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~ Special Report ~

Sexuality and Gender

Findings from the Biological, Psychological, and Social Sciences

Lawrence S. Mayer, M.B., M.S., Ph.D.
Paul R. McHugh, M.D.

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Editor's Note: Questions related to sexuality and gender bear on some of the most intimate and personal aspects of human life. In recent years they have also vexed American politics. We offer this report—written by Dr. Lawrence S. Mayer, an epidemiologist trained in psychiatry, and Dr. Paul R. McHugh, arguably the most important American psychiatrist of the last half-century—in the hope of improving public understanding of these questions. Examining research from the biological, psychological, and social sciences, this report shows that some of the most frequently heard claims about sexuality and gender are not supported by scientific evidence. The report has a special focus on the higher rates of mental health problems among LGBT populations, and it questions the scientific basis of trends in the treatment of children who do not identify with their biological sex. More effort is called for to provide these people with the understanding, care, and support they need to lead healthy, flourishing lives.

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The New Atlantis

A Journal of Technology & Society

The New Atlantis *(1627) was the title Francis Bacon selected for his fable of a society living with the benefits and challenges of advanced science and technology. Bacon, a founder and champion of modern science, sought not only to highlight the potential of technology to improve human life, but also to foresee some of the social, moral, and political difficulties that confront a society shaped by the great scientific enterprise. His book offers no obvious answers; perhaps it seduces more than it warns. But the tale also hints at some of the dilemmas that arise with the ability to remake and reconfigure the natural world: governing science, so that it might flourish freely without destroying or dehumanizing us, and understanding the effect of technology on human life, human aspiration, and the human good. To a great extent, we live in the world Bacon imagined, and now we must find a way to live well with both its burdens and its blessings. This very challenge, which now confronts our own society most forcefully, is the focus of this journal.*

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Preface

This report was written for the general public and for mental health professionals in order to draw attention to—and offer some scientific insight about—the mental health issues faced by LGBT populations.

It arose from a request from Paul R. McHugh, M.D., the former chief of psychiatry at Johns Hopkins Hospital and one of the leading psychiatrists in the world. Dr. McHugh requested that I review a monograph he and colleagues had drafted on subjects related to sexual orientation and identity; my original assignment was to guarantee the accuracy of statistical inferences and to review additional sources. In the months that followed, I closely read over five hundred scientific articles on these topics and perused hundreds more. I was alarmed to learn that the LGBT community bears a disproportionate rate of mental health problems compared to the population as a whole.

As my interest grew, I explored research across a variety of scientific fields, including epidemiology, genetics, endocrinology, psychiatry, neuroscience, embryology, and pediatrics. I also reviewed many of the academic empirical studies done in the social sciences including psychology, sociology, political science, economics, and gender studies.

I agreed to take over as lead author, rewriting, reorganizing, and expanding the text. I support every sentence in this report, without reservation and without prejudice regarding any political or philosophical debates. This report is about science and medicine, nothing more and nothing less.

Readers wondering about this report's synthesis of research from so many different fields may wish to know a little about its lead author. I am a full-time academic involved in all aspects of teaching, research, and professional service. I am a biostatistician and epidemiologist who focuses on the design, analysis, and interpretation of experimental and observational data in public health and medicine, particularly when the data are complex in terms of underlying scientific issues. I am a research physician, having trained in medicine and psychiatry in the U.K. and received the British equivalent (M.B.) to the American M.D. I have never practiced medicine (including psychiatry) in the United States or abroad. I have testified in dozens of federal and state legal proceedings and regulatory hearings, in

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most cases reviewing scientific literature to clarify the issues under examination. I strongly support equality and oppose discrimination for the LGBT community, and I have testified on their behalf as a statistical expert.

I have been a full-time tenured professor for over four decades. I have held professorial appointments at eight universities, including Princeton, the University of Pennsylvania, Stanford, Arizona State University, Johns Hopkins University Bloomberg School of Public Health and School of Medicine, Ohio State, Virginia Tech, and the University of Michigan. I have also held research faculty appointments at several other institutions, including the Mayo Clinic.

My full-time and part-time appointments have been in twenty-three disciplines, including statistics, biostatistics, epidemiology, public health, social methodology, psychiatry, mathematics, sociology, political science, economics, and biomedical informatics. But my research interests have varied far less than my academic appointments: the focus of my career has been to learn how statistics and models are employed across disciplines, with the goal of improving the use of models and data analytics in assessing issues of interest in the policy, regulatory, or legal realms.

I have been published in many top-tier peer-reviewed journals (including *The Annals of Statistics*, *Biometrics*, and *American Journal of Political Science*) and have reviewed hundreds of manuscripts submitted for publication to many of the major medical, statistical, and epidemiological journals (including *The New England Journal of Medicine*, *Journal of the American Statistical Association*, and *American Journal of Public Health*).

I am currently a scholar in residence in the Department of Psychiatry at Johns Hopkins School of Medicine and a professor of statistics and biostatistics at Arizona State University. Up until July 1, 2016, I also held part-time faculty appointments at the Johns Hopkins Bloomberg School of Public Health and School of Medicine, and at the Mayo Clinic.

An undertaking as ambitious as this report would not be possible without the counsel and advice of many gifted scholars and editors. I am grateful for the generous help of Laura E. Harrington, M.D., M.S., a psychiatrist with extensive training in internal medicine and neuroimmunology, whose clinical practice focuses on women in life transition, including affirmative treatment and therapy for the LGBT community. She contributed to the entire report, particularly lending her expertise to the sections on endocrinology and brain research. I am indebted also to Bentley J. Hanish, B.S., a young geneticist who expects to graduate medical school in 2021 with an M.D./Ph.D. in psychiatric epidemiology.

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He contributed to the entire report, particularly to those sections that concern genetics.

I gratefully acknowledge the support of Johns Hopkins University Bloomberg School of Public Health and School of Medicine, Arizona State University, and the Mayo Clinic.

In the course of writing this report, I consulted a number of individuals who asked that I not thank them by name. Some feared an angry response from the more militant elements of the LGBT community; others feared an angry response from the more strident elements of religiously conservative communities. Most bothersome, however, is that some feared reprisals from their own universities for engaging such controversial topics, regardless of the report's content—a sad statement about academic freedom.

I dedicate my work on this report, first, to the LGBT community, which bears a disproportionate rate of mental health problems compared to the population as a whole. We must find ways to relieve their suffering.

I dedicate it also to scholars doing impartial research on topics of public controversy. May they never lose their way in political hurricanes.

And above all, I dedicate it to children struggling with their sexuality and gender. Children are a special case when addressing gender issues. In the course of their development, many children explore the idea of being of the opposite sex. Some children may have improved psychological well-being if they are encouraged and supported in their cross-gender identification, particularly if the identification is strong and persistent over time. But nearly all children ultimately identify with their biological sex. The notion that a two-year-old, having expressed thoughts or behaviors identified with the opposite sex, can be labeled for life as transgender has absolutely no support in science. Indeed, it is iniquitous to believe that all children who have gender-atypical thoughts or behavior at some point in their development, particularly before puberty, should be encouraged to become transgender.

As citizens, scholars, and clinicians concerned with the problems facing LGBT people, we should not be dogmatically committed to any particular views about the nature of sexuality or gender identity; rather, we should be guided first and foremost by the needs of struggling patients, and we should seek with open minds for ways to help them lead meaningful, dignified lives.

Lawrence S. Mayer, M.B., M.S., Ph.D.

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Executive Summary

This report presents a careful summary and an up-to-date explanation of research—from the biological, psychological, and social sciences—related to sexual orientation and gender identity. It is offered in the hope that such an exposition can contribute to our capacity as physicians, scientists, and citizens to address health issues faced by LGBT populations within our society.

Some key findings:

Part One: Sexual Orientation

- The understanding of sexual orientation as an innate, biologically fixed property of human beings—the idea that people are "born that way"—is not supported by scientific evidence.

- While there is evidence that biological factors such as genes and hormones are associated with sexual behaviors and attractions, there are no compelling causal biological explanations for human sexual orientation. While minor differences in the brain structures and brain activity between homosexual and heterosexual individuals have been identified by researchers, such neurobiological findings do not demonstrate whether these differences are innate or are the result of environmental and psychological factors.

- Longitudinal studies of adolescents suggest that sexual orientation may be quite fluid over the life course for some people, with one study estimating that as many as 80% of male adolescents who report same-sex attractions no longer do so as adults (although the extent to which this figure reflects actual changes in same-sex attractions and not just artifacts of the survey process has been contested by some researchers).

- Compared to heterosexuals, non-heterosexuals are about two to three times as likely to have experienced childhood sexual abuse.

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Part Two: Sexuality, Mental Health Outcomes, and Social Stress

- Compared to the general population, non-heterosexual subpopulations are at an elevated risk for a variety of adverse health and mental health outcomes.

- Members of the non-heterosexual population are estimated to have about 1.5 times higher risk of experiencing anxiety disorders than members of the heterosexual population, as well as roughly double the risk of depression, 1.5 times the risk of substance abuse, and nearly 2.5 times the risk of suicide.

- Members of the transgender population are also at higher risk of a variety of mental health problems compared to members of the non-transgender population. Especially alarmingly, the rate of lifetime suicide attempts across all ages of transgender individuals is estimated at 41%, compared to under 5% in the overall U.S. population.

- There is evidence, albeit limited, that social stressors such as discrimination and stigma contribute to the elevated risk of poor mental health outcomes for non-heterosexual and transgender populations. More high-quality longitudinal studies are necessary for the "social stress model" to be a useful tool for understanding public health concerns.

Part Three: Gender Identity

- The hypothesis that gender identity is an innate, fixed property of human beings that is independent of biological sex—that a person might be "a man trapped in a woman's body" or "a woman trapped in a man's body"—is not supported by scientific evidence.

- According to a recent estimate, about 0.6% of U.S. adults identify as a gender that does not correspond to their biological sex.

- Studies comparing the brain structures of transgender and non-transgender individuals have demonstrated weak correlations between brain structure and cross-gender identification. These correlations do not provide any evidence for a neurobiological basis for cross-gender identification.

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- Compared to the general population, adults who have undergone sex-reassignment surgery continue to have a higher risk of experiencing poor mental health outcomes. One study found that, compared to controls, sex-reassigned individuals were about 5 times more likely to attempt suicide and about 19 times more likely to die by suicide.

- Children are a special case when addressing transgender issues. Only a minority of children who experience cross-gender identification will continue to do so into adolescence or adulthood.

- There is little scientific evidence for the therapeutic value of interventions that delay puberty or modify the secondary sex characteristics of adolescents, although some children may have improved psychological well-being if they are encouraged and supported in their cross-gender identification. There is no evidence that all children who express gender-atypical thoughts or behavior should be encouraged to become transgender.

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Sexuality and Gender

Findings from the Biological, Psychological, and Social Sciences

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Introduction

Few topics are as complex and controversial as human sexual orientation and gender identity. These matters touch upon our most intimate thoughts and feelings, and help to define us as both individuals and social beings. Discussions of the ethical questions raised by sexual orientation and gender identity can become heated and personal, and the associated policy issues sometimes provoke intense controversies. The disputants, journalists, and lawmakers in these debates often invoke the authority of science, and in our news and social media and our broader popular culture we hear claims about what "science says" on these matters.

This report offers a careful summary and an up-to-date explanation of many of the most rigorous findings produced by the biological, psychological, and social sciences related to sexual orientation and gender identity. We examine a vast body of scientific literature from several disciplines. We try to acknowledge the limitations of the research and to avoid premature conclusions that would result in over-interpretation of scientific findings. Since the relevant literature is rife with inconsistent and ambiguous definitions, we not only examine the empirical evidence but also delve into underlying conceptual problems. This report does not, however, discuss matters of morality or policy; our focus is on the scientific evidence—what it shows and what it does not show.

We begin in Part One by critically examining whether concepts such as heterosexuality, homosexuality, and bisexuality represent distinct, fixed, and biologically determined properties of human beings. As part of this discussion, we look at the popular "born that way" hypothesis, which

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posits that human sexual orientation is biologically innate; we examine the evidence for this claim across several subspecialties of the biological sciences. We explore the developmental origins of sexual attractions, the degree to which such attractions may change over time, and the complexities inherent in the incorporation of these attractions into one's sexual identity. Drawing on evidence from twin studies and other types of research, we explore genetic, environmental, and hormonal factors. We also explore some of the scientific evidence relating brain science to sexual orientation.

In Part Two we examine research on health outcomes as they relate to sexual orientation and gender identity. There is a consistently observed higher risk of poor physical and mental health outcomes for lesbian, gay, bisexual, and transgender subpopulations compared to the general population. These outcomes include depression, anxiety, substance abuse, and most alarmingly, suicide. For example, among the transgender subpopulation in the United States, the rate of attempted suicide is estimated to be as high as 41%, ten times higher than in the general population. As physicians, academics, and scientists, we believe all of the subsequent discussions in this report must be cast in the light of this public health issue.

We also examine some ideas proposed to explain these differential health outcomes, including the "social stress model." This hypothesis—which holds that stressors like stigma and prejudice account for much of the additional suffering observed in these subpopulations—does not seem to offer a complete explanation for the disparities in the outcomes.

Much as Part One investigates the conjecture that sexual orientation is fixed with a causal biological basis, a portion of Part Three examines similar issues with respect to gender identity. Biological sex (the binary categories of male and female) is a fixed aspect of human nature, even though some individuals affected by disorders of sex development may exhibit ambiguous sex characteristics. By contrast, gender identity is a social and psychological concept that is not well defined, and there is little scientific evidence that it is an innate, fixed biological property.

Part Three also examines sex-reassignment procedures and the evidence for their effectiveness at alleviating the poor mental health outcomes experienced by many people who identify as transgender. Compared to the general population, postoperative transgender individuals continue to be at high risk of poor mental health outcomes.

An area of particular concern involves medical interventions for gender-nonconforming youth. They are increasingly receiving therapies that affirm their felt genders, and even hormone treatments or surgical

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modifications at young ages. But the majority of children who identify as a gender that does not conform to their biological sex will no longer do so by the time they reach adulthood. We are disturbed and alarmed by the severity and irreversibility of some interventions being publicly discussed and employed for children.

Sexual orientation and gender identity resist explanation by simple theories. There is a large gap between the certainty with which beliefs are held about these matters and what a sober assessment of the science reveals. In the face of this complexity and uncertainty, we need to be humble about what we know and do not know. We readily acknowledge that this report is neither an exhaustive analysis of the subjects it addresses nor the last word on them. Science is by no means the only avenue for understanding these astoundingly complex, multifaceted topics; there are other sources of wisdom and knowledge—including art, religion, philosophy, and lived human experience. And much of our scientific knowledge in this area remains unsettled. However, we offer this overview of the scientific literature in the hope that it can provide a shared framework for intelligent, enlightened discourse in political, professional, and scientific exchanges—and may add to our capacity as concerned citizens to alleviate suffering and promote human health and flourishing.

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Part One

Sexual Orientation

While some people are under the impression that sexual orientation is an innate, fixed, and biological trait of human beings—that, whether heterosexual, homosexual, or bisexual, we are "born that way"—there is insufficient scientific evidence to support that claim. In fact, the concept of sexual orientation itself is highly ambiguous; it can refer to a set of behaviors, to feelings of attraction, or to a sense of identity. Epidemiological studies show a rather modest association between genetic factors and sexual attractions or behaviors, but do not provide significant evidence pointing to particular genes. There is also evidence for other hypothesized biological causes of homosexual behaviors, attractions, or identity—such as the influence of hormones on prenatal development—but that evidence, too, is limited. Studies of the brains of homosexuals and heterosexuals have found some differences, but have not demonstrated that these differences are inborn rather than the result of environmental factors that influenced both psychological and neurobiological traits. One environmental factor that appears to be correlated with non-heterosexuality is childhood sexual abuse victimization, which may also contribute to the higher rates of poor mental health outcomes among non-heterosexual subpopulations, compared to the general population. Overall, the evidence suggests some measure of fluidity in patterns of sexual attraction and behavior—contrary to the "born that way" notion that oversimplifies the vast complexity of human sexuality.

The popular discussion of sexual orientation is characterized by two conflicting ideas about why some individuals are lesbian, gay, or bisexual. While some claim that sexual orientation is a choice, others say that sexual orientation is a fixed feature of one's nature, that one is "born that way." We hope to show here that, though sexual orientation is not a choice, neither is there scientific evidence for the view that sexual orientation is a fixed and innate biological property.

A prominent recent example of a person describing sexual orientation as a choice is Cynthia Nixon, a star of the popular television series *Sex and the City*, who in a January 2012 *New York Times* interview explained, "For me it's a choice, and you don't get to define my gayness for me," and commented that she was "very annoyed" about the issue of whether or not gay people are born that way. "Why can't it be a choice? Why is that any less legitimate?"[1] Similarly, Brandon Ambrosino wrote in *The New Republic* in

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2014 that "It's time for the LGBT community to stop fearing the word 'choice,' and to reclaim the dignity of sexual autonomy."[2]

By contrast, proponents of the "born that way" hypothesis—expressed for instance in Lady Gaga's 2011 song "Born This Way"—posit that there is a causal biological basis for sexual orientation and often try to bolster their claims with scientific findings. Citing three scientific studies[3] and an article from *Science* magazine,[4] Mark Joseph Stern, writing for *Slate* in 2014, claims that "homosexuality, at least in men, is clearly, undoubtedly, inarguably an inborn trait."[5] However, as neuroscientist Simon LeVay, whose work in 1991 showed brain differences in homosexual men compared to heterosexual men, explained some years after his study, "It's important to stress what I didn't find. I did not prove that homosexuality is genetic, or find a genetic cause for being gay. I didn't show that gay men are 'born that way,' the most common mistake people make in interpreting my work. Nor did I locate a gay center in the brain."[6]

Many recent books contain popular treatments of science that make claims about the innateness of sexual orientation. These books often exaggerate—or at least oversimplify—complex scientific findings. For example, in a 2005 book, psychologist and science writer Leonard Sax responds to a worried mother's question as to whether her teenage son will outgrow his homosexual attractions: "Biologically, the difference between a gay man and a straight man is something like the difference between a left-handed person and a right-handed person. Being left-handed isn't just a phase. A left-handed person won't someday magically turn into a right-handed person.... Some children are destined at birth to be left-handed, and some boys are destined at birth to grow up to be gay."[7]

As we argue in this part of the report, however, there is little scientific evidence to support the claim that sexual attraction is simply fixed by innate and deterministic factors such as genes. Popular understandings of scientific findings often presume deterministic causality when the findings do not warrant that presumption.

Another important limitation for research and for interpretation of scientific studies on this topic is that some central concepts—including "sexual orientation" itself—are often ambiguous, making reliable measurements difficult both within individual studies and when comparing results across studies. So before turning to the scientific evidence concerning the development of sexual orientation and sexual desire, we will examine at some length several of the most troublesome conceptual ambiguities in the study of human sexuality in order to arrive at a fuller picture of the relevant concepts.

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Problems with Defining Key Concepts

A 2014 *New York Times Magazine* piece titled "The Scientific Quest to Prove Bisexuality Exists"[8] provides an illustration of the themes explored in this Part—sexual desire, attraction, orientation, and identity—and of the difficulties with defining and studying these concepts. Specifically, the article shows how a scientific approach to studying human sexuality can conflict with culturally prevalent views of sexual orientation, or with the self-understanding that many people have of their own sexual desires and identities. Such conflicts raise important questions about whether sexual orientation and related concepts are as coherent and well-defined as is often assumed by researchers and the public alike.

The author of the article, Benoit Denizet-Lewis, an openly gay man, describes the work of scientists and others trying to demonstrate the existence of a stable bisexual orientation. He visited researchers at Cornell University and participated in tests used to measure sexual arousal, tests that include observing the way pupils dilate in response to sexually explicit imagery. To his surprise, he found that, according to this scientific measure, he was aroused when watching pornographic films of women masturbating:

> Might I actually be bisexual? Have I been so wedded to my gay identity—one I adopted in college and announced with great fanfare to family and friends—that I haven't allowed myself to experience another part of myself? In some ways, even asking those questions is anathema to many gays and lesbians. That kind of publicly shared uncertainty is catnip to the Christian Right and to the scientifically dubious, psychologically damaging ex-gay movement it helped spawn. As out gay men and lesbians, after all, we're supposed to be sure—we're supposed to be "born this way."[9]

Despite the apparently scientific (though admittedly limited) evidence of his bisexual-typical patterns of arousal, Denizet-Lewis rejected the idea that he was actually bisexual, because "It doesn't feel true as a sexual orientation, nor does it feel right as my identity."[10]

Denizet-Lewis's concerns here illustrate a number of the quandaries raised by the scientific study of human sexuality. The objective measures the researchers used seemed to be at odds with the more intuitive, subjective understanding of what it is to be sexually aroused; our own understanding of what we are sexually aroused by is tied up with the entirety of our lived experience of sexuality. Furthermore, Denizet-Lewis's insistence

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that he is gay, not bisexual, and his concern that uncertainty about his identity could have social and political implications, points to the fact that sexual orientation and identity are understood not only in scientific and personal terms, but in social, moral, and political terms as well.

