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SCIENCE IN SOCIETY: A CASE STUDY OF HORMONAL CONTRACEPTION

HONORS 220B: Science in Context | Steve Harrel & David Battisti

> ***"In 1968 a popular writer ranked hormonal contraceptive's importance with the discovery of fire and the developments of tool-making, hunting, agriculture, urbanism, scientific medicine and nuclear energy. Twenty five years later the leading British weekly, the Economist, listed the pill as one of the seven wonders of the modern world," (1, Watkins).***

Introduction

Contraception (the actual devices called contraceptives), also known as birth control, is a diverse set of medical acts and measures taken for the purpose of preventing pregnancy. Hormonal Contraceptives are the most common form of contraception used today among women, and much pharmacological science has been devoted to their development and use in society. While contraception is widely used throughout the world across various cultures and regions and seen as a valid and elementary method of family planning, much controversy has surrounded its use within the context of society. Why has this scientifically developed and supported method of family planning and responsible population control been so opposed by sectors of society throughout history? Why does birth control and contraception remain such a hot topic for everyone from politicians to schools to hospitals? How has this scientific advance affected society? These are the questions I would like to tackle in this paper. I would like to develop a further understanding on how and why this scientific finding has been so disputed by the general public, and possibly shed light on why certain scientific findings and advancements are a lot more controversial in society than others.

In this paper, I will firstly outline the medical history of hormonal contraceptives specifically and summarize scientific findings through the course of their evolution. Secondly, I will outline the social context and history of contraception in order to explain the general public's reaction to contraceptives and the surrounding implications. With this established scientific and social history of contraception, I will next compare it to the scientific and social histories of the topics discussed in class, the science of climate change and the scientific theory of evolution via natural selection. Lastly, I will be able to discuss

and analyze the holistic controversy concerning contraception, which can be applied to scientific findings in general.

Part I: Scientific & Medical History of Hormonal Contraceptives

The topic of reproduction in the world of science did not emerge until after 1910 with increased attention being paid to inquiries on heredity and evolution. During this period, scientists did not frame their work by the term or notion of birth control, per say, but they began to see the significance of hormonal and other forms of advanced contraception as a scientific and medical frontier to be breached. Hormonal contraceptives today come in a variety of formulations including, “pills, injections, skin patches, subdermal implants, vaginal rings, and IUDs [Intrauterine devices]” (1186, Brunton). The most common on the market is the oral contraceptive. Oral contraceptive commonly known as The Pill emerged as a scientific and technological solution to the central issue that all contraception seeks to solve— unplanned pregnancy and family planning.

Basic Science behind Ovulation

Most contraceptives in the medical market today are known as hormone antagonists; they work in various ways to alter the natural hormonal cycle in women to disrupt ovulation and the biological possibility of conception. Naturally the woman’s menstrual cycle works through what we can consider a “symphony of hormones” (Mwendar). The hypothalamus of the brain stimulates the pituitary glands to periodically release pulses of gonadotropin-releasing hormone (GnRH). The pulses of GnRH in turn trigger a release of two hormones, luteinizing hormone (LH) and follicle stimulating hormone (FSH) from the pituitary glands. These two hormones are the main actors of the woman’s menstrual cycle and ovulation in that their presence regulates ovarian production of estrogen and progesterone. Estrogen and progesterone are the hormones that send feedback to the pituitary glands in the brain to start and

shut off ovulation.[1] With this basic understanding the biological and chemical mechanisms occurring during ovulation, we can start to understand how hormonal birth control takes an effect. Hormonal contraceptives inhibit the natural process of ovulation by pseudo increasing amounts of estrogen and progesterone in the body with synthetically made chemical structures that mimic natural estrogen and progesterone. The synthetic hormones (xenoestrogens and progestin) are able to trick the body into thinking that it has already ovulated and hence does not need to release eggs or prepare the womb for possible conception.

