "norm". Lastly, UD shows that the conversation of reproductive biology is emphasized on the male, with UD being more androcentric, and, at times, misogynistic. In sum, a gender-biased cultural paradigm is reinforced because the male reproductive system has a longer history of usage, people seem to discuss it more on UD, and Wikipedia provides more information on it as opposed to the female reproductive system.

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References

Azzam, A., Bresler, D., Leon, A., Maggio, L., Whitaker, E., Heilman, J., Orlowitz, J., Swisher, V., Basberry, L., Otoide K., Trotter F., Ross W., McCue, J. D. (2017). Why medical schools should embrace Wikipedia: Final-year medical student contributions to Wikipedia articles for academic credit at one school. *Academic Medicine*, *92*(2), 194–200.

Beldecos, A., Bailey, S., Gilbert, S., Kenschaft, K. H. L., Niemcyzk, N., Rosenberg, S. S., & Wedel, A. (1988). The importance of feminist critique for contemporary cell biology. *Hypatia, 3,* 61-76.

Bem, S. L. (1993). *The Lenses of Gender: Transforming the Debate on Sexual Inequality*. New Haven: Yale University Press.

Bing, J. M., & Bergvall, V. L. (1998). The question of questions: Beyond binary thinking. In J. Coates (Ed.). *Language and Gender: A Reader* (pp. 495-510). Wiley-Blackwell.

Bobe, J., & Labbé, C. (2010). Egg and sperm quality in fish. *General and Comparative Endocrinology*, *165*(3), 535-548.

Butler, J. (1990). *Gender Trouble: Feminism and the Subversion of Identity*. New York: Routledge.

Campo-Engelstein, L., & Johnson, N. L. (2014). Revisiting "The fertilization fairytale:" An analysis of gendered language used to describe fertilization in science textbooks from middle school to medical school. *Cultural Studies of Science Education, 9*, 201-220.

Dean, R., Nakagawa, S., & Pizzari, T. (2011). The risk and intensity of sperm ejection in female birds. *The American Naturalist, 178*(3), 343-354.

Eberhard W.G. (2010) Cryptic female choice. In Breed M. D. and Moore J. (Eds.), *Encyclopedia of Animal Behavior*, (pp. 430-434). Oxford: Academic Press.

Foroutan, Y. (2012). Gender representation in school textbooks in Iran: The place of languages. *Current Sociology, 60*(6), 771-787.

Gilbert, S. F., & Fausto-Sterling, A. (2003). Educating for social responsibility: Changing the syllabus of developmental biology. *International Journal of Developmental Biology*, *47*(2-3), 237-244.

Gould, S. J. (1996). *The Mismeasure of Man*. New York: Norton & Company

Hunter, M. G. (2000). Oocyte maturation and ovum quality in pigs. *Reviews of Reproduction*, *5*(2), 122-130.

Kuhn, T. S. (1996). *The Structure of Scientific Revolutions* (3rd ed.). Chicago, IL: University of Chicago Press.

Laqueur, T. W. (1990). *Making Sex: Body and Gender from the Greeks to Freud*. Cambridge, MA: Harvard University Press.

Lawrence, S. C., & Bendixen, K. (1992). His and hers: Male and female anatomy in anatomy texts for US medical students, 1890–1989. *Social Science & Medicine*, *35*(7), 925-934.

Lee, J. F. (2014). A hidden curriculum in Japanese EFL textbooks: Gender representation. *Linguistics and Education, 27*(1), 39-53.

Macaulay, M., & Brice, C. (1997). Don't touch my projectile: Gender bias and stereotyping in syntactic examples. *Language*, *73*(4), 798-825.

MacDonald, T., Noel-Weiss, J., West, D., Walks, M., Biener, M., Kibbe, A., & Myler, E. (2016). Transmasculine individuals' experiences with lactation, chestfeeding, and gender identity: A qualitative study. *BMC Pregnancy and Childbirth*, *16*(1), 106.

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

Metoyer, A. B., & Rust, R. (2011). The egg, sperm, and beyond: gendered assumptions in gynecology textbooks. *Women's Studies*, *40*(2), 177-205.

Nadeau, J. H. (2017). Do gametes woo? Evidence for their nonrandom union at fertilization. *Genetics*, *207*(2), 369-387.

Naseem, M. A. (2006). The soldier and the seductress: A post-structuralist analysis of gendered citizenship through inclusion in and exclusion from language and social studies textbooks in Pakistan. *International Journal of Inclusive Education*, *10*(4-5), 449-467.

Orr, T. J., & Zuk, M. (2012). Sperm storage. *Current Biology, 22*(1), R8-R10.

Pabst, K., Cépeda, P., Kotek, H., Syrett, K., Donelson, K., & McCarvel, M. (2018). Gender bias in linguistics textbooks: Has anything changed since Macaulay & Brice (1997)? *Annual Meeting of the Linguistic Society of America*. Salt Lake City, UT

Smith, R. E. (2011). Urban dictionary: Youth slanguage and the redefining of definition. *English Today, 27*(4), 43-48.

Sotelo, J. R., & Porter, K. R. (1959). An electron microscope study of the rat ovum. *The Journal of Cell Biology, 5*(2), 327-342.

Spender, D. (1985). *Man Made Language*. London, UK: Routledge & Kegan Paul.

Yeates, S. E., Diamond, S. E., Einum, S., Emerson, B. C., Holt, W. V., & Gage, M. J. (2013). Cryptic choice of conspecific sperm controlled by the impact of ovarian fluid on sperm swimming behavior. *Evolution, 67*(12), 3523-3536.

Wortham, J. (2014). A lexicon of instant argot. *The New York Times*. Retrieved from https://www.nytimes.com/2014/01/04/technology/a-lexicon-of-the-internet-updated-by-its-users.html?ref=technology