But how do categories of sexual orientation—with labels such as "bisexual" or "gay" or "straight"—help scientists study the complex phenomenon of human sexuality? When we examine the concept of sexual orientation, it becomes apparent, as this part will show, that it is too vague and poorly defined to be very useful in science, and that in its place we need more clearly defined concepts. We strive in this report to use clear terms; when discussing scientific studies that rely on the concept of "sexual orientation," we try as much as possible to specify how the scientists defined the term, or related terms.

One of the central difficulties in examining and researching sexual orientation is that the underlying concepts of "sexual desire," "sexual attraction," and "sexual arousal" can be ambiguous, and it is even less clear what it means that a person identifies as having a sexual orientation grounded in some pattern of desires, attractions, or states of arousal.

The word "desire" all by itself might be used to cover an aspect of volition more naturally expressed by "want": I want to go out for dinner, or to take a road trip with my friends next summer, or to finish this project. When "desire" is used in this sense, the objects of desire are fairly determinate *goals*—some may be perfectly achievable, such as moving to a new city or finding a new job; others may be more ambitious and out of reach, like the dream of becoming a world-famous movie star. Often, however, the language of desire is meant to include things that are less clear: indefinite *longings* for a life that is, in some unspecified sense, different or better; an inchoate sense of something being missing or lacking in oneself or one's world; or, in psychoanalytic literature, unconscious dynamic forces that shape one's cognitive, emotional, and social behaviors, but that are separate from one's ordinary, conscious sense of self.

This more full-blooded notion of desire is, itself, ambiguous. It might refer to a hoped-for state of affairs like finding a sense of meaning, fulfillment, and satisfaction with one's life, a desire that, while not completely clear in its implications, is presumably not entirely out of reach, although such longings may also be forms of fantasizing about a radically altered or perhaps even unattainable state of affairs. If I want to take a road trip with my friends, the steps are clear: call up my friends, pick a date, map out a route, and so on. However, if I have an inchoate longing for change, a hope for sustainable intimacy, love, and belonging, or an unconscious conflict

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that is disrupting my ability to move forward in the life I have tried to build for myself, I face a different sort of challenge. There is not necessarily a set of well-defined or conscious goals, much less established ways of achieving them. This is not to say that the satisfaction of these longings is impossible, but doing so often involves not only choosing concrete actions to achieve particular goals but the more complex shaping of one's own life through acting in and making sense of the world and one's place in it.

So the first thing to note when considering both popular discussions and scientific studies of sexuality is that the use of the term "desire" could refer to distinct aspects of human life and experience.

Just as the meanings that might be intended by the term "desire" are many, so also is each of these meanings varied, making clear delineations a challenge. For example, a commonsense understanding might suggest that the term "sexual desire" means wanting to engage in specific sexual acts with particular individuals (or categories of individuals). Psychiatrist Steven Levine articulated this common view in his definition of sexual desire as "the sum of the forces that incline us toward and away from sexual behavior."[11] But it is not obvious how one might study this "sum" in a rigorous way. Nor is it obvious why all the diverse factors that can potentially influence sexual behavior, such as material poverty—in the case of prostitution, for instance—alcohol consumption, and intimate affection, should all be grouped together as aspects of sexual desire. As Levine himself points out, "In anyone's hands, sexual desire can be a slippery concept."[12]

Consider a few of the ways that the term "sexual desire" has been employed in scientific contexts—designating one or more of the following distinct phenomena:

1. States of physical arousal that may or may not be linked to a specific physical activity and may or may not be objects of conscious awareness.

2. Conscious erotic interest in response to finding others attractive (in perception, memory, or fantasy), which may or may not involve any of the bodily processes associated with measurable states of physical arousal.

3. Strong interest in finding a companion or establishing a durable relationship.

4. The romantic aspirations and feelings associated with infatuation or falling in love with a specific individual.

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5. Inclination towards attachment to specific individuals.

6. The general motivation to seek intimacy with a member of some specific group.

7. An aesthetic measure that latches onto perceived beauty in others.[13]

In a given social science study, the concepts mentioned above will often each have its own particular operational definition for the purposes of research. But they cannot all mean the *same* thing. Strong interest in finding a companion, for example, is clearly distinguishable from physical arousal. Looking at this list of experiential and psychological phenomena, one can easily envision what confusions might arise from using the term "sexual desire" without sufficient care.

The philosopher Alexander Pruss provides a helpful summary of some of the difficulties involved in characterizing the related concept of sexual attraction:

> What does it mean to be "sexually attracted" to someone? Does it mean to have a tendency to be aroused in their presence? But surely it is possible to find someone sexually attractive without being aroused. Does it mean to form the belief that someone is sexually attractive to one? Surely not, since a belief about who is sexually attractive to one might be wrong—for instance, one might confuse admiration of form with sexual attraction. Does it mean to have a noninstrumental desire for a sexual or romantic relationship with the person? Probably not: we can imagine a person who has no sexual attraction to anybody, but who has a noninstrumental desire for a romantic relationship because of a belief, based on the testimony of others, that romantic relationships have noninstrumental value. These and similar questions suggest that there is a cluster of related concepts under the head of "sexual attraction," and any precise definition is likely to be an undesirable shoehorning. But if the concept of sexual attraction is a cluster of concepts, neither are there simply univocal concepts of heterosexuality, homosexuality, and bisexuality.[14]

The ambiguity of the term "sexual desire" (and similar terms) should give us pause to consider the diverse aspects of human experience that are often associated with it. The problem is neither irresolvable nor unique to this subject matter. Other social science concepts—aggression and addiction, for example—may likewise be difficult to define and to

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operationalize and for this reason admit of various usages.* Nevertheless, the ambiguity presents a significant challenge for both research design and interpretation, requiring that we take care in attending to the meanings, contexts, and findings specific to each study. It is also important to bracket any subjective associations with or uses of these terms that do not conform to well-defined scientific classifications and techniques.

It would be a mistake, at any rate, to ignore the varied uses of this and related terms or to try to reduce the many and distinct experiences to which they might refer to a single concept or experience. As we shall see, doing so could in some cases adversely affect the evaluation and treatment of patients.

The Context of Sexual Desire

We can further clarify the complex phenomenon of sexual desire if we examine what relationship it has to other aspects of our lives. To do so, we borrow some conceptual tools from a philosophical tradition known as phenomenology, which conceives of human experience as deriving its meaning from the whole context in which it appears.

The testimony of experience suggests that one's experience of sexual desire and sexual attraction is not voluntary, at least not in any immediate way. The whole set of inclinations that we generally associate with the experience of sexual desire—whether the impulse to engage in particular acts or to enjoy certain relationships—does not appear to be the sole product of any deliberate choice. Our sexual appetites (like other natural appetites) are experienced as given, even if their expression is shaped in subtle ways by many factors, which might very well include volition. Indeed, far from appearing as a product of our will, sexual desire—however we define it—is often experienced as a powerful force, akin to hunger, that many struggle (especially in adolescence) to bring under direction and control. Furthermore, sexual desire can impact one's attention involuntarily or color one's day-to-day perceptions, experiences, and encounters. What seems to be to some extent in our control is how we choose to live with this appetite, how we integrate it into the rest of our lives.

But the question remains: What *is* sexual desire? What is this part of our lives that we consider to be given, prior even to our capacity to

* "Operationalizing" refers to the way social scientists make a variable measurable. Homosexuality may be operationalized as the answers that survey respondents give to questions about their sexual orientation. Or it could be operationalized as answers to questions about their desires, attractions, and behavior. Operationalizing variables in ways that will reliably measure the trait or behavior being studied is a difficult but important part of any social science research.

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deliberate and make rational choices about it? We know that some sort of sexual appetite is present in non-human animals, as is evident in the mammalian estrous cycle; in most mammalian species sexual arousal and receptivity are linked to the phase of the ovulation cycle during which the female is reproductively receptive.[15] One of the relatively unique features of *Homo sapiens*, shared with only a few other primates, is that sexual desire is not exclusively linked to the woman's ovulatory cycle.[16] Some biologists have argued that this means that sexual desire in humans has evolved to facilitate the formation of sustaining relationships between parents, in addition to the more basic biological purpose of reproduction. Whatever the explanation for the origins and biological functions of human sexuality, the lived experience of sexual desires is laden with significance that goes beyond the biological purposes that sexual desires and behaviors serve. This significance is not just a subjective add-on to the more basic physiological and functional realities, but something that pervades our lived experience of sexuality.

As philosophers who study the structure of conscious experience have observed, our way of experiencing the world is shaped by our "embodiment, bodily skills, cultural context, language and other social practices."[17] Long before most of us experience anything like what we typically associate with sexual desire, we are already enmeshed in a cultural and social context involving other persons, feelings, emotions, opportunities, deprivations, and so on. Perhaps sexuality, like other human phenomena that gradually become part of our psychological constitution, has roots in these early meaning-making experiences. If meaning-making is integral to human experience in general, it is likely to play a key role in sexual experience in particular. And given that volition is operative in these other aspects of our lives, it stands to reason that volition will be operative in our experience of sexuality too, if only as one of many other factors.

This is not to suggest that sexuality—including sexual desire, attraction, and identity—is the result of any deliberate, rational decision calculus. Even if volition plays an important role in sexuality, volition itself is quite complex: many, perhaps most, of our volitional choices do not seem to come in the form of discrete, conscious, or deliberate decisions; "volitional" does not necessarily mean "deliberate." The life of a desiring, volitional agent involves many tacit patterns of behavior owing to habits, past experiences, memories, and subtle ways of adopting and abandoning different stances on one's life.

If something like this way of understanding the life of a desiring, volitional agent is true, then we do not deliberately "choose" the objects of our

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sexual desires any more than we choose the objects of our other desires. It might be more accurate to say that we gradually guide and give ourselves over to them over the course of our growth and development. This process of forming and reforming ourselves as human beings is similar to what Abraham Maslow calls self-actualization.[18] Why should sexuality be an exception to this process? In the picture we are offering, internal factors, such as our genetic make-up, and external environmental factors, such as past experiences, are only ingredients, however important, in the complex human experience of sexual desire.

Sexual Orientation

Just as the concept of "sexual desire" is complex and difficult to define, there are currently no agreed-upon definitions of "sexual orientation," "homosexuality," or "heterosexuality" for purposes of empirical research. Should homosexuality, for example, be characterized by reference to desires to engage in particular acts with individuals of the same sex, or to a patterned history of having engaged in such acts, or to particular features of one's private wishes or fantasies, or to a consistent impulse to seek intimacy with members of the same sex, or to a social identity imposed by oneself or others, or to something else entirely?

As early as 1896, in a book on homosexuality, the French thinker Marc-André Raffalovich argued that there were more than ten different types of affective inclination or behavior captured by the term "homosexuality" (or what he called "unisexuality").[19] Raffalovich knew his subject matter up close: he chronicled the trial, imprisonment, and resulting social disgrace of the writer Oscar Wilde, who had been prosecuted for "gross indecency" with other men. Raffalovich himself maintained a prolonged and intimate relationship with John Gray, a man of letters thought to be the inspiration for Wilde's classic *The Picture of Dorian Gray.*[20] We might also consider the vast psychoanalytic literature from the early twentieth century on the topic of sexual desire, in which the experiences of individual subjects and their clinical cases are catalogued in great detail. These historical examples bring into relief the complexity that researchers still face today when attempting to arrive at clean categorizations of the richly varied affective and behavioral phenomena associated with sexual desire, in both same-sex and opposite-sex attractions.

We may contrast such inherent complexity with a different phenomenon that can be delineated unambiguously, such as pregnancy. With very few exceptions, a woman is or is not pregnant, which makes classification

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of research subjects for the purposes of study relatively easy: compare pregnant women with other, non-pregnant women. But how can researchers compare, say, "gay" men to "straight" men in a single study, or across a range of studies, without mutually exclusive and exhaustive definitions of the terms "gay" and "straight"?

To increase precision, some researchers categorize concepts associated with human sexuality along a continuum or scale according to variations in pervasiveness, prominence, or intensity. Some scales focus on both intensity and the objects of sexual desire. Among the most familiar and widely used is the Kinsey scale, developed in the 1940s to classify sexual desires and orientations using purportedly measurable criteria. People are asked to choose one of the following options:

0 - Exclusively heterosexual
1 - Predominantly heterosexual, only incidentally homosexual
2 - Predominantly heterosexual, but more than incidentally homosexual
3 - Equally heterosexual and homosexual
4 - Predominantly homosexual, but more than incidentally heterosexual
5 - Predominantly homosexual, only incidentally heterosexual
6 - Exclusively homosexual[21]

But there are considerable limitations to this approach. In principle, measurements of this sort are valuable for social science research. They can be used, for example, in empirical tests such as the classic "t-test," which helps researchers measure statistically meaningful differences between data sets. Many measurements in social science, however, are "ordinal," meaning that variables are rank-ordered along a single, one-dimensional continuum but are not intrinsically significant beyond that. In the case of the Kinsey scale, this situation is even worse, because it measures the self-identification of individuals, while leaving unclear whether the values they report all refer to the same aspect of sexuality—different people may understand the terms "heterosexual" and "homosexual" to refer to feelings of attraction, or to arousal, or to fantasies, or to behavior, or to any combination of these. The ambiguity of the terms severely limits the use of the Kinsey scale as an ordinal measurement that gives a rank order to variables along a single, one-dimensional continuum. So it is not clear that this scale helps researchers to make even rudimentary classifications among the relevant groups using qualitative criteria, much less to rank-order variables or conduct controlled experiments.

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Perhaps, given the inherent complexity of the subject matter, attempts to devise "objective" scales of this sort are misguided. In a critique of such approaches to social science, philosopher and neuropsychologist Daniel N. Robinson points out that "statements that lend themselves to different interpretation do not become 'objective' merely by putting a numeral in front of them."[22] It may be that self-reported identifications with culturally fraught and inherently complex labels simply cannot provide an objective basis for quantitative measurements in individuals or across groups.

Another obstacle for research in this area may be the popular, but not well-supported, belief that romantic desires are sublimations of sexual desires. This idea, traceable to Freud's theory of unconscious drives, has been challenged by research on "attachment theory," developed by John Bowlby in the 1950s.[23] Very roughly, attachment theory holds that later affective experiences that are often grouped under the general rubric "romantic" are explained in part by early childhood attachment behaviors (associated with maternal figures or caregivers)—not by unconscious, sexual drives. Romantic desires, following this line of thought, might not be as strongly correlated with sexual desires as is commonly thought. All of this is to suggest that simple delineations of the concepts relating to human sexuality cannot be taken at face value and that ongoing empirical research sometimes changes or complicates the meanings of the concepts.

If we look at recent research, we find that scientists often use at least one of three categories when attempting to classify people as "homosexual" or "heterosexual": sexual *behavior*; sexual *fantasies* (or related emotional or affective experiences); and *self-identification* (as "gay," "lesbian," "bisexual," "asexual," and so forth).[24] Some add a fourth: inclusion in a community defined by sexual orientation. Consider, for example, the American Psychological Association's definition of sexual orientation in a 2008 document designed to educate the public:

> Sexual orientation refers to an enduring pattern of emotional, romantic and/or sexual *attractions* to men, women or both sexes. Sexual orientation also refers to a person's sense of *identity* based on those attractions, related *behaviors*, and membership in a *community* of others who share those attractions. Research over several decades has demonstrated that sexual orientation ranges along a *continuum*, from exclusive attraction to the other sex to exclusive attraction to the same sex.[25] [Emphases added.]

One difficulty with grouping these categories together under the same general rubric of "sexual orientation" is that research suggests they often

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do not coincide in real life. Sociologist Edward O. Laumann and colleagues summarize this point clearly in a 1994 book:

> While there is a core group (about 2.4 percent of the total men and about 1.3 percent of the total women) in our survey who *define themselves* as homosexual or bisexual, have same-gender *partners*, and express homosexual *desires*, there are also sizable groups who do not consider themselves to be either homosexual or bisexual but have had adult homosexual experiences or express some degree of desire.... [T]his preliminary analysis provides unambiguous evidence that no single number can be used to provide an accurate and valid characterization of the incidence and prevalence of homosexuality in the population at large. In sum, homosexuality is fundamentally a multidimensional phenomenon that has manifold meanings and interpretations, depending on context and purpose.[26] [Emphases added.]

More recently, in a 2002 study, psychologists Lisa M. Diamond and Ritch C. Savin-Williams make a similar point:

> The more carefully researchers map these constellations—differentiating, for example, between *gender identity* and *sexual identity*, *desire* and *behavior*, *sexual* versus *affectionate* feelings, early-appearing versus late-appearing *attractions* and *fantasies*, or social *identifications* and sexual *profiles*—the more complicated the picture becomes because few individuals report uniform inter-correlations among these domains.[27] [Emphases added.]

Some researchers acknowledge the difficulties with grouping these various components under a single rubric. For example, researchers John C. Gonsiorek and James D. Weinrich write in a 1991 book: "It can be safely assumed that there is no necessary relationship between a person's sexual behavior and self-identity unless both are individually assessed."[28] Likewise, in a 1999 review of research on the development of sexual orientation in women, social psychologist Letitia Anne Peplau argues: "There is ample documentation that same-sex attractions and behaviors are not inevitably or inherently linked to one's identity."[29]

In sum, the complexities surrounding the concept of "sexual orientation" present considerable challenges for empirical research on the subject. While the general public may be under the impression that there are widely accepted scientific definitions of terms such as "sexual orientation," in fact, there are not. Diamond's assessment of the situation in 2003 is still true today, that "there is currently no scientific or popular consensus on

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the exact constellation of experiences that definitively 'qualify' an individual as lesbian, gay, or bisexual."[30]

It is owing to such complexities that some researchers, for instance Laumann, proceed by characterizing sexual orientation as a "multidimensional phenomenon." But one might just as well wonder whether, in trying to shoehorn this "multidimensional phenomenon" into a single category, we are not reifying a concept that corresponds to something far too plastic and diffuse in reality to be of much value in scientific research. While labels such as "heterosexual" and "homosexual" are often taken to designate stable psychological or even biological traits, perhaps they do not. It may be that individuals' affective, sexual, and behavioral experiences do not conform well to such categorical labels because these labels do not, in fact, refer to natural (psychological or biological) kinds. At the very least, we should recognize that we do not yet possess a clear and well-established framework for research on these topics. Rather than attempting to research sexual desire, attraction, identity, and behavior under the general rubric of "sexual orientation," we might do better to examine empirically each domain separately and in its own specificity.

To that end, this part of our report considers research on sexual desire and sexual attraction, focusing on the empirical findings related to etiology and development, and highlighting the underlying complexities. We will continue to employ ambiguous terms like "sexual orientation" where they are used by the authors we discuss, but we will try to be attentive to the context of their use and the ambiguities attaching to them.

Challenging the "Born that Way" Hypothesis

Keeping in mind these reflections on the problems of definitions, we turn to the question of how sexual desires originate and develop. Consider the different patterns of attraction between individuals who report experiencing predominant sexual or romantic attraction toward members of the same sex and those who report experiencing predominant sexual or romantic attraction toward members of the opposite sex. What are the causes of these two patterns of attraction? Are such attractions or preferences innate traits, perhaps determined by our genes or prenatal hormones; are they acquired by experiential, environmental, or volitional factors; or do they develop out of some combination of both kinds of causes? What role, if any, does human agency play in the genesis of patterns of attraction? What role, if any, do cultural or social influences play?

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Research suggests that while genetic or innate factors may influence the emergence of same-sex attractions, these biological factors cannot provide a complete explanation, and environmental and experiential factors may also play an important role.

The most commonly accepted view in popular discourse we mentioned above—the "born that way" notion that homosexuality and heterosexuality are biologically innate or the product of very early developmental factors—has led many non-specialists to think that homosexuality or heterosexuality is in any given person unchangeable and determined entirely apart from choices, behaviors, life experiences, and social contexts. However, as the following discussion of the relevant scientific literature shows, this is not a view that is well-supported by research.