Scientific Development of Hormonal Contraception

The scientific development of hormonal contraception dates back to the beginning of the 20th century when scientists started playing with and influencing the levels of estrogen and progestin in rodents and rabbits. In the 1930s scientists mainly focused on the levels of estrogen, but in the 1950s, it was discovered that in fact progesterone and 19-norprogestins actually prevented ovulation in women. After clinical studies in Haiti and Puerto Rico, the FDA approved the first "Pill" in 1961, *Envoid*. The 1960s saw the first generation of hormonal oral contraceptives, which had very high levels of estrogen, ranging anywhere from "50 mg to 150 mg" (Mwendar) [Pills today carry around 20 mg of estrogen]. But such as the trial-and-error pattern of science, better hormonal oral contraceptives were soon developed. "Millions of women began using oral contraceptives, and frequent reports of untoward effects began appearing in the 1970s. The recognition that these side effects were dose-dependent and the realization that estrogens and progestins synergistically inhibited ovulation led to the reduction of doses and the development of the so-called low-dose or second-generation contraceptives" (1186, Brunton et. Al.). In the 1990s scientists were able to develop the third-generation of hormonal contraceptives (used most often today) which contain progestins with less androgenic side effects and which most significantly are

[1] Please see *Figure 1: Neuroendocrine Control of Gonadotropin Secretion in Females* for an illustration of this process

biphasic and triphasic, meaning they allot different levels of hormones throughout the weeks of a woman's menstrual cycle to most precisely protect her in her individual flow.

Throughout this scientific development, untoward effects on the woman's body have been discovered. The most common side effects noted with the use of hormonal contraceptives on the market today are relatively less adverse such as blood clots, hypertension, and swelling of the legs. Even less adverse effects of hormonal contraceptives available today include, "nausea, breast tenderness, bleeding between periods or so-called "breakthrough bleeding", mood changes, skin changes (acne- may improve or worsen, darkening of skin over cheeks- rare but may be permanent), and weight changes" (UW Medicine). Unfortunately with the earlier versions of hormonal contraceptives, more severe untoward effects were seen in the form of, "adverse cardiovascular effects, including hypertension, myocardial infarction, hemorrhagic or ischemic stroke, and venous thrombosis and embolism [blood clots]; breast, hepatocellular, and cervical cancers; and a number of endocrine and metabolic effects" (1187, Brunton).

Even though first-generation and second-generation contraceptives were significantly more harmful, cases of severe adverse side effects with third-generations of hormonal contraceptive still occur today. An example of this can be seen with the pill known as *Yaz®*. *Yaz* emerged on the markets in 2008 as primary-recommended birth control for women, especially targeting younger-aged healthy women in the teens and early twenties. The drug was marketed to females as young as 14 years old. *Yaz* along with a number of other oral contraceptives on the market contains the base active ingredient hormone of Desogestrel (a synthetic type of estrogen). In 2006, the advocacy group Public Citizens filed a petition to the FDA to ban all desogesrel-based oral contraceptives, "due to the approximately doubled risk of venous thrombosis" (1, United States). Public Citizens were not successful in their petition to ban desogestrel-based birth control, yet many individual drugs such as *Yaz* have been recalled and quietly withdrawn from the market because their untoward effects are in fact quite adverse. A pattern occurs

when further scientific research is done and certain drugs are shown to be not as optimal: drug companies quietly withdraw the drug from the market and never easily accede. It may seem ironic because, “neither the medical profession nor the pharmaceutical industry, at first, expressed interest in the scientific or commercial development of an oral contraceptive,” (7, Watkins). However, over the past hundred years and in this very day the pharmacological sector and medical industry have worked in conjunction with each other to quietly yet surely remedy for these side effects women have suffered to improve hormonal contraception.

In this case we see that while the science and medical findings on hormonal contraceptive may evolve, the science is always heavily intertwined with economic or corporate, political, and social structures and institutions within society. For change to occur the science must be approved and digested through a variety of facets within society first. With this understanding of the scientific developments and medical history of hormonal contraception we can start to look into the social context and history of contraception and the public general’s reaction to it.

Part II: Social History & Context of Contraceptives

As stated earlier, the science of contraception has been heavily interwoven with and in fact weighted down in every aspect by a particularly strong social context and history. Acts of contraception can be seen as commonplace in societies throughout history. Dating as far back as 150 years ago we see “precise terms are found relating to the wish to limit the number of children, whether by natural or artificial means” (1, Jütte). Ideas around *coitus interruptus* and sexual engagement itself purposed for birth control have always existed within society as far as written history dictates, however specific external acts purposed for limiting reproduction can be categorized as this relatively new notion of contraception. Contraception and even more recently hormonal contraception have been controversial innovations in society because they directly control and influence human sexuality. Sexuality is one of

the most taboo topics of many societies today and has far-reaching implications on social issues of morality, equality of many forms, and freedom of many forms. There are various social factors that can be seen as influential in the general public's reaction to contraception and its science. Some of these social factors were positive and reaffirming of the science such as the economic shifts in society affecting the role of family and the woman in the workplace and some of these social factors were negative and destructive towards the science such as the issue of legal regulation.

Reaffirming and Supportive Public Reactions towards Contraception

Societal context and public reaction to the science of contraception and specifically hormonal contraception has worked in ways to reaffirm its existence. Through an understanding of the socio-economic context and reaction to contraception and an understanding of the public interaction between the feminist sexual revolution and contraception, we can see how public reaction supported the scientific advancements of contraception.

The social context of contraception stems greatly from a socio-economic shift in familial quality of life and the place of women in the workforce. "Whether they worked for luxuries or out of necessity or not at all, married women in the 1950s like previous generations needed birth control both to limit their total number of children and to space the children they chose to have," (11, Watkins). Contraception and hormonal contraception in particular grew in popularity in societies around the world as general income rose with industrialization, and families started to prefer more qualitative lifestyles than quantitative in children. With higher incomes and better qualities of life, families did not have to have multiple children to ensure the survival of a few. Post WWII also saw the emergence of many women in the workforce. With women now on the same twenty-four-seven hustle and bustle of being full-time workers as men and also being the primary home caretakers, they simply did not have enough time or desire for large numbers of children. "The standard name applied to the demand for birth control was "voluntary motherhood"—incorporating a political statement about the nature of involuntary

motherhood and child-rearing in women's lives and a solution to the problems presented" (95, Gordon, Woman's Body). Voluntary Motherhood as movement allowed for contraception to gain great support among all types of women, conservative and liberal alike.

In an examination of the social history and context of contraception, the development of the female sexuality movement in society is also quite important. Feminists have often cited how the notion of modern birth control essentially rests on the acceptance of female sexuality and a woman's right to choose the purpose and expression of her sexuality. Female Sexuality as a movement was on the rise from the 1960s in the United States; this movement can be seen as a supporter of the emergence of contraception during this time. "The pill certainly ushered in a contraceptive revolution when it came onto the market in 1960, but the contraceptive revolution did not cause the sexual revolution," (2, Watkins). In this light we see that the sexual revolution and growth of feminist sexuality worked in a cyclical manner with the contraceptive revolution and its supporting science. Because a sexual revolution was in process, contraception was able to be better absorbed by greater portions of the population who believed in a woman's right to control her sexuality. Public reaction to the contraceptive movement which was tainted by the sexual revolution was reaffirming and reiterating.