Studies of Twins

One powerful research design for assessing whether biological or psychological traits have a genetic basis is the study of identical twins. If the probability is high that both members in a pair of identical twins, who share the same genome, exhibit a trait when one of them does—this is known as the concordance rate—then one can infer that genetic factors are likely to be involved in the trait. If, however, the concordance rate for identical twins is no higher than the concordance rate of the same trait in fraternal twins, who share (on average) only half their genes, this indicates that the shared environment may be a more important factor than shared genes.

One of the pioneers of behavioral genetics and one of the first researchers to use twins to study the effect of genes on traits, including sexual orientation, was psychiatrist Franz Josef Kallmann. In a landmark paper published in 1952, he reported that for all the pairs of identical twins he studied, if one of the twins was gay then both were gay, yielding an astonishing 100% concordance rate for homosexuality in identical twins.[31] Were this result replicated and the study designed better, it would have given early support to the "born that way" hypothesis. But the study was heavily criticized. For example, philosopher and law professor Edward Stein notes that Kallmann did not present any evidence that the twins in his study were in fact genetically identical, and his sample was drawn from psychiatric patients, prisoners, and others through what Kallmann described as "direct contacts with the clandestine homosexual world," leading Stein to argue that Kallmann's sample "in no way constituted a reasonable cross-section of the homosexual population."[32]

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(Samples such as Kallmann's are known as convenience samples, which involve selecting subjects from populations that are conveniently accessible to the researcher.)

Nevertheless, well-designed twin studies examining the genetics of homosexuality indicate that genetic factors likely play some role in determining sexual orientation. For example, in 2000, psychologist J. Michael Bailey and colleagues conducted a major study of sexual orientation using twins in the Australian National Health and Medical Research Council Twin Registry, a large probability sample, which was therefore more likely to be representative of the general population than Kallmann's.[33] The study employed the Kinsey scale to operationalize sexual orientation and estimated concordance rates for being homosexual of 20% for men and 24% for women in identical (maternal, monozygotic) twins, compared to 0% for men and 10% for women in non-identical (fraternal, dizygotic) twins.[34] The difference in the estimated concordance rates was statistically significant for men but not for women. On the basis of these findings, the researchers estimated that the heritability of homosexuality for men was 0.45 with a wide 95% confidence interval of 0.00–0.71; for women, it was 0.08 with a similarly wide confidence interval of 0.00–0.67. These estimates suggest that for males 45% of the differences between certain sexual orientations (homosexual versus heterosexuals as measured by the Kinsey scale) could be attributed to differences in genes.

The large confidence intervals in the study by Bailey and colleagues mean that we must be careful in assessing the substantive significance of these findings. The authors interpret their findings to suggest that "any major gene for strictly defined homosexuality has either low penetrance or low frequency,"[35] but their data did show (marginal) statistical significance. While the concordance estimates seem somewhat high in the models used, the confidence intervals are so wide that it is difficult to judge the reliability, including the replicability, of these estimates.

It is worth clarifying here what "heritability" means in these studies, since the technical meaning in population genetics is narrower and more precise than the everyday meaning of the word. Heritability is a measure of how much variation in a particular trait within a population can be attributed to variation in genes in that population. It is not, however, a measure of how much a trait is genetically determined.

Traits that are almost entirely genetically determined can have very low heritability values, while traits that have almost no genetic basis can be found to be highly heritable. For instance, the number of fingers human beings have is almost completely genetically determined. But there is little

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variation in the number of fingers humans have, and most of the variation we do see is due to non-genetic factors such as accidents, which would lead to low heritability estimates for the trait. Conversely, cultural traits can sometimes be found to be highly heritable. For instance, whether a given individual in mid-twentieth century America wore earrings would have been found to be highly heritable, because it was highly associated with being male or female, which is in turn associated with possessing XX or XY sex chromosomes, making variability in earring-wearing behavior highly associated with genetic differences, despite the fact that wearing earrings is a cultural rather than biological phenomenon. Today, heritability estimates for earring-wearing behavior would be lower than they were in mid-twentieth century America, not because of any changes in the American gene pool, but because of the increased acceptance of men wearing earrings.[36]

So, a heritability estimate of 0.45 does not mean that 45% of sexuality is determined by genes. Rather, it means that 45% of the variation between individuals in the population studied can be attributed in some way to genetic factors, as opposed to environmental factors.

In 2010, psychiatric epidemiologist Niklas Långström and colleagues conducted a large, sophisticated twin study of sexual orientation, analyzing data from 3,826 identical and fraternal same-sex twin pairs (2,320 identical and 1,506 fraternal pairs).[37] The researchers operationalized homosexuality in terms of lifetime same-sex sexual partners. The sample's concordance rates were somewhat lower than those found in the study by Bailey and colleagues. For having had at least one same-sex partner, the concordance for men was 18% in identical twins and 11% in fraternal twins; for women, 22% and 17%, respectively. For total number of sexual partners, concordance rates for men were 5% in identical twins and 0% in fraternal twins; for women, 11% and 7%, respectively.

For men, these rates suggest an estimated heritability rate of 0.39 for having had at least one lifetime same-sex partner (with a 95% confidence interval of 0.00–0.59), and 0.34 for total number of same-sex partners (with a 95% confidence interval of 0.00–0.53). Environmental factors experienced by one twin but not the other explained 61% and 66% of the variance, respectively, while environmental factors shared by the twins failed to explain any of the variance. For women, the heritability rate for having had at least one lifetime same-sex partner was 0.19 (95% confidence interval of 0.00–0.49); for total number of same-sex partners, it was 0.18 (95% confidence interval of 0.11–0.45). Unique environmental factors accounted for 64% and 66% of the variance, respectively, while

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shared environmental factors accounted for 17% and 16%, respectively. These values indicate that, while the genetic component of homosexual behavior is far from negligible, non-shared environmental factors play a critical, perhaps preponderant, role. The authors conclude that sexual orientation arises from both heritable and environmental influences unique to the individual, stating that "the present results support the notion that the individual-specific environment does indeed influence sexual preference."[38]

Another large and nationally representative study of twins published by sociologists Peter S. Bearman and Hannah Brückner in 2002 used data from the National Longitudinal Study of Adolescent to Adult Health (commonly abbreviated as "Add Health") of adolescents in grades 7–12.[39] They attempted to estimate the relative influence of social factors, genetic factors, and prenatal hormonal factors on the development of same-sex attractions. Overall, 8.7% of the 18,841 adolescents in their study reported same-sex attractions, 3.1% reported a same-sex romantic relationship, and 1.5% reported same-sex sexual behavior. The authors first analyzed the "social influence hypothesis," according to which opposite-sex twins receive less gendered socialization from their families than same-sex twins or opposite-sex siblings, and found that this hypothesis was well-supported in the case of males. While female opposite-sex twins in the study were the least likely of all the groups to report same-sex attractions (5.3%), male opposite-sex twins were the likeliest to report same-sex attractions (16.8%)—more than twice as likely as males with a full, non-twin sister (16.8% vs. 7.3%). The authors concluded there was "substantial indirect evidence in support of a socialization model at the individual level."[40]

The authors also examined the "intrauterine hormone transfer hypothesis," according to which prenatal hormone transfers between opposite-sex twin fetuses influences the sexual orientation of the twins. (Note that this is different from the more general hypothesis that prenatal hormones influence the development of sexual orientation.) In the study, the proportion of male opposite-sex twins reporting same-sex attraction was about twice as high for those without older brothers (18.7%) as for those with older brothers (8.8%). The authors argued that this finding was strong evidence against the hormone-transfer hypothesis, since the presence of older brothers should not decrease the likelihood of same-sex attraction if that attraction has a basis in prenatal hormonal transfers. However, that conclusion seems premature: the observations are consistent with the possibility of *both* hormonal factors *and* the presence of an older brother having an effect (especially if the latter influences the former). This study

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also found no correlation between experiencing same-sex attraction and having multiple older brothers, which had been reported in some earlier studies.[41]

Finally, Bearman and Brückner did not find evidence of significant genetic influence on sexual attraction. Significant influence would require that identical twins have significantly higher concordance rates for same-sex attraction than fraternal twins or non-twin siblings. But in the study, the rates were statistically similar: identical twins were 6.7% concordant, dizygotic pairs 7.2% concordant, and full siblings 5.5% concordant. The authors concluded that "it is more likely that any genetic influence, if present, can only be expressed in specific and circumscribed social structures."[42] Based on their data, they suggested the one observed social structure that might enable this genetic expression is the more limited "gender socialization associated with firstborn OS [opposite-sex] twin pairs."[43] Thus, they inferred that their results "support the hypothesis that less gendered socialization in early childhood and preadolescence shapes subsequent same-sex romantic preferences."[44] While the findings here are suggestive, further research is needed to confirm this hypothesis. The authors also argued that the higher concordance rates for same-sex attraction reported in previous studies may be unreliable due to methodological problems such as non-representative samples and small sample sizes. (It should be noted, however, that these remarks were published prior to the study by Långström and colleagues discussed above, which uses a study design that does not appear to have these limitations.)

To reconcile the somewhat mixed data on heritability, we could hypothesize that attraction to the same sex may have a stronger heritable component as people age—that is, when researchers attempt to measure sexual orientation later in life (as in the 2010 study by Långström and colleagues) than when measured earlier in life. Heritability estimates can change depending on the age at which a trait is measured because changes in the environmental factors that might influence variation in the trait may vary for individuals at different ages, and because genetically influenced traits may become more fixed at a later stage in an individual's development (height, for instance, becomes fixed in early adulthood). This hypothesis is also suggested by findings, discussed below, that same-sex attraction may be more fluid in adolescence than in later stages of adulthood.

In contrast to the studies just summarized, psychiatrist Kenneth S. Kendler and colleagues conducted a large twin study using a probability sample of 794 twin pairs and 1,380 non-twin siblings.[45] Based on concordance rates for sexual orientation (defined in this study as self-iden-

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tification based on attraction), the authors state that their results "suggest that genetic factors may provide an important influence on sexual orientation."[46] The study does not, however, appear to be sufficiently powerful to draw strong conclusions about the degree of genetic influence on sexuality: only 19 of 324 identical twin pairs had any non-heterosexual member, with 6 of the 19 pairs concordant; 15 of 240 same-sex fraternal twin pairs had any non-heterosexual member, with 2 of the 15 pairs concordant. Because only 8 twin pairs were concordant for non-heterosexuality, the study's ability to draw substantively significant comparisons between identical and fraternal twins (or between twins and non-twin siblings) is limited.

Overall, these studies suggest that (depending on how homosexuality is defined) in anywhere from 6% to 32% of cases, both members of an identical twin pair would be homosexual if at least one member is. Since some twin studies found higher concordance rates in identical twins than in fraternal twins or non-twin siblings, there may be genetic influences on sexual desire and behavioral preferences. One needs to bear in mind that identical twins typically have even more similar environments—early attachment experiences, peer relationships, and the like—than fraternal twins or non-twin siblings. Because of their similar appearances and temperaments, for example, identical twins may be more likely than fraternal twins or other siblings to be treated similarly. So some of the higher concordance rates may be attributable to environmental factors rather than genetic factors. In any case, if genes do play a role in predisposing people toward certain sexual desires or behaviors, these studies make clear that genetic influences cannot be the whole story.

Summarizing the studies of twins, we can say that there is no reliable scientific evidence that sexual orientation is determined by a person's genes. But there is evidence that genes play a role in influencing sexual orientation. So the question "Are gay people born that way?" requires clarification. There is virtually no evidence that anyone, gay or straight, is "born that way" if that means their sexual orientation was genetically determined. But there is some evidence from the twin studies that certain genetic profiles probably increase the likelihood the person later identifies as gay or engages in same-sex sexual behavior.

Future twin studies on the heritability of sexual orientation should include analyses of larger samples or meta-analyses or other systematic reviews to overcome the limited sample size and statistical power of some of the existing studies, and analyses of heritability rates across different dimensions of sexuality (such as attraction, behavior, and identity) to

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overcome the imprecisions of the ambiguous concept of sexual orientation and the limits of studies that look at only one of these dimensions of sexuality.

Molecular Genetics

In examining the question whether, and perhaps to what extent, there may be genetic contributions to homosexuality, we have so far looked at studies that employ methods of classical genetics to estimate the heritability of a trait like sexual orientation but that do not identify particular genes that may be associated with the trait.[47] But genetics can also be studied using what are often called molecular methods that provide estimates of which particular genetic variations are associated with traits, whether physical or behavioral.

One early attempt to identify a more specific genetic basis for homosexuality was a 1993 study by geneticist Dean Hamer and colleagues of 40 pairs of homosexual brothers.[48] By examining the family history of homosexuality for these individuals, they identified a possible linkage between homosexuality in males and genetic markers on the Xq28 region of the X chromosome. Attempts to replicate this influential study's results have had mixed results: George Rice and colleagues attempted and failed to replicate Hamer's findings,[49] though in 2015 Alan R. Sanders and colleagues were able to replicate Hamer's original findings using a larger population size of 409 male twin pairs of homosexual brothers, and to find additional genetic linkage sites.[50] (Since the effect was small, however, the genetic marker would not be a good predictor of sexual orientation.)

Genetic linkage studies like the ones discussed above are able to identify particular regions of chromosomes that may be associated with a trait by looking at patterns of inheritance. Today, one of the chief methods for inferring which genetic variants are associated with a trait is the genome-wide association study, which uses DNA sequencing technologies to identify particular differences in DNA that may be associated with a trait. Scientists examine millions of genetic variants in large numbers of individuals who have a particular trait, as well as individuals who do not have the trait, and compare the frequency of genetic variants among those who do and do not have the trait. Specific genetic variants that occur more frequently among those who have than those who do not have the trait are inferred to have some association with that trait. Genome-wide association studies have become popular in recent years, yet few such scientific studies have found significant associations of genetic variants with sexual

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orientation. The largest attempt to identify genetic variants associated with homosexuality, a study of over 23,000 individuals from the 23andMe database presented at the American Society of Human Genetics annual meeting in 2012, found no linkages reaching genome-wide significance for same-sex sexual identity for males or females.[51]

So, again, the evidence for a genetic basis for homosexuality is inconsistent and inconclusive, which suggests that, though genetic factors explain some of the variation in sexual orientation, the genetic contribution to this trait is not likely to be strong and even less likely to be decisive.

As is often true of human behavioral tendencies, there may be genetic contributions to the tendency toward homosexual inclinations or behaviors. Phenotypic expression of genes is usually influenced by environmental factors—different environments may lead to different phenotypes even for the same genes. So even if there are genetic factors that contribute to homosexuality, an individual's sexual attractions or preferences may also be influenced by a number of environmental factors, such as social stressors, including emotional, physical, or sexual abuse. Looking to developmental, environmental, experiential, social, or volitional factors will be necessary to arrive at a fuller picture of how sexual interests, attractions, and desires develop.

The Limited Role of Genetics

Lay readers might note at this point that even at the purely biological level of genetics, the shopworn "nature vs. nurture" debates regarding human psychology have been abandoned by scientists, who recognize that no credible hypothesis can be offered for any particular traits that would be determined either purely by genetics or the environment. The growing field of epigenetics, for example, demonstrates that even for relatively simple traits, gene expression itself can be influenced by innumerable other external factors that can shape the functioning of genes.[52] This is even more relevant when it comes to the relationship between genes and complex traits like sexual attraction, drives, and behaviors.

These gene-environment relationships are complex and multidimensional. Non-genetic developmental factors and environmental experiences may be sculpted, in part, by genetic factors working in subtle ways. For example, social geneticists have documented the indirect role of genes in peer-aligned behaviors, such that an individual's physical appearance could influence whether a particular social group will include or exclude that individual.[53]

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Contemporary geneticists know that genes can influence a person's range of interests and motivations, therefore indirectly affecting behavior. While genes may in this way incline a person to certain behaviors, compelling behavior directly, independently of a wide range of other factors, seems less plausible. They may influence behavior in more subtle ways, depending on external environmental stimuli (for instance, peer pressure, suggestion, and behavioral rewards) in conjunction with psychological factors and physical makeup. Dean Hamer, whose work on the possible role of genetics in homosexuality was examined above, explained some of the limitations of behavioral genetics in a 2002 article in *Science*: "The real culprit [of lack of progress in behavioral genetics] is the assumption that the rich complexity of human thought and emotion can be reduced to a simple, linear relation between individual genes and behaviors.... This oversimplified model, which underlies most current research in behavior genetics, ignores the critical importance of the brain, the environment, and gene expression networks."[54]

The genetic influences affecting any complex human behavior—whether sexual behaviors, or interpersonal interactions—depend in part on individuals' life experiences as they mature. Genes constitute only one of the many key influences on behavior in addition to environmental influences, personal choices, and interpersonal experiences. The weight of evidence to date strongly suggests that the contribution of genetic factors is modest. We can say with confidence that genes are not the sole, essential cause of sexual orientation; there is evidence that genes play a modest role in contributing to the development of sexual attractions and behaviors but little evidence to support a simplistic "born that way" narrative concerning the nature of sexual orientation.

The Influence of Hormones

Another area of research relevant to the hypothesis that people are born with dispositions toward different sexual orientations involves prenatal hormonal influences on physical development and subsequent male- or female-typical behaviors in early childhood. For ethical and practical reasons, the experimental work in this field is carried out in non-human mammals, which limits how this research can be generalized to human cases. However, children who are born with disorders of sexual development (DSD) serve as a population in which to examine the influence of genetic and hormonal abnormalities on the subsequent development of non-typical sexual identity and sexual orientation.

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Hormones responsible for sexual differentiation are generally thought to exert on the developing fetus either *organizational* effects—which produce permanent changes in the wiring and sensitivity of the brain, and thus are considered largely irreversible—or *activating* effects, which occur later in an individual's life (at puberty, and into adulthood).[55] Organizational hormones may prime the fetal systems (including the brain) structurally, and set the stage for sensitivity to hormones presenting at puberty and beyond, when the hormone will then "activate" systems which were "organized" prenatally.

Periods of peak response to the hormonal environment are thought to occur during gestation. For example, testosterone is thought to influence the male fetus maximally between weeks 8 and 24, and then again at birth, until about three months of age.[56] Estrogens are provided throughout gestation by the placenta and the mother's blood system.[57] Studies in animals reveal there may even be multiple periods of sensitivity for a variety of hormones, that the presence of one hormone may influence the action of another hormone, and the sensitivity of the receptors for these hormones can influence their actions.[58] Sexual differentiation, alone, is a highly complex system.

Specific hormones of interest in this area of research are testosterone, dihydrotestosterone (a metabolite of testosterone, and more potent than testosterone), estradiol (which can be metabolized into testosterone), progesterone, and cortisol. The generally accepted pathways of normal hormonal influence of development in utero are as follows. The typical pattern of sex differentiation in human fetuses begins with the differentiation of the sex organs into testes or ovaries, a process that is largely genetically controlled. Once these organs have differentiated, they produce specific hormones that determine development of external genitalia. This window of time in gestation is when hormones exert their phenotypic and neurological effects. Testosterone secreted by the testes contributes to the development of male external genitalia and affects neurological development in males;[59] it is the absence of testosterone in females which allows for the female pattern of external genitalia to develop.[60] Imbalances of testosterone or estrogen, as well as their presence or absence at specific critical periods of gestation, may cause disorders of sexual development. (Genetic or environmental effects can also lead to disorders of sexual development.)