In relation to the sexual agency of women however, some scholars have also noticed an ironic implication of hormonal contraception on the freedom and agency of a woman over her body within the societal context. This special issue and social debate arises in the realm of birth control with Long-Term Contraception specifically. Medical contraception such as *Nexaplanon*, an implantable hormonal device which stops the release of an egg from the ovary, and *Depo Provera*, a synthetic progestin hormone injected to prevent ovulation have been attacked by portions of the general public for their longer- and stronger-acting alterations of the female physiology. The ironic issue arises that these forms of contraception provide a "safety, reversibility, and convenience that create the possibility of long-acting

contraception yet actually significantly restrict the reproductive freedom of some women… as a tool of social policy—that is, as a means to address complex, severe, and seemingly intractable problems such as child abuse and intergenerational poverty" (*viii*, Moskowitz &Jennings). Such long-acting hormonal contraceptives have been proposed in policy forums as a solution for targeted population control. Lower-income, ex-convict, and classically marginalized populations within society such as people of color have historically been particularly targeted with this type of policy. So we see that one public reaction to developments in hormonal contraception on a more macro-policy level was to support the scientific advancements and promote them as tools for policy, yet in reality they worked as tools of oppression.

Negative & Destructive Public Reactions: Regulation, Restriction, and Morality

Though there has been a clear developing need and public reaction of acceptance of contraception in society there has also been negative public reactions of clear opposition and rejection of contraception by the general public. We see this negative public reaction in a history of certain legal regulations and restrictions and in the interplay of morality within society towards contraception.

The Comstock Act of 1873 prohibited any use of birth control or form of abortion in the United States, iterating the illegality of selling, distributing, sending via mail, or importing from abroad any "obscene, lewd, and/or lascivious" (Comstock Act) materials which could be used for "immoral purposes"(Comstock Act). This law was a response to the extreme changes the nation was undergoing as a recovering post-Civil War society, where former slaves were now de jure citizens of the country. Methods of contraception were shunned as obscene and immoral because of their novelty and representation of *change*. Post-Civil War many Americans sought to return to the antebellum, calm and traditional foundations of American. As a common theme in history, however, the illegality of birth control substances only made it more appealing to the public. People more popularly used forms of birth control such as condoms made of animal intestines and female douches of household items. The prohibition of birth control worked to enliven a black market producing false advertisement, disease,

death, and unwanted pregnancy. Even though there really was no science behind contraception in this earlier stage, public reaction to contraception in the form of this law illustrates the conflict between so-called morality within a culture and science. The human concept of morality is integral to cultural makeup and seems to have real conflict with scientific advancements which support a change or revision of those established morals and culture.

While by the 1950s, "most Americans were not troubled by the moral implications of contraception and the separation of sexual intercourse from procreation," (11, Watkins), the regulation and restriction of contraception within society still remained [and still does remain] a tacit desire of many conservative Americans. This public reaction can be understood though because of the direct implications of contraception on primary social issues like sexual activity, population size, and the role of women. Birth control not only has effects on societal development, but also paradigms of culture, religion, civil liberties such as freedom of speech and individual agency, and corporate control and economic interests in the health industry. With such influence on societal pillars, a conflictive public reaction is almost inevitable.

Through this base understanding of the far-reaching implications of contraceptive science in politics, economics, and society, we can now compare and contrast its scientific and social histories to those of climate change science and the theory of evolution via natural selection.

A Comparison to the Scientific & Social Histories of Climate Change & Evolution via Natural Selection

Comparisons to Climate Change Science

The scientific histories of hormonal contraception and climate change both acutely illustrate the trial-and-error improving processes of science as a field. In our study of climate change science and history, we learned that over the years scientists developed and tested models of climate change. In the 1960s Edward Lorenz developed more complex computer models for understanding climate change that were

seen as, “plausible models of climate change” (64, Weart). Scientific models were the best available during those specific time periods, but through their trial-and-error were further developed over the years to be more accurate and precise models and predictors of climate change.