Stress may also play some role in influencing the way hormones shape gonadal development, neurodevelopment, and subsequent sex-typical behaviors in early childhood.[61] Cortisol is the main hormone associated

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with stress responses. It may originate from the mother, if she experiences severe stressors during her pregnancy, or from the fetus under stress.[62] Elevated levels of cortisol may also occur from genetic defects.[63] One of the most extensively studied disorders of sexual development is congenital adrenal hyperplasia (CAH), which in females can result in genital virilization.[64] Over 90% of cases of CAH result from a mutation in a gene that codes for an enzyme that helps synthesize cortisol.[65] This results in an overproduction of cortisol precursors, some of which are converted into androgens (hormones associated with male sex development).[66] As a result, girls are born with some degree of virilization of their genitalia, depending on the severity of the genetic defect.[67] For severe cases of genital virilization, surgical intervention is sometimes performed to normalize the genitalia. Hormone therapies are also often administered to mitigate the effects of excess androgen production.[68] Females with CAH, who as fetuses were exposed to above-average levels of androgens, are less likely to be exclusively heterosexual than females without CAH, and females with more severe forms of CAH are more likely to be non-heterosexual than females with milder forms of the condition.[69]

Likewise, there are disorders of sexual development in genetic males affected by androgen insensitivity. In males with androgen insensitivity syndrome, the testes produce testosterone normally, but the receptors to testosterone are not functional.[70] The genitalia, at birth, appear to be female, and the child is usually raised as a female. The individual's endogenous testosterone is broken down into estrogen, such that the individual begins to develop female secondary sex characteristics.[71] It does not become apparent that there is a problem until puberty, when the individual does not start menses appropriately.[72] These patients generally prefer to continue life as females, and their sexual orientation does not differ from females having an XX genotype.[73] Studies have suggested that they are just as likely if not more likely to be exclusively interested in male partners than XX females.[74]

There are other disorders of sexual development affecting some genetic males (i.e., with an XY genotype) in whom androgen deficiencies are a direct result of the lack of enzymes either to synthesize dihydrotestosterone from testosterone or to produce testosterone from its precursor hormone.[75] Individuals with these deficiencies are born with varied degrees of ambiguous genitalia, and are sometimes raised as girls. During puberty, however, these individuals often experience physical virilization, and must then decide whether to live as men or women. Peggy T. Cohen-Kettenis, a professor of gender development and psychopathology, found that 39 to

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64% of individuals with these deficiencies who are raised as girls change to live as men in adolescence and early adulthood, and she also reported that "the degree of external genital masculinization at birth does not seem to be related to gender role changes in a systematic way."[76]

The twin studies reviewed earlier may shed light on the role of maternal hormonal influences, since both identical and fraternal twins are exposed to similar maternal hormonal influences in utero. The relatively weak concordance rates in the twin studies suggest that prenatal hormones, like genetic factors, do not play a strongly determinative role in sexual orientation. Other attempts at finding significant hormonal influences on sexual development have likewise been mixed, and the salience of the findings is not yet clear. Since direct studies of prenatal hormonal influences on sexual development are methodologically difficult, some studies have tried to develop models whereby differences in prenatal hormonal exposure can be inferred indirectly—by measuring subtle morphological changes or by examining hormonal disorders that are present later during development.

For example, one rough proxy of prenatal testosterone levels used by researchers is the ratio between the length of the second finger (index finger) and the fourth finger (ring finger), which is commonly called the "2D:4D ratio." Some evidence suggests that the ratio may be influenced by prenatal exposure to testosterone, such that in males higher levels of exposure to testosterone cause shorter index fingers relative to the ring finger (or having a low 2D:4D ratio), and vice versa.[77] According to one hypothesis, homosexual men may have a higher 2D:4D ratio (closer to the ratio found in females than in heterosexual males), while another hypothesis suggests the opposite, that homosexual men may be hypermasculinized by prenatal testosterone, resulting in a lower ratio than in heterosexual men. For women, the hypothesis for homosexuality that they have been hypermasculinized (lower ratio, higher testosterone) has also been proposed. Several studies comparing this trait in homosexually versus heterosexually identified men and women have shown mixed results.

A study published in *Nature* in 2000 found that in a sample of 720 California adults, the right-hand 2D:4D ratio of homosexual women was significantly more masculine (that is, the ratio was smaller) than that of heterosexual women and did not differ significantly from that of heterosexual men.[78] This study also found no significant difference in mean 2D:4D ratio between heterosexual and homosexual men. Another study that year, which used a relatively small sample of homosexual and heterosexual men from the United Kingdom, reported a lower 2D:4D (that

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is, more masculine) ratio in homosexual men.[79] A 2003 study using a London-based sample also found that homosexual men had a lower 2D:4D ratio than heterosexuals,[80] while two other studies with samples from California and Texas showed *higher* 2D:4D ratios for homosexual men.[81]

A 2003 twin study compared seven female monozygotic twin pairs discordant for homosexuality (one twin was lesbian) and five female monozygotic twin pairs concordant for homosexuality (both twins were lesbian).[82] In the twin pairs discordant for sexual orientation, the individuals identifying as homosexual had significantly lower 2D:4D ratios than their twins, whereas the concordant twins showed no difference. The authors interpreted this result as suggesting that "low 2D:4D ratio is a result of differences in prenatal environment."[83] Finally, a 2005 study of 2D:4D ratios in an Austrian sample of 95 homosexual and 79 heterosexual men found that the 2D:4D ratios of heterosexual men were not significantly different from those of homosexual men.[84] After reviewing the several studies on this trait, the authors conclude that "more data are essential before we can be sure whether there is a 2D:4D effect for sexual orientation in men when ethnic variation is controlled for."[85]

Much research has examined the effects of prenatal hormones on behavior and brain structure. Again, these results come primarily from studies of non-human primates, but the study of disorders of sexual development has provided helpful insights into the effects of hormones on sexual development in humans. Since hormonal influences typically occur during time-sensitive periods of development, when their effects manifest physically, it is reasonable to assume that organizational effects of these early, time-linked hormonal patterns are likely to direct aspects of neural development. Neuroanatomical connectivity and neurochemical sensitivities may be among such influences.

In 1983, Günter Dörner and colleagues performed a study investigating whether there is any relationship between maternal stress during pregnancy and later sexual identity of their children, interviewing two hundred men about stressful events that may have occurred to their mothers during their prenatal lives.[86] Many of these events occurred as a consequence of World War II. Of men who reported that their mothers had experienced moderately to severely stressful events during pregnancy, 65% were homosexual, 25% were bisexual, and 10% were heterosexual. (Sexual orientation was assessed using the Kinsey scale.) However, more recent studies have shown much smaller or no significant correlations.[87] In a 2002 prospective study on the relationship between sexual orientation and prenatal stress during the second and third trimesters, Hines

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and colleagues found that stress reported by mothers during pregnancy showed "only a small relationship" to male-typical behaviors in their daughters at the age of 42 months, "and no relationship at all" to female-typical behaviors in their sons.[88]

In summary, some forms of prenatal hormone exposure, particularly CAH in females, are associated with differences in sexual orientation, while other factors are often important in determining the physical and psychological effects of those exposures. Hormonal conditions that contribute to disorders of sex development may contribute to the development of non-heterosexual orientations in some individuals, but this does not demonstrate that such factors explain the development of sexual attractions, desires, and behaviors in the majority of cases.

Sexual Orientation and the Brain

There have been several studies examining neurobiological differences between individuals who identify as heterosexual and those who identify as homosexual. This work began with neuroscientist Simon LeVay's 1991 study that reported biological differences in the brains of gay men as compared to straight men—specifically, a difference in volume in a particular cell group of the interstitial nuclei of the anterior hypothalamus (INAH3).[89] Later work by psychiatrist William Byne and colleagues showed more nuanced findings: "In agreement with two prior studies… we found INAH3 to be sexually dimorphic, occupying a significantly greater volume in males than females. In addition, we determined that the sex difference in volume was attributable to a sex difference in neuronal number and not in neuronal size or density."[90] The authors noted that, "Although there was a trend for INAH3 to occupy a smaller volume in homosexual men than in heterosexual men, there was no difference in the number of neurons within the nucleus based on sexual orientation." They speculated that "postnatal experience" may account for the differences in volume in this region between homosexual and heterosexual men, though this would require further research to confirm.[91] They also noted that the functional significance of sexual dimorphism in INAH3 is unknown. The authors conclude: "Based on the results of the present study as well as those of LeVay (1991), sexual orientation cannot be reliably predicted on the basis of INAH3 volume alone."[92] In 2002, psychologist Mitchell S. Lasco and colleagues published a study examining a different part of the brain—the anterior commissure—and found that there were no significant differences in that area based either on sex or sexual orientation.[93]

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Other studies have since been conducted to ascertain structural or functional differences between the brains of heterosexual and homosexual individuals (using a variety of criteria to define these categories). Findings from several of these studies are summarized in a 2008 commentary published in the *Proceedings of the National Academy of Sciences.*[94] Research of this kind, however, does not seem to reveal much of relevance regarding the etiology or biological origins of sexual orientation. Due to inherent limitations, this research literature is fairly unremarkable. For example, in one study functional MRI was used to measure activity changes in the brain when pictures of men and women were shown to subjects, finding that viewing a female face produced stronger activity in the thalamus and orbitofrontal cortex of heterosexual men and homosexual women, whereas in homosexual men and heterosexual women these structures reacted more strongly to the face of a man.[95] That the brains of heterosexual women and homosexual men reacted distinctively to the faces of men, whereas the brains of heterosexual men and homosexual women reacted distinctively to the faces of women, is a finding that seems rather trivial with respect to understanding the etiology of homosexual attractions. In a similar vein, one study reported different responses to pheromones between homosexual and heterosexual men,[96] and a follow-up study showed a similar finding in homosexual compared to heterosexual women.[97] Another study showed differences in cerebral asymmetry and functional connectivity between homosexual and heterosexual subjects.[98]

While findings of this kind may suggest avenues for future investigation, they do not move us much closer to an understanding of the biological or environmental determinants of sexual attractions, interests, preferences, or behaviors. We will say more about this below. For now, we will briefly illustrate a few of the inherent limitations in this area of research with the following hypothetical example. Suppose we were to study the brains of yoga teachers and compare them to the brains of bodybuilders. If we search long enough, we will eventually find statistically significant differences in some area of brain morphology or brain function between these two groups. But this would not imply that such differences determined the different life trajectories of the yoga teacher and the bodybuilder. The brain differences could have been the result, rather than the cause, of distinctive patterns of behavior or interests.[99] Consider another example. Suppose that gay men tend to have less body fat than straight men (as indicated by lower average scores on body mass indices). Even though body mass is, in part, determined by genetics, we could not claim based on this finding that there is some innate, genetic cause of both body

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mass and homosexuality at work. It could be the case, for instance, that being gay is associated with a diet that lowers body mass. These examples illustrate one of the common problems encountered in the popular interpretation of such research: the suggestion that the neurobiological pattern determines a particular behavioral expression.

With this overview of studies on biological factors that might influence sexual attraction, preferences, or desires, we can understand the rather strong conclusion by social psychologist Letitia Anne Peplau and colleagues in a 1999 review article: "To recap, more than 50 years of research has failed to demonstrate that biological factors are a major influence in the development of women's sexual orientation.... Contrary to popular belief, scientists have not convincingly demonstrated that biology determines women's sexual orientation."[100] In light of the studies we have summarized here, this statement could also be made for research on male sexual orientation, however this concept is defined.

Misreading the Research

There are some significant built-in limitations to what the kind of empirical research summarized in the preceding sections can show. Ignoring these limitations is one of the main reasons the research is routinely misinterpreted in the public sphere. It may be tempting to assume, as we just saw with the example of brain structure, that if a particular biological profile is associated with some behavioral or psychological trait, then that biological profile *causes* that trait. This reasoning relies on a fallacy, and in this section we explain why, using concepts from the field of epidemiology. While some of these issues are rather technical in detail, we will try to explain them in a general way that is accessible to the non-specialist reader.

Suppose for the sake of illustration that one or more differences in a biological trait are found between homosexual and heterosexual men. That difference could be a discrete measure (call this D) such as presence of a genetic marker, or it could be a continuous measure (call this C) such as the average volume of a particular part of the brain.

Showing that a risk factor significantly increases the chances of a particular health outcome or a behavior might give us a clue to development of that health outcome or that behavior, but it does not provide evidence of causation. Indeed, it may not provide evidence of anything but the weakest of correlations. The inference is sometimes made that if it can be shown that gay men and straight men differ significantly in the

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probability that D is present (whether a gene, a hormonal factor, or something else), no matter how low that probability, then this finding suggests that being gay has a biological basis. But this inference is unwarranted. Doubling (or even tripling or quadrupling) the probability of a relatively rare trait can have little value in terms of predicting who will or will not identify as gay.

The same would be true for any continuous variable (C). Showing a significant difference at the mean or average for a given trait (such as the volume of a particular brain region) between men who identify as heterosexual and men who identify as homosexual does not suffice to show that this average difference contributes to the probability of identifying as heterosexual or homosexual. In addition to the reasons explained above, a significant difference at the means of two distributions can be consistent with a great deal of overlap between the distributions. That is, there may be virtually no separation in terms of distinguishing between some individual members of each group, and thus the measure would not provide much predictability for sexual orientation or preference.

Some of these issues could, in part, be addressed by additional methodological approaches, such as the use of a training sample or cross-validation procedures. A training sample is a small sample used to develop a model (or hypothesis); this model is then tested on a larger independent sample. This method avoids testing a hypothesis on the same data used to develop the hypothesis. Cross-validation includes procedures used to examine whether a statistically significant effect is really there or just due to chance. If one wants to show the result did not occur by chance (and if the sample is large), one can run the same tests on a random split of the relevant sample. After finding a difference in the prevalence of trait D or C between a gay sample and a straight sample, researchers could randomly split the gay sample into two groups and then show that these two groups do not differ regarding D or C. Suppose one finds five differences out of 100 comparing gay to straight men in the overall samples, then finds five differences out of 100 when comparing the split gay samples. This would cast additional doubt on the initial finding of a difference between the means of gay and straight individuals.

Sexual Abuse Victimization

Whereas the preceding discussion considered the part that biological factors might play in the development of sexual orientation, this section will summarize evidence that a particular environmental factor—childhood

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sexual abuse—is reported significantly more often among those who later identify as homosexual. The results presented below raise the question whether there is an association between sexual abuse, particularly in childhood, and later expressions of sexual attraction, behavior, or identity. If so, might child abuse increase the probability of having a non-heterosexual orientation?

Correlations, at least, have been found, as we will summarize below. But we should note first that they might be accounted for by one or more of the following conjectures:

1. Abuse might contribute to the development of non-heterosexual orientation.

2. Children with (signs of future) non-heterosexual tendencies might attract abusers, placing them at elevated risk.

3. Certain factors might contribute to *both* childhood sexual abuse and non-heterosexual tendencies (for instance, a dysfunctional family or an alcoholic parent).

It should be kept in mind that these three hypotheses are not mutually exclusive; all three, and perhaps others, might be operative. As we summarize the studies on this issue, we will try to evaluate each of these hypotheses in light of current scientific research.

Behavioral and community health professor Mark S. Friedman and colleagues conducted a 2011 meta-analysis of 37 studies from the United States and Canada examining sexual abuse, physical abuse, and peer victimization in heterosexuals as compared to non-heterosexuals.[101] Their results showed that non-heterosexuals were on average 2.9 times more likely to report having been abused as children (under 18 years of age). In particular, non-heterosexual males were 4.9 times likelier—and non-heterosexual females, 1.5 times likelier—than their heterosexual counterparts to report sexual abuse. Non-heterosexual adolescents as a whole were 1.3 times likelier to indicate physical abuse by parents than their heterosexual peers, but gay and lesbian adolescents were only 0.9 times as likely (bisexuals were 1.4 times as likely). As for peer victimization, non-heterosexuals were 1.7 times likelier to report being injured or threatened with a weapon or being attacked.

The authors note that although they hypothesized that the rates of abuse would decrease as social acceptance of homosexuality rose, "disparities in prevalence rates of sexual abuse, parental physical abuse, and peer

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victimization between sexual minority and sexual nonminority youths did not change from the 1990s to the first decade of the 2000s."[102] While these authors cite authorities who claim that sexual abuse does not "cause individuals to become gay, lesbian, or bisexual,"[103] their data do not give evidence against the hypothesis that childhood sexual abuse might affect sexual orientation. On the other hand, the causal path could be in the opposite direction or bi-directional. The evidence does not refute or support this conjecture; the study's design is not capable of shedding much light on the question of directionality.

The authors invoke a widely-cited hypothesis to explain the higher rates of sexual abuse among non-heterosexuals, the hypothesis that "sexual minority individuals are…more likely to be targeted for sexual abuse, as youths who are perceived to be gay, lesbian, or bisexual are more likely to be bullied by their peers."[104] The two conjectures—that abuse is a cause and that it is a result of non-heterosexual tendencies—are not mutually exclusive: abuse may be a causal factor in the development of non-heterosexual attractions and desires, and at the same time non-heterosexual attractions, desires, and behaviors may increase the risk of being targeted for abuse.

Community health sciences professor Emily Faith Rothman and colleagues conducted a 2011 systematic review of the research investigating the prevalence of sexual assault against people who identify as gay, lesbian, or bisexual in the United States.[105] They examined 75 studies (25 of which used probability sampling) involving a total of 139,635 gay or bisexual (GB) men and lesbian or bisexual (LB) women, which measured the prevalence of victimization due to lifetime sexual assault (LSA), childhood sexual assault (CSA), adult sexual assault (ASA), intimate partner sexual assault (IPSA), and hate-crime-related sexual assault (HC). Although the study was limited by not having a heterosexual control group, it showed alarmingly high rates of sexual assault, including childhood sexual assault, for this population, as summarized in Table 1.

Using a multi-state probability-based sample in a 2013 study, psychologist Judith Anderson and colleagues compared differences in adverse childhood experiences—including dysfunctional households; physical, sexual, or emotional abuse; and parental discord—among self-identified homosexual, heterosexual, and bisexual adults.[106] They found that bisexuals had significantly higher proportions than heterosexuals of all adverse childhood experience factors, and that gays and lesbians had significantly higher proportions than heterosexuals of all these measures except parental separation or divorce. Overall, gays and lesbians had nearly 1.7 times,

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Table 1. Sexual Assault among Gay/Bisexual Men and Lesbian/Bisexual Women

GB Men (%)	LB Women (%)
CSA: 4.1–59.2 (median 22.7)	CSA: 14.9–76.0 (median 34.5)
ASA: 10.8–44.7 (median 14.7)	ASA: 11.3–53.2 (median 23.2)
LSA: 11.8–54.0 (median 30.4)	LSA: 15.6–85.0 (median 43.4)
IPSA: 9.5–57.0 (median 12.1)	IPSA: 3.0–45.0 (median 13.3)
HC: 3.0–19.8 (median 14.0)	HC: 1.0–12.3 (median 5.0)

and bisexuals 1.6 times, the heterosexual rate of adverse childhood experiences. The data for abuse are summarized in Table 2.

While this study, like some others we have discussed, may be limited by recall bias—that is, inaccuracies introduced by errors of memory—it has the merit of having a control group of self-identified heterosexuals to compare with self-identified gay/lesbian and bisexual cohorts. In their discussion of findings, the authors critique the hypothesis that childhood trauma has a causal relationship to homosexual preferences. Among their reasons for skepticism, they note that the vast majority of individuals who suffer childhood trauma do not become gay or bisexual, and that gender-nonconforming behavior may help explain the elevated rates of abuse. However, it is plausible from these and related results to hypothesize

Table 2. Adverse Childhood Experiences among Gays/Lesbians, Bisexuals, and Heterosexuals

Sexual Abuse (%)

GLs	Bisexuals	Heterosexuals
29.7	34.9	14.8

Emotional Abuse (%)

GLs	Bisexuals	Heterosexuals
47.9	48.4	29.6

Physical Abuse (%)

GLs	Bisexuals	Heterosexuals
29.3	30.3	16.7

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that adverse childhood experiences may be a significant—but not a determinative—factor in developing homosexual preferences. Further studies are needed to see whether either or both hypotheses have merit.

A 2010 study by professor of social and behavioral sciences Andrea Roberts and colleagues examined sexual orientation and risk of post-traumatic stress disorder (PTSD) using data from a national epidemiological face-to-face survey of nearly 35,000 adults.[107] Individuals were placed into several categories: heterosexual with no same-sex attraction or partners (reference group); heterosexual with same-sex attraction but no same-sex partners; heterosexual with same-sex partners; self-identified gay/lesbian; and self-identified bisexual. Among those reporting exposure to traumatic events, gay and lesbian individuals as well as bisexuals had about twice the lifetime risk of PTSD compared to the heterosexual reference group. Differences were found in rates of childhood maltreatment and interpersonal violence: gays, lesbians, bisexuals, and heterosexuals with same-sex partners reported experiencing worse traumas during childhood and adolescence than the reference group. The findings are summarized in Table 3.