In the scientific discoveries and evolution of hormonal contraception we see this same trial-and-error pattern. In terms of contraception during the early 20th century doctors recommended the practice of Behavioral Birth Control, which included precautions such as sexual intercourse during the time of month when a woman is not ovulating, abstinence taught in particular to soldiers abroad during World War I, and the Pulling-Out or *coitus interruptus* method of not ejaculating while still in the action sexual intercourse. While today society would even laugh at such absurd and inaccurate methods of birth control, these methods were once held as the scientifically-backed and doctor-recommended ways of contraception. This specific history of Behavioral Birth Control illustrates the recurring theme of scientific findings in the field of contraception: scientific research is used to validate a recommended form of birth control at a certain time, however the furthering nature of scientific research re-evaluates and extends a different or improved upon solution later on. While some may consider this an extreme example of medical science applying disinformation or misinformation to public society, this case illustrates the pattern of scientific trial-and-error. Women had to go through multiple trials-and-errors of large population sets over many years for physicians and society in general to be able to note adverse side effects and correct for those effects in the chemistry and administration of the medicines.

Comparisons to Theory of Evolution via Natural Selection

A significant comparison can be made between the social histories of contraception and the theory of evolution via natural selection. Parallels between the public reactions to evolution and birth control can be drawn in regards to a religious significance and contestation. In our study of evolution via natural selection this quarter we saw an undying conflict between the science and religion. Religious opposition of natural selection stems from a conflict of the theory with the Creationism theory. Evolution as a

theory has implications on believers in terms of the foundation of their faith and consequently their identity.

Towards birth control, we have seen that historically much opposition stems from religious dogma as well. In the history of religions, "Judaism only allowed for contraception in a few exceptional cases and Christianity forbade all means of contraception, Islam saw no reason to prohibit, although… The Koran leaves us in no doubt that procreation is the main goal of sexual union," (26, Jütte & Russell). With such great importance placed on the notion of sex primarily for procreation, a conflict with contraception is quite understandable. The science of contraception allows humans to break a major tenet of God's laws and intentions to multiple. In this sense, contraception definitely conflicts with religion. It seems that whenever science has contributions or discoveries on the human body, reproduction, and our existence an opposition with religious teaching and dictation, which is meant to explain those things, is inevitable.

Conclusion

The Controversy in Contraceptive Science

In conclusion we can see that certain scientific findings do prove to be more controversial in society than others. What is it that separates the science behind Contraception, Climate Change, and Evolution from the science behind mechanical engineering or cloud formation? Why does the public general react so starkly to certain types of science, yet remains complacent and indifferent towards other science? In my study and research of the social context of science I have seen a pattern of controversial sciences being those which imply direct action or regulation of humans in regards to our agency, cultural traditions and beliefs, and our embedded behavior.