Similar patterns emerged in a 2012 study by psychologist Brendan Zietsch and colleagues that primarily focused on the distinct question of whether common causal factors could explain the association between sexual orientation—in this study defined as sexual preference—and depression.[108] In a community sample of 9,884 adult twins, the authors found that non-heterosexuals had significantly elevated prevalence of lifetime depression (odds ratio for males 2.8; odds ratio for females 2.7). As the authors point out, the data raised questions about whether higher rates of depression for non-heterosexuals could be explained, in their entirety, by the social stress hypothesis (the idea, discussed in depth in Part Two of this report, that social stress

Table 3. Childhood Exposure to Maltreatment or Interpersonal Violence (before Age 18)

Women	Men
49.2% of lesbians	31.5% of gays
51.2% of bisexuals	Approximately 32% of bisexuals[109]
40.9% of heterosexuals with same-sex partners	27.9% of heterosexuals with same-sex partners
21.2% of heterosexuals	19.8% of heterosexuals

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experienced by sexual minorities accounts for their elevated risks of poor mental health outcomes). Heterosexuals with a non-heterosexual twin had higher rates of depression (39%) than heterosexual twin pairs (31%), suggesting that genetic, familial, or other factors may play a role.

The authors note that "in both males and females, significantly higher rates of non-heterosexuality were found in participants who experienced childhood sexual abuse and in those with a risky childhood family environment."[110] Indeed, 41% of non-heterosexual males and 42% of non-heterosexual females reported childhood family dysfunction, compared to 24% and 30% of heterosexual males and females, respectively. And 12% of non-heterosexual males and 24% of non-heterosexual females reported sexual abuse before the age of 14, compared with 4% and 11% of heterosexual males and females, respectively. The authors are careful to emphasize that their findings should not be interpreted as disproving the social stress hypothesis, but suggest that there may be other factors at work. Their findings do, however, suggest there could be common etiological factors for depression and non-heterosexual preferences, as they found that genetic factors account for 60% of the correlation between sexual orientation and depression.[111]

In a 2001 study, psychologist Marie E. Tomeo and colleagues noted that the previous literature had consistently found increased rates of reported childhood molestation in the homosexual population, with somewhere between 10% and 46% reporting that they had experienced childhood sexual abuse.[112] The authors found that 46% of homosexual men and 22% of homosexual women reported that they had been molested by a person of the same gender, as compared with 7% of heterosexual men and 1% of heterosexual women. Moreover, 38% of homosexual women interviewed did not identify as homosexual until after the abuse, while the authors report conflicting figures—68% in one part of the paper and (by inference) 32% in another—for the number of homosexual men who did not identify as homosexual until after the abuse. The sample for this study was relatively small, only 267 individuals; also, the "sexual contact" measure of abuse in the survey was somewhat vague, and the subjects were recruited from participants in gay pride events in California. But the authors state that "it is most unlikely that all the present findings apply only to homosexual persons who go to homosexual fairs and volunteer to participate in questionnaire research."[113]

In 2010, psychologists Helen Wilson and Cathy S. Widom published a prospective 30-year follow-up study—one that looked at children who had experienced abuse or neglect between 1961 and 1971, and then followed up with those children after 30 years—to ascertain whether physical abuse, sexual abuse, or neglect in childhood increased the likelihood of same-sex

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sexual relationships later in life.[114] An original sample of 908 abused and/or neglected children was matched with a non-maltreated control group of 667 individuals (matched for age, sex, race or ethnicity, and approximate socioeconomic status). Homosexuality was operationalized as anyone who had cohabited with a same-sex romantic partner or had a same-sex sexual partner, which made up 8% of the sample. Among these 8%, most individuals also reported having had opposite-sex partners, suggesting high rates of bisexuality or fluidity in sexual attractions or behaviors. The study found that those who reported histories of childhood sexual abuse were 2.8 times more likely to report having had same-sex sexual relationships, though the "relationship between childhood sexual abuse and same-sex sexual orientation was significant only for men."[115] This finding suggested that boys who are sexually abused may be more likely to establish both heterosexual and homosexual relationships.

The authors advised caution in interpreting this result, because the sample size of sexually abused men was small, but the association remained statistically significant when they controlled for total lifetime number of sexual partners and for engaging in prostitution. The study was also limited by a definition of sexual orientation that was not sensitive to how participants identified themselves. It may have failed to capture people with same-sex attractions but no same-sex romantic relationship history. The study had two notable methodological strengths. The prospective design is better suited for evaluating causal relationships than the typical retrospective design. Also, the childhood abuse recorded was documented when it occurred, thus mitigating recall bias.

Having examined the statistical association between childhood sexual abuse and later homosexuality, we turn to the question of whether the association suggests causation.

A 2013 analysis by health researcher Andrea Roberts and colleagues attempted to provide an answer to this question.[116] The authors noted that while studies show 1.6 to 4 times more reported childhood sexual and physical abuse among gay and lesbian individuals than among heterosexuals, conventional statistical methods cannot demonstrate a strong enough statistical relationship to support the argument of causation. They argued that a sophisticated statistical method called "instrumental variables," imported from econometrics and economic analysis, could increase the level of association.[117] (The method is somewhat similar to the method of "propensity scores," which is more sophisticated and more familiar to public health researchers.) The authors applied the method of instrumental variables to data collected from a nationally representative sample.

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They used three dichotomous measures of sexual orientation: any vs. no same-sex attraction; any vs. no lifetime same-sex sexual partners; and lesbian, gay, or bisexual vs. heterosexual self-identification. As in other studies, the data showed associations between childhood sexual abuse or maltreatment and all three dimensions of non-heterosexuality (attraction, partners, identity), with associations between sexual abuse and sexual identity being the strongest.

The authors' instrumental variable models suggested that early sexual abuse increased the predicted rate of same-sex attraction by 2.0 percentage points, same-sex partnering by 1.4 percentage points, and same-sex identity by 0.7 percentage points. The authors estimated the rate of homosexuality that might be attributable to sexual abuse "using effect estimates from conventional models" and found that on conventional effect estimates, "9% of same-sex attraction, 21% of any lifetime same-sex sexual partnering, and 23% of homosexual or bisexual identity was due to childhood sexual abuse."[118] We should note that these correlations are cross-sectional: they compare groups of people to groups of people, rather than model the course of individuals over time. (A study design with a time-series analysis would give the strongest statistical support to the claim of causality.) Additionally, these results have been strongly criticized on methodological grounds for having made unjustified assumptions in the instrumental variables regression; a commentary by Drew H. Bailey and J. Michael Bailey claims, "Not only do Roberts et al.'s results fail to provide support for the idea that childhood maltreatment causes adult homosexuality, the pattern of differences between males and females is opposite what should be expected based on better evidence."[119]

Roberts and colleagues conclude their study with several conjectures to explain the epidemiological associations. They echo suggestions made elsewhere that sexual abuse perpetrated by men might cause boys to think they are gay or make girls averse to sexual contact with men. They also conjecture that sexual abuse might leave victims feeling stigmatized, which in turn might make them more likely to act in ways that are socially stigmatized (as by engaging in same-sex sexual relationships). The authors also point to the biological effects of maltreatment, citing studies that show that "quality of parenting" can affect chemical and hormonal receptors in children, and hypothesizing that this might influence sexuality "through epigenetic changes, particularly in the stria terminalis and the medial amygdala, brain regions that regulate social behavior."[120] They also mention the possibilities that emotional numbing caused by maltreatment may drive victims to seek out risky behaviors associated

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with same-sex sexuality, or that same-sex attractions and partnering may result from "the drive for intimacy and sex to repair depressed, stressed, or angry moods," or from borderline personality disorder, which is a risk factor in individuals who have been maltreated.[121]

In short, while this study suggests that sexual abuse may sometimes be a causal contributor to having a non-heterosexual orientation, more research is needed to elucidate the biological or psychological mechanisms. Without such research, the idea that sexual abuse may be a causal factor in sexual orientation remains speculative.

Distribution of Sexual Desires and Changes Over Time

However sexual desires and interests develop, there is a related issue that scientists debate: whether sexual desires and attractions tend to remain fixed and unalterable across the lifespan of a person—or are fluid and subject to change over time but tend to become fixed after a certain age or developmental period. Advocates of the "born that way" hypothesis, as mentioned earlier, sometimes argue that a person is not only born with a sexual orientation but that that orientation is immutable; it is fixed for life.

There is now considerable scientific evidence that sexual desires, attractions, behaviors, and even identities can, and sometimes do, change over time. For findings in this area we can turn to the most comprehensive study of sexuality to date, the 1992 National Health and Social Life Survey conducted by the National Opinion Research Center at the University of Chicago (NORC).[122] Two important publications have appeared using data from NORC's comprehensive survey: *The Social Organization of Sexuality: Sexual Practices in the United States*, a large tome of data intended for the research community, and *Sex in America: A Definitive Survey*, a smaller and more accessible book summarizing the findings for the general public.[123] These books present data from a reliable probability sample of the American population between ages 18 and 59.

According to data from the NORC survey, the estimated prevalence of non-heterosexuality, depending on how it was operationalized, and on whether the subjects were male or female, ranged between roughly 1% and 9%.[124] The NORC studies added scientific respectability to sexual surveys, and these findings have been largely replicated in the United States and abroad. For example, the British National Survey of Sexual Attitudes and Lifestyles (Natsal) is probably the most reliable source of information on sexual behavior in that country—a study conducted every ten years since 1990.[125]

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The NORC study also suggested ways in which sexual behaviors and identities can vary significantly under different social and environmental circumstances. The findings revealed, for example, a sizable difference in rates of male homosexual behavior among individuals who spent their adolescence in rural as compared to large metropolitan cities in America, suggesting the influence of social and cultural environments. Whereas only 1.2% of males who had spent their adolescence in a rural environment responded that they had had a male sexual partner in the year of the survey, those who had spent adolescence living in metropolitan areas were close to four times (4.4%) more likely to report that they had had such an encounter.[126] From these data one cannot infer differences between these environments in the prevalence of sexual interests or attractions, but the data do suggest differences in sexual behaviors. Also of note is that women who attended college were nine times more likely to identify as lesbians than women who did not.[127]

Moreover, other population-based surveys suggest that sexual desire may be fluid for a considerable number of individuals, especially among adolescents as they mature through the early stages of adult development. In this regard, opposite-sex attraction and identity seem to be more stable than same-sex or bisexual attraction and identity. This is suggested by data from the National Longitudinal Study of Adolescent to Adult Health (the "Add Health" study discussed earlier). This prospective longitudinal study of a nationally representative sample of U.S. adolescents starting in grades 7–12 began during the 1994–1995 school year, and followed the cohort into young adulthood, with four follow-up interviews (referred to as Waves I, II, III, IV in the literature).[128] The most recent was in 2007–2008, when the sample was aged 24–32.

Same-sex or both-sex romantic attractions were quite prevalent in the study's first wave, with rates of approximately 7% for the males and 5% for the females.[129] However, 80% of the adolescent males who had reported same-sex attractions at Wave I later identified themselves as exclusively heterosexual as young adults at Wave IV.[130] Similarly, for adolescent males who, at Wave I, reported romantic attraction to both sexes, over 80% of them reported no same-sex romantic attraction at Wave III.[131] The data for the females surveyed were similar but less striking: for adolescent females who had both-sex attractions at Wave I, more than half reported exclusive attraction to males at Wave III.[132]

J. Richard Udry, the director of Add Health for Waves I, II, and III,[133] was among the first to point out the fluidity and instability of romantic attraction between the first two waves. He reported that among boys who

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reported romantic attraction *only* to boys and *never* to girls at Wave I, 48% did so during Wave II; 35% reported no attraction to either sex; 11% reported exclusively same-sex attraction; and 6% reported attraction to both sexes.[134]

Ritch Savin-Williams and Geoffrey Ream published a 2007 analysis of the data from Waves I–III of Add Health.[135] Measures used included whether individuals ever had a romantic attraction for a given sex, sexual behavior, and sexual identity. (The categories for sexual identity were 100% heterosexual, mostly heterosexual but somewhat same-sex attracted, bisexual, mostly homosexual but somewhat attracted to opposite sex, and 100% homosexual.) While the authors noted the "stability of opposite-sex attraction and behavior" between Waves I and III, they found a "high proportion of participants with same- and both-sex attraction and behavior that migrated into opposite-sex categories between waves."[136] A much smaller proportion of those in the heterosexual categories, and a similar proportion of those without attraction, moved to non-heterosexual categories. The authors summarize: "All attraction categories other than opposite-sex were associated with a lower likelihood of stability over time. That is, individuals reporting any same-sex attractions were more likely to report subsequent shifts in their attractions than were individuals without any same-sex attractions."[137]

The authors also note the difficulties these data present for trying to define sexual orientation and to classify individuals according to such categories: "the critical consideration is whether having 'any' same-sex sexuality qualifies as nonheterosexuality. How much of a dimension must be present to tip the scales from one sexual orientation to another was not resolved with the present data, only that such decisions matter in terms of prevalence rates."[138] The authors suggested that researchers could "forsake the general notion of sexual orientation altogether and assess only those components relevant for the research question."[139]

Another prospective study by biostatistician Miles Ott and colleagues of 10,515 youth (3,980 males; 6,535 females) in 2013 showed findings on sexual orientation change in adolescents consistent with the findings of the Add Health data, again suggesting fluidity and plasticity of same-sex attractions among many adolescents.[140]

A few years after the Add Health data were originally published, the *Archives of Sexual Behavior* published an article by Savin-Williams and Joyner that critiqued the Add Health data on sexual attraction change.[141] Before outlining their critique, Savin-Williams and Joyner summarize the key Add Health findings: "in the approximately 13 years between Waves

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I and IV, regardless of whether the measure was identical across waves (romantic attraction) or discrepant in words but not in theory (romantic attraction and sexual orientation identity), approximately 80% of adolescent boys and half of adolescent girls who expressed either partial or exclusive same-sex romantic attraction at Wave I 'turned' heterosexual (opposite-sex attraction or exclusively heterosexual identity) as young adults."[142] The authors propose three hypotheses to explain these discrepancies:

> (1) gay adolescents going into the closet during their young adult years; (2) confusion regarding the use and meaning of romantic attraction as a proxy for sexual orientation; and (3) the existence of mischievous adolescents who played a 'jokester' role by reporting same-sex attraction when none was present.[143]

Savin-Williams and Joyner reject the first hypothesis but find support for the second and the third. With respect to the second hypothesis, they question the use of romantic attraction to operationalize sexual identity:

> To help us assess whether the construct/measurement issue (romantic attraction versus sexual orientation identity) was driving results, we compared the two constructs at Wave IV.... Whereas over 99% of young adults with opposite-sex romantic attraction identified as heterosexual or mostly heterosexual and 94% of those with same-sex romantic attraction identified as homosexual or mostly homosexual, 33% of both-sex attracted men identified as heterosexual (just 6% of both-sex attracted women identified as heterosexual). These data indicated that young adult men and women generally understood the meaning of romantic attraction to the opposite- or same-sex to imply a particular (and consistent) sexual orientation identity, with one glaring exception—a substantial subset of young adult men who, despite their stated both-sex romantic attraction, identified as heterosexual.

Regarding the third hypothesis for explaining the Add Health data, Savin-Williams and Joyner note that surveys of adolescents sometimes yield unusual or distorted results due to adolescents who do not respond truthfully. The Add Health survey, they observe, had a significant number of unusual responders. For example, several hundred adolescents reported in the Wave I questionnaire that they had an artificial limb, whereas in later at-home interviews, only two of those adolescents reported having an artificial limb.[144] Adolescent boys who went from nonheterosexual in Wave I to heterosexual in Wave IV were significantly less likely to report

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having filled out the Wave I questionnaire honestly; these boys also displayed other significant differences, such as lower grade point averages. Additionally, like consistently heterosexual boys, boys who were inconsistent between Waves I and IV were more popular in their school with boys than girls, whereas consistently nonheterosexual boys were more popular with girls. These and other data[145] led the authors to conclude that "boys who emerged from a gay or bisexual adolescence to become a heterosexual young adulthood were, by-and-large, heterosexual adolescents who were either confused and did not understand the measure of romantic attraction or jokesters who decided, for reasons we were not able to detect, to dishonestly report their sexuality."[146] However, the authors were not able to estimate the proportion of inaccurate responders, which would have helped evaluate the explanatory power of the hypotheses.

Later in 2014, the *Archives of Sexual Behavior* published a critique of the Savin-Williams and Joyner explanation of Add Health data by psychologist Gu Li and colleagues.[147] Along with criticizing the methodology of Savin-Williams and Joyner, these authors argued that the data were consistent with a scenario in which some nonheterosexual adolescents went "back into the closet" in later years as a possible reaction to social stress. (We will examine the effects of social stress on mental health in LGBT populations in Part Two of this report.) They also claimed that "it makes little sense to use responses to Wave IV sexual identity to validate or invalidate responses to Waves I or IV romantic attractions when these aspects of sexual orientation may not align in the first place."[148] Regarding the jokester hypothesis, these authors pose this difficulty: "Although some participants might be 'jokesters,' and we as researchers should be cautious of problems associated with self-report surveys whenever analyzing and interpreting data, it is unclear why the 'jokesters' would answer questions about delinquency honestly, but not questions about their sexual orientation."[149]

Savin-Williams and Joyner published a response to the critique in the same issue of the journal.[150] Responding to the criticism that their comparison of Wave IV self-reported sexual identity to Wave I self-reported romantic attractions was unsound, Savin-Williams and Joyner claimed that the results were quite similar if one used attraction as the Wave IV measure. They also deemed it highly unlikely that a large proportion of the respondents who were classified as nonheterosexuals in Wave I and heterosexuals in Wave IV went "back into the closet," because the proportion of individuals in adolescence and young adulthood who are "out of the closet" usually increases over time.[151]

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The following year, the *Archives of Sexual Behavior* published another response to Savin-Williams and Joyner by psychologist Sabra Katz-Wise and colleagues, which argued that Savin-Williams and Joyner's "approach to identifying 'dubious' sexual minority youth is inherently flawed."[152] They wrote that "romantic attraction and sexual orientation identity are two distinct dimensions of sexual orientation that may not be concordant, even at a single time point."[153] They also claimed that "even if Add Health had assessed the same facets of sexual orientation at all waves, it would still be incorrect to infer 'dubious' sexual minorities from changes on the same dimension of sexual orientation, because these changes may reflect sexual fluidity."[154]

Unfortunately, the Add Health study does not appear to contain the data that would allow an assessment to determine which, if any, of these interpretations is likely to be correct. It may well be the case that a combination of factors contributed to the differences between the Wave I and Wave IV data. For example, there may have been some adolescents who responded to the Wave I sexual attraction questions inaccurately, some openly nonheterosexual adolescents who later went "back into the closet," and some adolescents who experienced nonheterosexual attractions before Wave I that largely disappeared by Wave IV. Other prospective study designs that track specific individuals across adolescent and adult development may shed further light on these issues.

While ambiguities in defining and characterizing sexual desire and orientation make changes in sexual desire difficult to study, data from these large, population-based national studies of randomly sampled individuals do suggest that all three dimensions of sexuality—affect, behavior, and identity—may change over time for some people. It is unclear, and current research does not address, whether and to what extent factors subject to volitional control—choice of sexual partners or sexual behaviors, for example—may influence such changes through conditioning and other mechanisms that are characterized in the behavioral sciences.

Several researchers have suggested that sexual orientation and attractions may be especially plastic for women.[155] For example, Lisa Diamond argued in her 2008 book *Sexual Fluidity* that "women's sexuality is fundamentally more fluid than men's, permitting greater variability in its development and expression over the life course," based on research by her and many others.[156]

Diamond's longitudinal five-year interviews of women in sexual relationships with other women also shed light on the problems with the concept of sexual orientation. In many cases, the women in her study

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reported not so much setting out to form a lesbian sexual relationship but rather experiencing a gradual growth of affective intimacy with a woman that eventually led to sexual involvement. Some of these women rejected the labels of "lesbian," "straight," or "bisexual" as being inconsistent with their lived experience.[157] In another study, Diamond calls into question the utility of the concept of sexual orientation, especially as it applies to females.[158] She points out that if the neural basis of parent-child attachment—including attachment to one's mother—forms at least part of the basis for romantic attachments in adulthood, then it would not be surprising for a woman to experience romantic feelings for another woman without necessarily wanting to be sexually intimate with her. Diamond's research indicates that these kinds of relationships form more often than we typically recognize, especially among women.

Some researchers have also suggested that men's sexuality is more fluid than it was previously thought. For example, Diamond presented a 2014 conference paper, based on initial results from a survey of 394 people, entitled "I Was Wrong! Men Are Pretty Darn Sexually Fluid, Too!"[159] Diamond based this conclusion on a survey of men and women between the ages of 18 and 35, which asked about their sexual attractions and self-described identities at different stages of their lives. The survey found that 35% of self-identified gay men reported experiencing opposite-sex attractions in the past year, and 10% of self-identified gay men reported opposite-sex sexual behavior during the same period. Additionally, nearly as many men transitioned at some time in their life from gay to bisexual, queer, or unlabeled identity as did men from bisexual to gay identity.