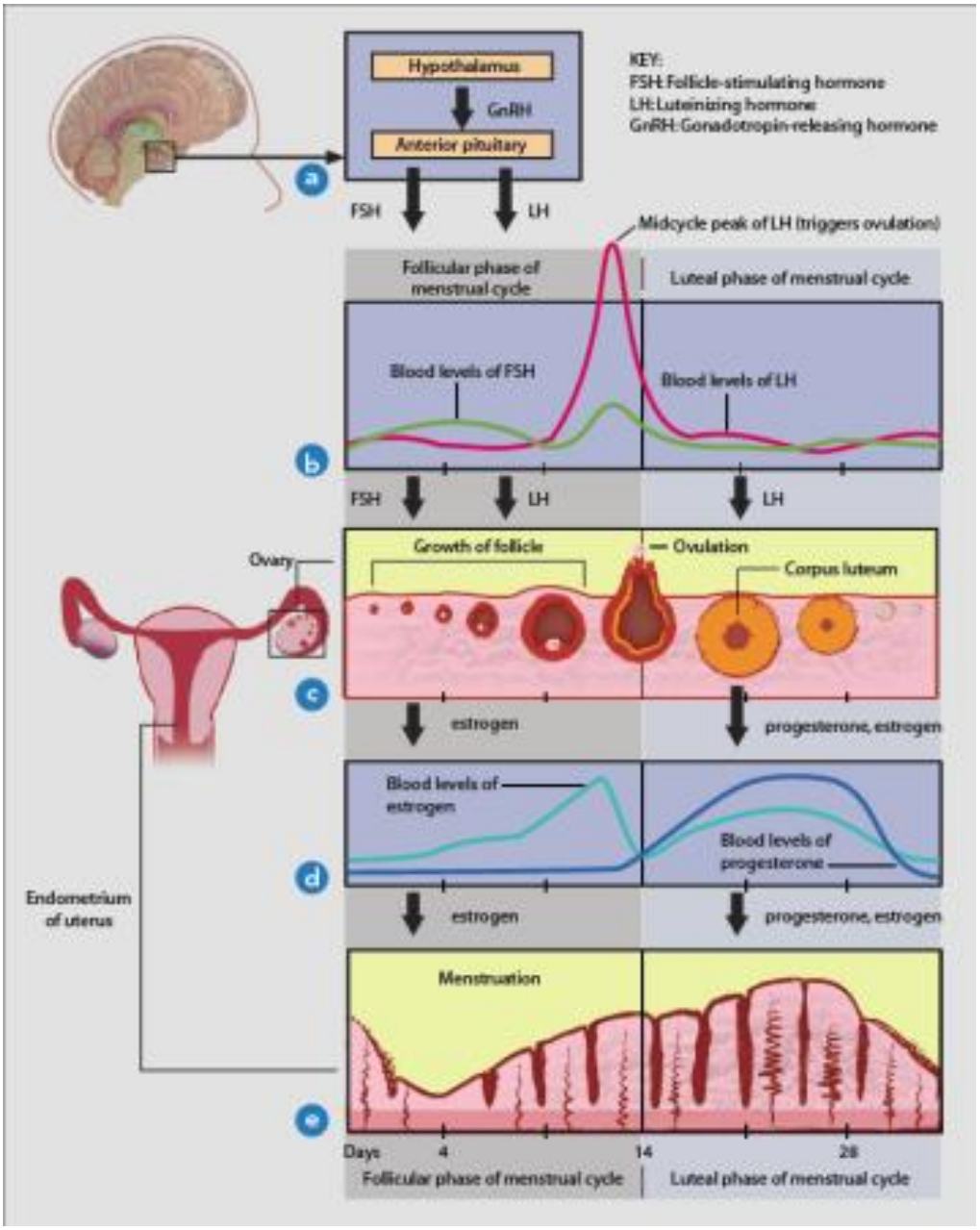
The science of Climate Change calls humans to act now, take responsibility of our environment and retrain our behavior to be less anthropocentric and more considerate of our entire ecosystem. The Theory of Evolution via natural selection directly destructs the human instinctual and foundational

notion of religion and God. While a theory of evolution offers a scientific understanding of the origins of our universe and ecosystems, it is often used and portrayed as a challenger of religious creationist theories and understandings of the origins of our universe. Evolution in a way calls humans to abandon their belief. Lastly, contraception interferes with our innate and survivalist human cycle of reproduction. The science of contraception gives individual people control over the regeneration of the entire human race. Aside from this contraception speaks very loudly to how we view the ever-taboo topic of sexuality. "The eventual widespread acceptance of birth control required a major reorientation of sexual values," (*xi*, Gordon, Moral Property). This means contraception pushes us to our cultural boundaries.

Because these sciences speak directly to the historical past of our existence, the current state of our culture, and the future direction of our individual and group decisions, they will necessarily come under much fire and scrutiny within society before being accepted as public consensus. Politics, religion, corporate influence, health industry interests, public advocacy, culture and gender paradigms are simply all expressions of the anthropocentrism intrinsic within humanity. These are all social structures or institutions which advocate for humanity and our place on this earth; anything, any science or movement which threatens these established institutions will come against opposition. Public consensus concerning science seems much easier to derive with scientific findings that cannot directly dictate human agency. In general however, of findings with implications on human agency and identity we can see that any public consensus is a hard notion to come by—consensus almost always takes time, a shared struggle, and a shared necessity. In terms of future scientific findings, I would conclude that we will see societal opposition or controversy any time the agency or identity of humanity is to be threatened.

Appendix

Figure 1: Neuroendocrine Control of Gonadotropin Secretion in Females



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