In a 2012 review article entitled "Can We Change Sexual Orientation?" published in the *Archives of Sexual Behavior*, psychologist Lee Beckstead wrote, "Although their sexual behavior, identity, and attractions may change throughout their lives, this may not indicate a change in sexual orientation…but a change in awareness and an expansion of sexuality."[160] It is difficult to know how to interpret this claim—that sexual behavior, identity, and attractions may change but that this does not necessarily indicate a change in sexual orientation. We have already analyzed the inherent difficulties of defining sexual orientation, but however one chooses to define this construct, it seems that the definition would somehow be tied to sexual behavior, identity, or attraction. Perhaps we can take Beckstead's claim here as one more reason to consider dispensing with the construct of sexual orientation in the context of social science research, as it seems that whatever it might represent, it is only loosely or inconsistently tied to empirically measurable phenomena.

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Given the possibility of changes in sexual desire and attraction, which research suggests is not uncommon, any attempt to infer a stable, innate, and fixed identity from a complex and often shifting mélange of inner fantasies, desires, and attractions—sexual, romantic, aesthetic, or otherwise—is fraught with difficulties. We can imagine, for example, a sixteen-year-old boy who becomes infatuated with a young man in his twenties, developing fantasies centered around the other's body and build, or perhaps on some of his character traits or strengths. Perhaps one night at a party the two engage in physical intimacy, catalyzed by alcohol and by the general mood of the party. This young man then begins an anguished process of introspection and self-exploration aimed at finding the answer to the enigmatic question, "Does this mean I'm gay?"

Current research from the biological, psychological, and social sciences suggests that this question, at least as it is framed, makes little sense. As far as science can tell us, there is nothing "there" for this young man to discover—no fact of nature to uncover or to find buried within himself. What his fantasies, or his one-time liaison, "really mean" is subject to any number of interpretations: that he finds the male figure beautiful, that he was lonely and feeling rejected the night of the party and responded to his peer's attentions and affections, that he was intoxicated and influenced by the loud music and strobe lights, that he does have a deep-seated sexual or romantic attraction to other men, and so on. Indeed, psychodynamic interpretations of such behaviors citing unconscious motivational factors and inner conflicts, many of them interesting, most impossible to prove, can be spun endlessly.

What we can say with more confidence is that this young man had an experience encompassing complex feelings, or that he engaged in a sexual act conditioned by multiple complex factors, and that such fantasies, feelings, or associated behaviors may (or may not) be subject to change as he grows and develops. Such behaviors could become more habitual with repetition and thus more stable, or they may extinguish and recur rarely or never. The research on sexual behaviors, sexual desire, and sexual identity suggests that both trajectories are real possibilities.

Conclusion

The concept of sexual orientation is unusually ambiguous compared to other psychological traits. Typically, it refers to at least one of three things: attractions, behaviors, or identity. Additionally, we have seen that sexual orientation often refers to several other things as well: belonging

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to a certain community, fantasies (as distinct in some respects from attractions), longings, strivings, felt needs for certain forms of companionship, and so on. It is important, then, that researchers are clear about which of these domains are being studied, and that we keep in mind the researchers' specified definitions when we interpret their findings.

Furthermore, not only can the term "sexual orientation" be understood in several different senses, most of the senses are themselves complex concepts. Attraction, for example, could refer to arousal patterns, or to romantic feelings, or to desires for company, or other things; and each of these things can be present either sporadically and temporarily or pervasively and long-term, either exclusively or not, either in a deep or shallow way, and so forth. For this reason, even specifying one of the basic senses of orientation (attraction, behavior, or identity) is insufficient for doing justice to the richly varied phenomenon of human sexuality.

In this part we have criticized the common assumption that sexual *desires*, *attractions*, or *longings* reveal some innate and fixed feature of our biological or psychological constitution, a fixed sexual *identity* or *orientation*. Furthermore, we may have some reasons to doubt the common assumption that in order to live happy and flourishing lives, we must somehow discover this innate fact about ourselves that we call *sexuality* or *sexual orientation*, and invariably express it through particular patterns of sexual behavior or a particular life trajectory. Perhaps we ought instead to consider what sorts of behaviors—whether in the sexual realm or elsewhere—tend to be conducive to health and flourishing, and what kinds of behaviors tend to undermine a healthy and flourishing life.

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Part Two

Sexuality, Mental Health Outcomes, and Social Stress

Compared to the general population, non-heterosexual and transgender subpopulations have higher rates of mental health problems such as anxiety, depression, and suicide, as well as behavioral and social problems such as substance abuse and intimate partner violence. The prevailing explanation in the scientific literature is the social stress model, which posits that social stressors—such as stigmatization and discrimination—faced by members of these subpopulations account for the disparity in mental health outcomes. Studies show that while social stressors do contribute to the increased risk of poor mental health outcomes for these populations, they likely do not account for the entire disparity.

Many of the issues surrounding sexual orientation and gender identity remain controversial among researchers, but there is general agreement on the observation at the heart of Part Two: lesbian, gay, bisexual, and transgender (LGBT) subpopulations are at higher risk, compared to the general population, of numerous mental health problems. Less certain are the causes of that increased risk and thus the social and clinical approaches that may help to ameliorate it. In this part we review some of the research documenting the increased risk, focusing on papers that are data-based with sound methodology, and that are widely cited in the scientific literature.

A robust and growing body of research examines the relationships between sexuality or sexual behaviors and mental health status. The first half of this part discusses the associations of sexual identities or behaviors with psychiatric disorders (such as mood disorders, anxiety disorders, and adjustment disorders), suicide, and intimate partner violence. The second half explores the reasons for the elevated risks of these outcomes among non-heterosexual and transgender populations, and considers what social science research can tell us about one of the most prevalent ways of explaining these risks, the social stress model. As we will see, social stressors such as harassment and stigma likely explain some but not all of the elevated mental health risks for these populations. More research

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is needed to understand the causes of and potential solutions for these important clinical and public health issues.

Some Preliminaries

We turn first to the evidence for the statistical links between sexual identities or behaviors and mental health outcomes. Before summarizing the relevant research, we should mention the criteria used in selecting the studies reviewed. In an attempt to distill overall findings of a large body of research, each section begins by summarizing the most extensive and reliable meta-analyses—papers that compile and analyze the statistical data from the published research literature. For some areas of research, no comprehensive meta-analyses have been conducted, and in these areas we rely on review articles that summarize the research literature without going into quantitative analyses of published data. In addition to reporting these summaries, we also discuss a few select studies that are of particular value because of their methodology, sample size, controls for confounding factors, or ways in which concepts such as heterosexuality or homosexuality are operationalized; and we discuss key studies published after the meta-analyses or review articles were published.

As we showed in Part One, explaining the exact biological and psychological origins of sexual desires and behaviors is a difficult scientific task, one that has not yet been and may never be satisfactorily completed. However, researchers can study the correlations between sexual behavior, attraction, or identity and mental health outcomes, though there may be—and often are found to be—differences between how sexual behavior, attraction, and identity relate to particular mental health outcomes. Understanding the scope of the health challenges faced by individuals who engage in particular sexual behaviors or experience certain sexual attractions is a necessary step in providing these individuals with the care they need.

Sexuality and Mental Health

In a 2008 meta-analysis of research on mental health outcomes for non-heterosexuals, University College London professor of psychiatry Michael King and colleagues concluded that gays, lesbians, and bisexuals face "higher risk of suicidal behaviour, mental disorder and substance misuse and dependence than heterosexual people."[1] This survey of the literature examined papers published between January 1966 and April 2005 with data from 214,344 heterosexual and 11,971 non-heterosexual individuals.

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The large sample size allowed the authors to generate estimates that are highly reliable, as indicated by the relatively small confidence intervals.[2]

Compiling the risk ratios found in these papers, the authors estimated that lesbian, gay, and bisexual individuals had a 2.47 times higher lifetime risk than heterosexuals for suicide attempts,[3] that they were about twice as likely to experience depression over a twelve-month period,[4] and approximately 1.5 times as likely to experience anxiety disorders.[5] Both non-heterosexual men and women were found to be at an elevated risk for substance abuse problems (1.51 times as likely),[6] with the risk for non-heterosexual women especially high—3.42 times higher than for heterosexual women.[7] Non-heterosexual men, on the other hand, were at a particularly high risk for suicide attempts: while non-heterosexual men and women together were at a 2.47 times greater risk of suicide attempts over their lifetimes, non-heterosexual men were found to be at a 4.28 times greater risk.[8]

These findings have been replicated in other studies, both in the United States and internationally, confirming a consistent and alarming pattern. However, there is considerable variation in the estimates of the increased risks of various mental health problems, depending on how researchers define terms such as "homosexual" or "non-heterosexual." The findings from a 2010 study by Northern Illinois University professor of nursing and health studies Wendy Bostwick and colleagues examined associations of sexual orientation with mood and anxiety disorders among men and women who either identified as gay, lesbian, or bisexual, or who reported engaging in same-sex sexual behavior, or who reported feeling same-sex attractions. The study employed a large, U.S.-based random population sample, using data collected from the 2004–2005 wave of the National Epidemiologic Survey on Alcohol and Related Conditions, which was based on 34,653 interviews.[9] In its sample, 1.4% of respondents identified as lesbian, gay, or bisexual; 3.4% reported some lifetime same-sex sexual behavior; and 5.8% reported non-heterosexual attractions.[10]

Women who identified as lesbian, bisexual, or "not sure" reported higher rates of lifetime mood disorders than women who identified as heterosexual: the prevalence was 44.4% in lesbians, 58.7% in bisexuals, and 36.5% in women unsure of their sexual identity, as compared to 30.5% in heterosexuals. A similar pattern was found for anxiety disorders, with bisexual women experiencing the highest prevalence, followed by lesbians and those unsure, and heterosexual women experiencing the lowest prevalence. Examining the data for women with different sexual *behavior* or sexual *attraction* (rather than identity), those reporting sexual behavior

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with or attractions to both men and women had a higher rate of lifetime disorders than women who reported exclusively heterosexual or homosexual behaviors or attractions, and women reporting exclusive same-sex sexual behavior or exclusive same-sex attraction in fact had the *lowest* rates of lifetime mood and anxiety disorders.[11]

Men who identified as gay had more than double the prevalence of lifetime mood disorders compared to men who identified as heterosexual (42.3% vs. 19.8%), and more than double the rate of any lifetime anxiety disorder (41.2% vs. 18.6%), while those who identified as bisexual had a slightly lower prevalence of mood disorders (36.9%) and anxiety disorders (38.7%) than gay men. When looking at sexual attraction or behavior for men, those who reported sexual attraction to "mostly males" or sexual behavior with "both females and males" had the highest prevalence of lifetime mood disorders and anxiety disorders compared to other groups, while those reporting exclusively heterosexual attraction or behavior had the lowest prevalence of any group.

Other studies have found that non-heterosexual populations are at a higher risk of physical health problems in addition to mental health problems. A 2007 study by UCLA professor of epidemiology Susan Cochran and colleagues examined data from the California Quality of Life Survey of 2,272 adults to assess links between sexual orientation and self-reported physical health status, health conditions, and disability, as well as psychological distress among lesbians, gay men, bisexuals, and those they classified as "homosexually experienced heterosexual individuals."[12] While the study, like most, was limited by the use of self-reporting of health conditions, it had several strengths: it studied a population-based sample; it separately measured identity and behavioral dimensions of sexual orientation; and it controlled for race (ethnicity), education, relationship status, and family income, among other factors.

While the authors of this study found a number of health conditions that appeared to have elevated prevalence among non-heterosexuals, after adjusting for demographic factors that are potential confounders the only group with significantly greater prevalence of non-HIV physical health conditions was bisexual women, who were more likely to have health problems than heterosexual women. Consistent with the 2010 study by Bostwick and colleagues, higher rates of psychological stress were reported by lesbians, bisexual women, gay men, and homosexually experienced heterosexual men, both before and after adjusting for demographic confounding. Among men, self-identified gay and homosexually experienced heterosexual respondents reported the highest rates of several health problems.

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Using the same California Quality of Life Survey, a 2009 study by UCLA professor of psychiatry and biobehavioral sciences Christine Grella and colleagues (including Cochran) examined the relationship between sexual orientation and receiving treatment for substance use or mental disorders.[13] They used a population-based sample, with sexual minorities oversampled to provide more statistical power to detect group differences. The usage of treatment was classified according to whether or not respondents reported receiving treatment in the preceding twelve months for "emotional, mental health, alcohol or other drug problems." Sexual orientation was operationalized by a combination of behavioral history and self-identification. For example, they grouped together as "gay/bisexual" or "lesbian/bisexual" both those who identified as gay, lesbian, or bisexual, and those who had reported same-sex sexual behaviors. They found that women who were lesbian or bisexual were most likely to have received treatment, followed by men who were gay or bisexual, then heterosexual women, with heterosexual men being the least likely group to have reported receiving treatment. Overall, more than twice as many LGB individuals, compared to heterosexuals, had reported receiving treatment in the past twelve months (48.5% compared to 22.5%). The pattern was similar for men and women; 42.5% of homosexual men, compared to 17.1% of heterosexual men, had reported receiving treatment, while 55.3% of lesbian and bisexual women and 27.1% of heterosexual women reported receiving treatment. (Bostwick and colleagues had found that women with exclusively same-sex attractions and behaviors had a lower prevalence of mood and anxiety disorders compared to heterosexual women. The difference in results could be due to the fact that Grella and colleagues grouped those who identified as lesbians together with those who identified as bisexuals or who reported same-sex sexual behavior.)

A 2006 study by Columbia University psychiatry professor Theodorus Sandfort and colleagues examined a representative, population-based sample from the second Dutch National Survey of General Practice, carried out in 2001, to assess links between self-reported sexual orientation and health status among 9,511 participants, of whom 0.9% were classified as bisexual and 1.5% as gay or lesbian.[14] To operationalize sexual orientation, the researchers asked respondents about their sexual preference on a 5-point scale: exclusively women, predominantly women, equally men and women, predominantly men, and exclusively men. Only those who reported an equal preference for men and women were classified as bisexual, while men reporting predominant preferences for women, or women reporting a predominant preference for men were classified as heterosexual. They

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found that gay, lesbian, and bisexual respondents reported experiencing higher numbers of acute mental health problems and reported worse general mental health than heterosexuals. The results for physical health were mixed, however: lesbian and gay respondents reported experiencing more acute physical symptoms (such as headaches, back pain, or sore throats) over the past fourteen days, though they did not report experiencing two or more such symptoms any more than heterosexuals.

Lesbian and gay respondents were more likely to report chronic health problems, though bisexual men (that is, men who reported an equal sexual preference for men and women) were less likely to report chronic health problems and bisexual women were no more likely than heterosexual women to do so. The researchers did not find a statistically significant relationship between sexual orientation and overall physical health. After controlling for the possible confounding effects of mental health problems on the reporting of physical health problems, the researchers also found that the statistical effect of reporting a gay or lesbian sexual preference on chronic and acute physical conditions disappeared, though the effect of bisexual preference remained.

The Sandfort study defined sexual orientation in terms of preference or attraction without reference to behavior or self-identification, which makes it a challenge to compare its results to the results of studies that operationalize sexual orientation differently. For example, it is difficult to compare the findings of this study regarding bisexuals (defined as men or women who report an equal sexual preference for men and women) with the findings of other studies regarding "homosexually experienced heterosexual individuals" or those who are "unsure" of their sexual identity. As in most of these types of studies, the health assessments were self-reported, which may make the results somewhat unreliable. But this study also has several strengths: it used a large and representative sample of a country's population, as opposed to the convenience samples that are sometimes used for these kinds of studies, and this sample included a sufficient number of gays and lesbians for their data to be treated in separate groups in the study's statistical analyses. Only three people in the sample reported HIV infection, so this did not appear to be a potential confounding factor, though HIV could have been underreported.

In an effort to summarize findings in this area, we can cite the 2011 report from the Institute of Medicine (IOM), *The Health of Lesbian, Gay, Bisexual, and Transgender People.*[15] This report is an extensive review of scientific literature citing hundreds of studies that examine the health status of LGBT populations. The authors are scientists who are well versed

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in these issues (although we wish there had been more involvement of experts in psychiatry). The report reviews findings on physical and mental health in childhood, adolescence, early and middle adulthood, and late adulthood. Consistent with the studies cited above, this report reviews evidence showing that, compared with heterosexual youth, LGB youth are at a higher risk of depression, as well as suicide attempts and suicidal ideation. They are also more likely to experience violence and harassment and to be homeless. LGB individuals in early or middle adulthood are more prone to mood and anxiety disorders, depression, suicidal ideation, and suicide attempts.

The IOM report shows that, like LGB youth, LGB adults—and women in particular—appear to be likelier than heterosexuals to smoke, use or abuse alcohol, and abuse other drugs. The report cites a study[16] that found that self-identified non-heterosexuals used mental health services more often than heterosexuals, and another[17] that found that lesbians used mental health services at higher rates than heterosexuals.

The IOM report notes that "more research has focused on gay men and lesbians than on bisexual and transgender people."[18] The relatively few studies focusing on transgender populations show high rates of mental disorders, but the use of nonprobability samples and the lack of non-transgender controls call into question the validity of the studies.[19] Although some studies have suggested that the use of hormone treatments may be associated with negative physical health outcomes among transgender populations, the report notes that the relevant research has been "limited" and that "no clinical trials on the subject have been conducted."[20] (Health outcomes for transgender individuals will be further discussed below in this part and also in Part Three.)

The IOM report claims that the evidence that LGBT populations have worse mental and physical health outcomes is not fully conclusive. To support this claim, the IOM report cites a 2001 study[21] of mental health in 184 sister pairs in which one sister was lesbian and the other heterosexual. The study found no significant differences in rates of mental health problems, and found significantly higher self-esteem in the lesbian sisters. The IOM report also cites a 2003 study[22] that found no significant differences between heterosexual and gay or bisexual men in general happiness, perceived health, and job satisfaction. Acknowledging these caveats and the studies that do not support the general trend, the vast majority of studies cited in the report point to a generally higher risk of poor mental health status in LGBT populations compared to heterosexual populations.

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Sexuality and Suicide

The association between sexual orientation and suicide has strong scientific support. This association merits particular attention, since among all the mental health risks, the increased risk of suicide is the most concerning, owing in part to the fact that the evidence is robust and consistent, and in part to the fact that suicide is so devastating and tragic for the person, family, and community. A better understanding of the risk factors for suicide could allow us, quite literally, to save lives.[23]

Sociologist and suicide researcher Ann Haas and colleagues published an extensive review article in 2011 based on the results of a 2007 conference sponsored by the Gay and Lesbian Medical Association, the American Foundation for Suicide Prevention, and the Suicide Prevention Resource Center.[24] They also examined studies reported since the 2007 conference. For the purposes of their report, the authors defined sexual orientation as "sexual self-identification, sexual behavior, and sexual attraction or fantasy."[25]

Haas and colleagues found the association between homosexual or bisexual orientation and suicide attempts to be well supported by data. They noted that population-based surveys of U.S. adolescents since the 1990s indicate that suicide attempts are two to seven times more likely in high school students who identify as LGB, with sexual orientation being a stronger predictor in males than females. They reviewed data from New Zealand that suggested that LGB individuals were six times more likely to have attempted suicide. They cited health-related surveys of U.S. men and Dutch men and women showing same-sex behavior linked to higher risk of suicide attempts. Studies cited in the report show that lesbian or bisexual women are likelier, on average, to experience suicidal ideation, that gay or bisexual men are more likely, on average, to attempt suicide, and that lifetime suicide attempts among non-heterosexuals are greater in men than in women.

Examining studies that looked at rates of mental disorders in relation to suicidal behavior, Haas and colleagues discussed a New Zealand study[26] showing that gay people reporting suicide attempts had higher rates of depression, anxiety, and conduct disorder. Large-scale health surveys suggested that rates of substance abuse are up to one third higher for the LGB subpopulation. Combined worldwide studies showed up to 50% higher rates of mental disorders and substance abuse among persons self-identifying in surveys as lesbian, gay, or bisexual. Lesbian or bisexual women showed higher levels of substance abuse, while gay or bisexual men had higher rates of depression and panic disorder.

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Haas and colleagues also examined transgender populations, noting that scant information is available about transgender suicides but that the existing studies indicate a dramatic increased risk of completed suicide. (These findings are noted here but examined in more detail in Part Three.) A 1997 clinical study[27] estimated elevated risks of suicide for Dutch male-to-female transsexual individuals on hormone therapy, but found no significant differences in overall mortality. A 1998 international review of 2,000 persons receiving sex-reassignment surgery identified 16 possible suicides, an "alarmingly high rate of 800 suicides for every 100,000 post-surgery transsexuals."[28] In a 1984 study, a clinical sample of transgender individuals requesting sex-reassignment surgery showed suicide attempt rates between 19% and 25%.[29] And a large sample of 40,000 mostly U.S. volunteers completing an Internet survey in 2000 found transgender persons to report higher rates of suicide attempts than any group except lesbians.[30]

Finally, the review by Haas and colleagues suggests that it is not clear which aspects of sexuality (identity, attraction, behavior) are most closely linked with the risk of suicidal behavior. The authors cite a 2010 study[31] showing that adolescents identifying as heterosexual while reporting same-sex attraction or behavior did not have significantly higher suicide rates than other self-identified heterosexuals. They also cite the large national survey of U.S. adults conducted by Wendy Bostwick and colleagues (discussed earlier),[32] which showed mood and anxiety disorders—key risk factors for suicidal behavior—more closely related to sexual self-identity than to behavior or attraction, especially for women.

A more recent critical review of existing studies of suicide risk and sexual orientation was presented by Austrian clinical psychologist Martin Plöderl and colleagues.[33] This review rejects several hypotheses developed to account for the increased suicide risk among non-heterosexuals, including biases in self-reporting and failures to measure suicide attempts accurately. The review argues that methodological improvements in studies since 1997 have provided control groups, better representativeness of study samples, and more clarity in defining both suicide attempts and sexual orientation.

The review mentions a 2001 study[34] by Ritch Savin-Williams, a Cornell University professor of developmental psychology, that reported no statistically significant difference between heterosexual and LGB youths after eliminating false-positive reports of suicide attempts and blaming a "'suffering suicidal' script" for leading to an over-reporting of suicidal behavior among gay youths. Plöderl and colleagues argue, however, that

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the Savin-Williams study's finding that there was no statistically significant difference between the suicide rates of LGB and heterosexual youths might be attributable to the small sample size, which yielded low statistical power.[35] The later work has not replicated this finding. Subsequent questionnaire or interview-based studies with stricter definitions of suicide attempts have found significantly increased rates of suicide attempts among non-heterosexuals. Several large-scale surveys of young people have found that the elevated risk of reported suicidal behavior increased with the severity of the attempts.[36] Finally, according to Plöderl and colleagues, comparing results of questionnaires with clinical interviews indicates that homosexual youth are less likely to over-report suicide attempts in surveys than heterosexual youth.

Plöderl and colleagues concluded that among psychiatric patients, homosexual or bisexual populations are over-represented in "serious suicide attempts," and that sexual orientation is one of the strongest predictors of suicide. Similarly, in nonclinical population-based studies, non-heterosexual status is found to be one of the strongest predictors of suicide attempts. The authors note:

> The most exhaustive collation of published and unpublished international studies on the association of suicide attempts and sexual orientation with different methodologies has produced a very consistent picture: nearly all studies found increased incidences of self-reported suicide attempts among sexual minorities.[37]

In acknowledging the challenges of all such research, the authors suggest that "the major problem remains as to where one draws the line between a heterosexual or non-heterosexual orientation."[38]

A 1999 study by Richard Herrell and colleagues analyzed 103 middle-aged male twin pairs from the Vietnam Era Twin Registry in Hines, Illinois, in which one twin, but not the other, reported having a male sex partner after the age of 18.[39] The study adopted several measures of suicidality and controlled for potential confounding factors such as substance abuse or depression. It found a "substantially increased lifetime prevalence of suicidal symptoms" in male twins who had sex with men compared with co-twins who did not, independent of the potential confounding effects of drug and alcohol abuse.[40] Though it is a relatively small study and relied on self-reporting for both same-sex behaviors and suicidal thoughts or behaviors, it is notable for using a probability sample (which eliminates selection bias), and for using the co-twin control method (which reduces the effects of genetics, age, race, and the like).

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The study looked at middle-aged men; what the implications might be for adolescents is not clear.

In a 2011 study, Robin Mathy and colleagues analyzed the impact of sexual orientation on suicide rates in Denmark during the first twelve years after the legalization of same-sex registered domestic partnerships (RDPs) in that country, using data from death certificates issued between 1990 and 2001 as well as Danish census population estimates.[41] The researchers found that the age-adjusted suicide rate for same-sex RDP men was nearly eight times the rate for men in heterosexual marriages, and nearly twice the rate for men who had never married. For women, RDP status had a small, statistically insignificant effect on suicide mortality risk, and the authors conjectured that the impact of HIV status on the health of gay men might have contributed to this difference between the results for men and women. The study is limited by the fact that RDP status is an indirect measure of sexual orientation or behavior, and does not include those gays and lesbians who are not in a registered domestic partnership; the study also excluded individuals under the age of 18. Finally, the absolute number of individuals with current or past RDP status was relatively small, which may limit the study's conclusions.

Professor of pediatrics Gary Remafedi and colleagues published a 1991 study that looked at 137 males age 14–21 who self-identified as gay (88%) or bisexual (12%). Remafedi and colleagues attempted, with a case-controlled approach, to examine which factors for this population were most predictive of suicide.[42] Compared to those who did not attempt suicide, those who did were significantly more likely to label themselves and identify publicly as bisexual or homosexual at younger ages, report sexual abuse, and report illicit drug use. The authors noted that the likelihood of a suicide attempt "diminished with advancing age at the time of bisexual or homosexual self-labeling." Specifically, "with each year's delay in self-identification, the odds of a suicide attempt declined by more than 80%."[43] This study is limited by using a relatively small nonprobability sample, though the authors note that its result comports with their previous finding[44] of an inverse relationship between psychosocial problems and the age at which one identifies as homosexual.

In a 2010 study, Plöderl and colleagues solicited self-reported suicide attempts among 1,382 Austrian adults to confirm existing evidence that homosexual and bisexual individuals are at higher risk.[45] To sharpen the results, the authors developed more rigorous definitions of "suicide attempts" and assessed multiple dimensions of sexual orientation, distinguishing among sexual fantasies, preferred partners, self-identification,

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recent sexual behavior, and lifetime sexual behavior. This study found an increased risk for suicide attempts for sexual minorities along all dimensions of sexual orientation. For women, the risk increases were largest for those with homosexual behaviors; for men, they were largest for homosexual or bisexual behavior in the previous twelve months and self-identification as homosexual or bisexual. Those reporting being unsure of their identity reported the highest percentage of suicide attempts (44%), although this group was small, comprising less than 1% of participants.

A 2016 meta-analysis by University of Toronto graduate student Travis Salway Hottes and colleagues aggregated data from thirty cross-sectional studies on suicide attempts that together included 21,201 sexual minority adults.[46] These studies used either population-based sampling or community-based sampling. Since each sampling method has its own strengths and potential biases,[47] the researchers wanted to examine any differences in the rates of attempted suicide between the two sampling types. Of the LGB respondents to population-based surveys, 11% reported having attempted suicide at least once, compared to 4% of heterosexual respondents to these surveys.[48] Of the LGB respondents to community-based surveys, 20% reported having attempted suicide.[49] Statistical analysis showed that the difference in the sampling methods accounted for 33% of the variation in the suicide figures reported by the studies.

The research on sexuality and the risk of suicide suggests that those who identify as gay, lesbian, bisexual, or transgender, or those who experience same-sex attraction or engage in same-sex sexual behavior are at substantially increased risk of suicidal ideation, suicide attempts, and completed suicide. In the section later in Part Two on the social stress model, we will examine—and raise questions about—one set of arguments put forward to explain these findings. Given the tragic consequences of inadequate or incomplete information in these matters and its effect on public policy and clinical care, more research into the reasons for elevated suicide risk among sexual minorities is desperately needed.

Sexuality and Intimate Partner Violence

Several studies have examined the differences between rates of intimate partner violence (IPV) in same-sex couples and opposite-sex couples. The research literature examines rates of IPV *victimization* (being subjected to violence by a partner) and rates of IPV *perpetration* (committing violence against a partner). In addition to physical and sexual violence, some studies also examine psychological violence, which comprises verbal attacks,

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threats, and similar forms of abuse. The weight of evidence indicates that the rate of intimate partner violence is significantly higher among same-sex couples.

In 2014, London School of Hygiene and Tropical Medicine researcher Ana Buller and colleagues conducted a systematic review of 19 studies (with a meta-analysis of 17 of these studies) examining associations between intimate partner violence and health among men who have sex with men.[50] Combining the available data, they found that the pooled lifetime prevalence of any IPV was 48% (estimates from the studies were quite heterogeneous, ranging from 32% to 82%). For IPV within the previous five years, pooled prevalence was 32% (estimates ranging from 16% to 51%). IPV victimization was associated with increased rates of substance use (pooled odds ratio of 1.9), positive HIV status (pooled odds ratio of 1.5), and increased rates of depressive symptoms (pooled odds ratio of 1.5). IPV perpetration was also associated with increased rates of substance use (pooled odds ratio of 2.0). An important limitation of this meta-analysis was that the number of studies it included was relatively small. Also, the heterogeneity of the studies' results may undermine the precision of the meta-analysis. Further, most of the reviewed studies used convenience samples rather than probabilistic samples, and they used the word "partner" without distinguishing long-term relationships from casual encounters.

English psychologists Sabrina Nowinski and Erica Bowen conducted a 2012 review of 54 studies on the prevalence and correlates of intimate partner violence victimization among heterosexual and gay men.[51] The studies showed rates of IPV victimization for gay men ranging from 15% to 51%. Compared to heterosexual men, the review reports, "it appears that gay men experienced more total and sexual IPV, slightly less physical IPV, and similar levels of psychological IPV."[52] The authors also report that according to estimates of IPV prevalence over the most recent twelve months, gay men "experienced less physical, psychological and sexual IPV" than heterosexual men, though the relative lack of twelve-month estimates may make this result unreliable. The authors note that "one of the most worrying findings is the prevalence of severe sexual coercion and abuse in male same-gender relationships,"[53] citing a 2005 study[54] on IPV in HIV-positive gay men. Nowinski and Bowen found positive HIV status to be associated with IPV in both gay and heterosexual relationships. An important limitation of their review is the fact that many of the same-sex IPV studies they examined were based on small convenience samples.

Catherine Finneran and Rob Stephenson of Emory University in 2012 conducted a systematic review of 28 studies examining IPV among men

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who have sex with men.[55] Every study in the review estimated rates of IPV for gay men that were similar to or higher than those for all women regardless of sexual orientation. The authors conclude that "the emergent evidence reviewed here demonstrates that IPV—psychological, physical, and sexual—occurs in male-male partnerships at alarming rates."[56] Physical IPV victimization was reported most frequently, with rates ranging from 12% to 45%.[57] The rate of sexual IPV victimization ranged from 5% to 31%, with 9 out of 19 studies reporting rates over 20%. Psychological IPV victimization was recorded in six studies, with rates ranging from 5% to 73%.[58] Perpetration of physical IPV was reported in eight studies, with rates ranging from 4% to 39%. Rates of perpetration of sexual IPV ranged from 0.7% to 28%; four of the five studies reviewed reported rates of 9% or more. Only one study measured perpetration of psychological violence, and the estimated prevalence was 78%. Lack of consistent research design among the studies examined (for example, some differences regarding the exact definition of IPV, the correlates of IPV examined, and the recall periods used to measure violence) makes it impossible to calculate a pooled prevalence estimate, which would be useful given the lack of a national probability-based sample.

A 2013 study by UCLA's Naomi Goldberg and Ilan Meyer used a large probability sample of almost 32,000 individuals from the California Health Interview Survey to assess differences in intimate partner violence between various cohorts: heterosexual; self-identified gay, lesbian, and bisexual individuals; and men who have sex with men but did not identify as gay or bisexual, and women who have sex with women but did not identify as lesbian or bisexual.[59] All three LGB groups had greater lifetime and one-year prevalence of intimate partner violence than the heterosexual group, but this difference was only statistically significant for bisexual women and gay men. Bisexual women were more likely to have experienced lifetime IPV (52% of bisexual women vs. 22% of heterosexual women and 32% of lesbians) and to have experienced IPV in the preceding year (27% of bisexuals vs. 5% of heterosexuals and 10% of lesbians). For men, all three non-heterosexual groups had higher rates of lifetime and one-year IPV, but this was only statistically significant for gay men, who were more likely to have experienced IPV over a lifetime (27% of gay men vs. 11% of heterosexual men and 19.6% of bisexual men) and over the preceding year (12% of gay men vs. 5% of heterosexual men and 9% of bisexual men). The authors also tested whether binge drinking and psychological distress could explain the higher prevalence of IPV victimization in gay men and bisexual women; controlling for these

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variables revealed that they did not. This study is limited by the fact that other potentially confounding psychological variables (besides drinking and distress) were not controlled for, statistically or otherwise, and may have accounted for the findings.

To estimate the prevalence of battering victimization among gay partners, AIDS-prevention researcher Gregory Greenwood and colleagues published a 2002 study based on telephone interviews with a probability-based sample of 2,881 men who have sex with men (MSM) in four cities from 1996 to 1998.[60] Of those interviewed, 34% reported experiencing psychological or symbolic abuse, 22% reported physical abuse, and 5% reported sexual abuse. Overall, 39% reported some type of battering victimization, and 18% reported more than one type of battering in the previous five years. Men younger than 40 were significantly more likely than men over 60 to report battering violence. The authors conclude that "the prevalence of battering within the context of intimate partner relationships was very high" among their sample of men who have sex with men, and that since lifetime rates are usually higher than those for a five-year recall, "it is likely that a substantially greater number of MSM than of heterosexual men have experienced lifetime victimization."[61] The five-year prevalence of physical battering among this sample of urban MSM was also "significantly higher" than the annual rate of severe violence (3%) or total violence (12%) experienced in a representative sample of heterosexual women living with men, suggesting that the estimates of battering victimization for MSM in this study "are higher than or comparable to those reported for heterosexual women."[62] This study was limited by its use of a sample from four cities, so it is not clear how well the results generalize to non-urban settings.

Transgender Health Outcomes

The research literature for mental health outcomes in transgender individuals is more limited than the research on mental health outcomes in LGB populations. Because people identifying as transgender make up a very small proportion of the population, large population-based surveys and studies of such individuals are difficult if not impossible to conduct. Nevertheless, the limited available research strongly suggests that transgender people have increased risks of poor mental health outcomes. It appears that the rates of co-occurring substance use disorders, anxiety disorders, depression, and suicide tend to be higher for transgender people than for LGB individuals.

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In 2015, Harvard pediatrics professor and epidemiologist Sari Reisner and colleagues conducted a retrospective matched-pair cohort study of mental health outcomes for 180 transgender subjects aged 12–29 years (106 female-to-male and 74 male-to-female), matched to non-transgender controls based on gender identity.[63] Transgender youth had an elevated risk of depression (50.6% vs. 20.6%)[64] and anxiety (26.7% vs. 10.0%).[65] Transgender youth also had higher risk of suicidal ideation (31.1% vs. 11.1%),[66] suicide attempts (17.2% vs. 6.1%),[67] and self-harm without lethal intent (16.7% vs. 4.4%)[68] relative to the matched controls. A significantly greater proportion of transgender youth accessed inpatient mental health care (22.8% vs. 11.1%)[69] and outpatient mental health care (45.6% vs. 16.1%)[70] services. No statistically significant differences in mental health status were observed when comparing female-to-male transgender individuals to the male-to-female transgender individuals after adjusting for age, race/ethnicity, and hormone use.

This study had the merit of including individuals who presented to a community-based health clinic, and who thus were not identified solely as meeting the diagnostic criteria for gender identity disorder in the fourth edition of the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV*), and were not selected from a population of patients presenting to a clinic for treatment of gender identity issues. However, Reisner and colleagues note that their study has the limitations typically found in the retrospective chart review study design, such as incomplete documentation and variation in the quality of information recorded by medical professionals.

A report from the American Foundation for Suicide Prevention and the Williams Institute, a think tank for LGBT issues at the UCLA School of Law, summarized findings on suicide attempts among transgender and gender-nonconforming adults from a large national sample of over 6,000 individuals.[71] This constitutes the largest study of transgender and gender-nonconforming adults to date, though it used a convenience sample rather than a population-based sample. (Large population-based samples are nearly impossible given the low overall prevalence in the general population of transgendered individuals.) Summarizing the major findings of this study, the authors write:

> The prevalence of suicide attempts among respondents to the National Transgender Discrimination Survey (NTDS), conducted by the National Gay and Lesbian Task Force and National Center for Transgender Equality, is 41 percent, which vastly exceeds the 4.6

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> percent of the overall U.S. population who report a lifetime suicide attempt, and is also higher than the 10–20 percent of lesbian, gay and bisexual adults who report ever attempting suicide.[72]

The authors note that "respondents who said they had received transition-related health care or wanted to have it someday were more likely to report having attempted suicide than those who said they did not want it," however, "the survey did not provide information about the timing of reported suicide attempts in relation to receiving transition-related health care, which precluded investigation of transition-related explanations for these patterns."[73] The survey data suggested associations between suicide attempts, co-occurring mental health disorders, and experiences of discrimination or mistreatment, although the authors note some limitations of these outcomes: "The survey data did not allow us to determine a direct causal relationship between experiencing rejection, discrimination, victimization, or violence, and lifetime suicide attempts," although they did find evidence that stressors interacted with mental health factors "to produce a marked vulnerability to suicidal behavior in transgender and gender non-conforming individuals."[74]

A 2001 study by Kristen Clements-Nolle and colleagues of 392 male-to-female and 123 female-to-male transgender persons found that 62% of the male-to-female and 55% of the female-to-male transgender persons were depressed at the time of the study, and 32% of each population had attempted suicide.[75] The authors note: "The prevalence of suicide attempts among male-to-female and female-to-male transgender persons in our study was much higher than that found in US household probability samples and a population-based sample of adult men reporting same-sex partners."[76]

Explanations for the Poor Health Outcomes: The Social Stress Model

The greater prevalence of mental health problems in LGBT subpopulations is a cause for concern, and policymakers and clinicians should strive to reduce these risks. But to know what kinds of measures will help ameliorate them we must better understand their causes. At this time, the medical and social strategies for helping non-heterosexual populations in the United States are quite limited, and this may be due in part to the relatively limited explanations for the poor mental health outcomes offered by social scientists and psychologists.

Despite the limits of the scientific understanding of why non-heterosexual subpopulations are more likely to have such poor mental

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health outcomes, much of the public effort to ameliorate these problems is motivated by a particular hypothesis called the *social stress model.* This model posits that discrimination, stigmatization, and other similar stresses contribute to poor mental health outcomes among sexual minorities. An implication of the social stress model is that reducing these stresses would ameliorate the mental health problems experienced by sexual minorities.

Sexual minorities face distinct social challenges such as stigma, overt discrimination and harassment, and, often, struggle with reconciling their sexual behaviors and identities with the norms of their families and communities. In addition, they tend to be subject to challenges similar to those of some other minority populations, arising from marginalization by or conflict with the larger part of society in ways that may adversely impact their health.[77] Many researchers classify these various challenges under the concept of *social stress* and believe that social stress contributes to the generally higher rates of mental health problems among LGBT subpopulations.[78]

In attempting to account for the mental health disparities between heterosexuals and non-heterosexuals, researchers occasionally refer to a social or minority stress *hypothesis.*[79] However, it is more accurate to refer to a social or minority stress *model*, because the postulated connection between social stress and mental health is more complex and less precise than anything that could be stated as a single hypothesis.[80] The term *stress* can have a number of meanings, ranging from a description of a physiological condition to a mental or emotional state of anger or anxiety to a difficult social, economic, or interpersonal situation. More questions arise when one thinks about various kinds of *stressors* that may disproportionately affect mental health in minority populations. We will discuss some of these aspects of the social stress model after a concise overview of the model as it has been presented in recent literature on LGBT mental health.

The social stress model attempts to explain why non-heterosexual people have, on average, higher incidences of poor mental health outcomes than the rest of the population. It does not put forth a complete explanation for the disparities between non-heterosexuals and heterosexuals, and it does not explain the mental health problems of a particular patient. Rather, it describes social factors that might directly or indirectly influence the health risks for LGBT people, which may only become apparent at a population level. Some of these factors may also influence heterosexuals, but LGBT people are probably disproportionately exposed to them.

In an influential 2003 article on the social stress model, psychiatric epidemiologist and sexual orientation law expert Ilan Meyer distinguished between *distal* and *proximate* minority stressors. Distal stressors do not

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depend on the individual's "perceptions or appraisals," and thus "can be seen as independent of personal identification with the assigned minority status."[81] For instance, if a man who was perceived to be gay by an employer was fired on that basis, this would be a distal stressor, since the stressful event of discrimination would have had nothing to do with whether the man actually identified as gay, but only with someone else's attitude and perception. Distal stressors tend to reflect social circumstances rather than the individual's reaction to those circumstances. Proximate stressors, in contrast, are more subjective and are closely related to the individual's self-identity as lesbian, gay, bisexual, or transgender. An example of a proximate stressor would be when a young woman personally identifies as being a lesbian, and chooses to hide that identity from her family members out of fear of disapproval, or because of an internal sense of shame. The effects of proximate stressors such as this one are highly dependent on the individual's self-understanding and unique social circumstances. In this section we describe the types of stressors postulated in the social stress model, starting at the distal and proceeding to the most proximate stressors, and examine some of the empirical evidence that has been offered on the links between the stressors and mental health outcomes.

Discrimination and prejudice events. Overt acts of mistreatment, ranging from violence to harassment and discrimination, are categorized together by researchers as "prejudice events." These are thought to be significant stressors for non-heterosexual populations.[82] Surveys of LGBT subpopulations have found that they tend to experience these kinds of prejudice events more frequently than the general population.[83]

The available evidence indicates that prejudice events likely contribute to mental health problems. A 1999 study by UC Davis professor of psychology Gregory Herek and colleagues using survey data from 2,259 LGB individuals in Sacramento found that self-identified lesbians and gays who experienced a bias crime in the preceding five years—a crime, such as assault, theft, or vandalism, motivated by the actual or perceived sexual identity of the victim—reported significantly higher levels of depressive symptoms, traumatic stress symptoms, and anxiety than lesbians and gays who had not experienced a bias crime over that same period.[84] Additionally, lesbians and gays who reported being the victims of bias crimes in the last five years showed significantly higher levels of depressive and traumatic stress symptoms than individuals who experienced non-bias crimes in the same period (though the two groups did not display significant differences in anxiety). Comparable significant correlations were not found for

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self-identified bisexuals, who constituted a much smaller portion of the survey respondents. The study also found that lesbians and gays subject to bias crimes were significantly more likely than other respondents to report feelings of vulnerability and a decreased sense of personal mastery or agency. Corroborating these findings on the harmful impact of bias crimes was a 2001 study by Northeastern University social scientist Jack McDevitt and colleagues that examined aggravated assaults using data from the Boston Police Department.[85] They found that bias crime victims tended to experience the effects of victimization more intensely and for a longer period of time than non-bias crime victims. (The study looked at bias-motivated assaults in general, rather than restricting its analysis to assaults motivated by LGBT bias, though a substantial portion of the subjects did experience assaults motivated by their non-heterosexual status.)

Similar patterns also appear among non-heterosexual adolescents, for whom maltreatment is particularly high.[86] In a 2011 study, University of Arizona social and behavioral scientist Stephen T. Russell and colleagues analyzed a survey of 245 young LGBT adults that retrospectively assessed school victimization due to actual or perceived LGBT status between the ages of 13 and 19. They found strong correlations between school victimization and poor mental health as young adults.[87] Victimization was assessed by asking yes-or-no questions, such as, "During my middle or high school years, while at school, I was pushed, shoved, slapped, hit, or kicked by someone who wasn't just kidding around," followed by a question of how often these events were related to the respondent's sexual identity. Respondents who reported high levels of school victimization due to their sexual identity were 2.6 times more likely to report depression as young adults and 5.6 times more likely to report that they had attempted suicide, compared to those who reported low levels of victimization. These differences were highly statistically significant, though the study is potentially limited by its use of retrospective surveys to measure incidents of victimization. A study by professor of social work Joanna Almeida and colleagues, which relied on the 2006 Boston Youth Survey (a biennial survey of high school students in Boston public schools), found that perceptions of having been victimized due to LGBT status accounted for increased symptoms of depression among LGBT students. For male LGBT students, but not females, the study also found a positive correlation between victimization and suicidal thoughts and self-harm.[88]

Differences in compensation suggest discrimination in the workplace, which can have both direct and indirect effects on mental health. M. V. Lee Badgett, a professor of economics at the University of Massachusetts,

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Amherst, analyzed data collected between 1989 and 1991 in the General Social Survey and found that non-heterosexual male employees received significantly lower compensation (11% to 27%) than heterosexuals, even after controlling for experience, education, occupation, and other factors.[89] According to a 2009 review by Badgett,[90] nine studies from the 1990s and early 2000s "consistently show that gay and bisexual men earned 10% to 32% less than heterosexual men," and that differences in occupation cannot account for much of the wage disparity. Researchers have also found that non-heterosexual women earn more than heterosexual women,[91] which may suggest either that patterns of discrimination differ for men and women, or that there are other factors associated with non-heterosexual behavior and self-identification in men and women influencing their respective earnings, such as a lower rate of child-rearing or being the family primary wage earner.

There is evidence that suggests that wage disparities can help explain some population-level disparities in mental health outcomes,[92] though it is difficult to tell if differences in mental health help explain the differences in wages. A 1999 study[93] by Craig Waldo on the relationship between workplace heterosexism—defined as negative social attitudes toward non-heterosexuals—and stress-related outcomes in 287 LGB individuals found that LGB individuals who experienced heterosexism in the workplace "exhibited higher levels of psychological distress and health-related problems, as well as decreased satisfaction with several aspects of their jobs." The cross-sectional data used by many of these studies make it impossible to infer causality, though both prospective studies and qualitative analyses of the impact of unemployment on mental health suggest that at least some of the correlations are likely accounted for by the psychological and material effects of unemployment.[94]

Stigma. Sociologists have for many years documented a range of adverse effects of stigma on individuals, ranging from issues with self-esteem to academic achievement.[95] Stigma is typically regarded as an attribute attaching to a person that reduces that person's worth to others in a particular social context.[96] These negative evaluations are in many cases widely shared among a cultural group and become the basis for excluding or differentially treating stigmatized individuals. For example, mental illness can become stigmatized when it is regarded as a character flaw in mentally ill people. One reason why stigma serves an important role in the social stress model is that it can be invoked as an explanation even in the absence of particular events of discrimination or maltreatment. For

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example, stigmatization of depression may take place when a depressed person conceals the depression on the expectation that friends and family members will regard it as a character flaw. Even when this concealment is successful, and there is therefore no actual discrimination or mistreatment by the individual's friends or family, anxiety over the attitudes others may have can affect the depressed person's emotional and mental well-being.

Researchers have found associations between the risk of poor mental health and stigma toward certain populations, though there has been little empirical research on the mental health effects of stigma on LGBT people in particular. Stigma is not easy to define or operationalize, making it a difficult and vague concept for empirical social scientists to study. Nevertheless, researchers have attempted to work with the concept using surveys of self-perceived devaluation by others and have found correlations between experiences of stigma and the risk of poor mental health status. One highly cited 1997 study by sociologist and epidemiologist Bruce Link and colleagues on the connection between stigma and mental health found a "strong and enduring" negative effect of stigma on the mental well-being of men who were suffering from a mental disorder and substance abuse.[97] In this study, the effects of stigma appeared to persist even after the men had received largely successful treatment for their original mental and substance abuse problems. The study found significant correlations between certain stigma variables—self-reported experiences of devaluation and rejection—and depressive symptoms before and after treatment, suggesting that the effects of stigma are relatively long-lasting. This might simply indicate that people with depressive symptoms tend to report more stigma, but if that were the case, one would have expected reports of stigma to decline over the course of the treatment program, as depression did. However, since stigma reports stayed constant, the authors concluded that stigma must have had a causal role in shaping depressive symptoms. It is worth noting that this study found stigma variables to account uniquely for around 10% or slightly more of the variance in depressive symptoms—in other words, stigma had a minor effect on depressive symptoms, though such an effect might manifest itself in significant ways on a population level. Some other researchers have suggested that the effects of stigma are usually minor and transitory; for example, Vanderbilt sociologist Walter Gove argued that for the "vast majority of cases the stigma [experienced by mental patients] appears to be transitory and does not appear to pose a severe problem."[98]

Researchers have relatively recently begun pursuing both empirical and theoretical work[99] on how stigma affects the mental health of LGBT

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people, though there has been some controversy over the magnitude and duration of effects due to stigma. Some of the controversy may stem from the difficulty of defining and quantifying stigma as well as the variations in stigma across different social contexts. A 2013 study by Columbia University medical psychologist Walter Bockting and colleagues on mental health in 1,093 transgender people found a positive correlation between psychological distress and both enacted and felt stigma, which were measured using survey questions.[100] A 2003 study[101] by clinical psychologist Robin Lewis and colleagues of predictors of depressive symptoms in 201 LGB individuals found that stigma consciousness was significantly associated with depressive symptoms, where stigma consciousness was assessed using a ten-item questionnaire that assessed "the degree to which one expects to be judged on the basis of a stereotype."[102] However, depressive symptoms are often associated with negative cognition about the self, the world, and the future, and this may contribute to the subjective perception of stigmatization among individuals suffering from depression.[103] A 2011 study[104] by Bostwick that also used measures of stigma consciousness and depressive symptoms found a modest positive correlation between stigma scores and depressive symptoms in bisexual women, although the study was limited by having a relatively small sample size. However, a 2003 longitudinal study[105] of Norwegian adolescents by psychologist Lars Wichstrøm and colleague found that sexual orientation was associated with poor mental health status after accounting for a variety of psychological risk factors, including self-worth. While this study did not directly consider stigma as a risk factor, it suggests that psychological factors such as stigma consciousness alone likely cannot fully account for the disparities in mental health between heterosexuals and non-heterosexuals. Additionally, it is important to note that due to the cross-sectional design of these studies, causal inferences cannot be supported by the data—different kinds of data and more evidence would be needed to support conclusions about causal relationships. In particular, it is impossible to prove through these studies that stigma leads to poor mental health, as opposed to, for example, poor mental health leading people to report higher levels of stigma, or a third factor being responsible for both poor mental health and higher levels of stigma.

Concealment. Stigma may affect non-heterosexual individuals' decisions about whether to disclose or conceal their sexual orientation. LGBT people may decide to conceal their sexual orientation to protect themselves against possible bias or discrimination, to avoid a sense of shame, or to

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avoid a potential conflict between their social role and sexual desires or behaviors.[106] Particular contexts in which LGBT people may be more likely to conceal their sexual orientation include school, work, and other places in which they feel that disclosure could negatively affect the way that people regard them.

There is a large amount of evidence from psychological research indicating that concealment of an important aspect of one's identity may have adverse mental health consequences. In general, expressing one's emotions and sharing important aspects of one's life with others play large roles in maintaining mental health.[107] Recent decades have seen a growing body of research on the relationships between concealment and disclosure and mental health in LGBT subpopulations.[108] For example, a 2007 study[109] by Belle Rose Ragins and colleagues of workplace concealment and disclosure in 534 LGB individuals found that fear of disclosing was associated with psychological strain and other outcomes such as job satisfaction. However, the study also challenged the notion that disclosure leads to positive psychological and social outcomes, since employees' disclosure was not significantly associated with most of the outcome variables. The authors interpret this result by saying that "this study suggests that concealment may be a necessary and adaptive decision in an unsupportive or hostile environment, thus underscoring the importance of social context."[110] Due to the relatively rapid changes in social acceptance of same-sex marriage and of same-sex relationships more broadly in recent decades,[111] it is possible that some of the research on the psychological effects of concealment and disclosure is outdated, because in general there may now be less pressure for those identifying as LGB to conceal their identities.

Testing the model. One of the implications of the social stress model is that reducing the amount of discrimination, prejudice, and stigmatization of sexual minorities would help reduce the rates of mental health problems for these populations. Some jurisdictions have sought to reduce these social stressors by passing anti-discrimination and hate-crime laws. If such policies are in fact successful at reducing these stressors then they could be expected to reduce the rates of mental health problems in LGB populations to the extent that the social stress model accurately accounts for the causes of these problems. So far, studies have not been designed in such a way that could allow them to test conclusively the hypothesis that social stress accounts for the high rates of poor mental health outcomes in non-heterosexual populations, but there is research that provides some data on a testable implication of the social stress model.

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A 2009 study by sociomedical scientist Mark Hatzenbuehler and colleagues investigated the association between psychiatric morbidity in LGB populations and two state-level policies that pertained to these populations: hate-crime laws that did not include sexual orientation as a protected category, and laws prohibiting employment discrimination based on sexual orientation.[112] The study used data on mental health outcomes from Wave 2 of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), a nationally representative sample of 34,653 civilian, non-institutionalized adults, and measuring psychiatric disorders according to *DSM-IV* criteria.[113] Wave 2 of NESARC took place in 2004–2005. Of the sample, 577 respondents identified as lesbian, gay, or bisexual. The analysis of the data showed that LGB individuals living in states with no hate-crime laws and no non-discrimination laws tended to have higher odds of psychiatric morbidity (compared to LGB individuals in states with one or two protective laws), but the analysis found statistically significant correlations only for dysthymia (a less severe but more persistent form of depression), generalized anxiety disorder, and post-traumatic stress disorder, while the correlations between seven other psychiatric conditions investigated were not found to be statistically significant. No epidemiological inferences can be made due to the nature of the data, suggesting the need for more studies on this and similar topics.

Hatzenbuehler and colleagues attempted to improve on this cross-sectional study by doing a prospective study, published in 2010, this time examining changes in psychiatric morbidity over the period in which certain states passed constitutional amendments defining marriage as a union between one man and one woman—amendments that were described by the study's authors as "bans on gay marriage."[114] The authors examined differences in psychiatric morbidity between Wave 1 of NESARC, which took place in 2001–2002, and Wave 2, which coincided with the 2004 and 2005 state-constitutional amendments. They observed that the prevalence in mood disorders in LGB respondents living in states that passed marriage amendments increased by 36.6% between Waves 1 and 2. Mood disorders for LGB respondents living in states that did not pass marriage amendments decreased by 23.6%, though this change was not statistically significant. The prevalence of certain disorders increased both in states that passed such amendments and in states that did not. Generalized anxiety disorder, for example, increased in both, but by a much larger and statistically significant magnitude in states that passed marriage amendments. Hatzenbuehler and colleagues found that drug-use disorders increased more in states that did *not* pass marriage amendments,

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and the increase was statistically significant only for those states. (Total substance abuse disorders increased in both cases, by a roughly similar amount.) As with the earlier cross-sectional study, for the majority of the psychiatric conditions investigated there were no significant correlations between the conditions and the social policies that were hypothesized to have an influence on mental health outcomes.

Some of the limitations of the study's findings noted by the authors include the following: healthier LGB respondents may have moved out of the states that would eventually pass marriage amendments into the states that would not; sexual orientation was only assessed during Wave 2 of NESARC, and there is some fluidity to sexual identity that may have led to misclassification of some LGB respondents; and the sample size of LGB respondents living in states that passed marriage amendments was relatively small, limiting the statistical power of the study.

One hypothesized causal mechanism for the change in mental health variables associated with the marriage amendments is that the public debate surrounding the amendments may have elevated the stress experienced by non-heterosexuals—a hypothesis that was put forward by psychologist Sharon Scales Rostosky and colleagues in a study of the attitudes of LGB adults in states that passed marriage amendments in 2006.[115] The survey data collected during this study showed that LGB respondents living in states that passed marriage amendments in 2006 had higher levels of various kinds of psychological distress, including stress and depressive symptoms. The study also found that participation in LGBT activism during the election season was associated with increased psychological distress. It may be that part of the psychological distress recorded by this survey, which included perceived stress, depressive symptoms (but not diagnoses of depressive disorders), and what the researchers called "amendment-related affect," may have simply reflected the typical feelings of advocates when they experience political defeat on an issue that they care passionately about. Other key limitations of the study were its cross-sectional design and its reliance on volunteers for the survey (in contrast to the previous study by Hatzenbuehler and colleagues). The survey methodology may also have biased the results—the researchers advertised on websites and through listserv e-mail announcements that they were looking for survey respondents for a study on "attitudes and experiences of LGB…individuals regarding the debate" over gay marriage. As with many forms of convenience sampling, individuals with strong attitudes regarding the issues under investigation in the survey may have been more likely to respond.

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As for the effects of particular policies, the evidence is equivocal at best. The 2009 study by Hatzenbuehler and colleagues demonstrated significant correlations between the risk of some (though not all) mental health problems in the LGB subpopulation and state policies on hate crime and employment protections. Even for the aspects of mental health that this study found to be correlated with hate-crime or employment-protection policies, the study was unable to show an epidemiological relationship between policies and health outcomes.

Conclusion

The social stress model probably accounts for some of the poor mental health outcomes experienced by sexual minorities, though the evidence supporting the model is limited, inconsistent and incomplete. Some of the central concepts of the model, such as stigmatization, are not easily operationalized. There is evidence linking some forms of mistreatment, stigmatization, and discrimination to some of the poor mental health outcomes experienced by non-heterosexuals, but it is far from clear that these factors account for all of the disparities between the heterosexual and non-heterosexual populations. Those poor mental health outcomes may be mitigated to some extent by reducing social stressors, but this strategy is unlikely to eliminate all of the disparities in mental health status between sexual minorities and the wider population. Other factors, such as the elevated rates of sexual abuse victimization among the LGBT population discussed in Part One, may also account for some of these mental health disparities, as research has consistently shown that "survivors of childhood sexual abuse are significantly at risk of a wide range of medical, psychological, behavioral, and sexual disorders."[116]

Just as it does a disservice to non-heterosexual subpopulations to ignore or downplay the statistically higher risks of negative mental health outcomes they face, so it does them a disservice to misattribute the causes of these elevated risks, or to ignore other potential factors that may be at work. Assuming that a single model can explain all of the mental health risks faced by non-heterosexuals can mislead clinicians and therapists charged with helping this vulnerable subpopulation. The social stress model deserves further research, but should not be assumed to offer a complete explanation of the causes of mental health disparities if clinicians and policymakers want to adequately address the mental health challenges faced by the LGBT community. More research is needed to explore the causes of, and solutions to, these important public health challenges.

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Part Three

Gender Identity

The concept of biological sex is well defined, based on the binary roles that males and females play in reproduction. By contrast, the concept of gender is not well defined. It is generally taken to refer to behaviors and psychological attributes that tend to be typical of a given sex. Some individuals identify as a gender that does not correspond to their biological sex. The causes of such cross-gender identification remain poorly understood. Research investigating whether these transgender individuals have certain physiological features or experiences in common with the opposite sex, such as brain structures or atypical prenatal hormone exposures, has so far been inconclusive. Gender dysphoria—a sense of incongruence between one's biological sex and one's gender, accompanied by clinically significant distress or impairment—is sometimes treated in adults by hormones or surgery, but there is little scientific evidence that these therapeutic interventions have psychological benefits. Science has shown that gender identity issues in children usually do not persist into adolescence or adulthood, and there is little scientific evidence for the therapeutic value of puberty-delaying treatments. We are concerned by the increasing tendency toward encouraging children with gender identity issues to transition to their preferred gender through medical and then surgical procedures. There is a clear need for more research in these areas.

As described in Part One, there is a widely held belief that *sexual orientation* is a well-defined concept, and that it is innate and fixed in each person—as it is often put, gay people are "born that way." Another emerging and related view is that *gender identity*—the subjective, internal sense of being a man or a woman (or some other gender category)—is also fixed at birth or at a very early age and can diverge from a person's biological sex. In the case of children, this is sometimes articulated by saying that a little boy may be trapped in a little girl's body, or vice versa.

In Part One we argued that scientific research does not give much support to the hypothesis that sexual orientation is innate and fixed. We will argue here, similarly, that there is little scientific evidence that gender identity is fixed at birth or at an early age. Though biological sex is innate, and gender identity and biological sex are related in complex ways, they

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are not identical; gender is sometimes defined or expressed in ways that have little or no biological basis.

Key Concepts and Their Origins

To clarify what is meant by "gender" and "sex," we begin with a widely used definition, here quoted from a pamphlet published by the American Psychological Association (APA):

> *Sex* is assigned at birth, refers to one's biological status as either male or female, and is associated primarily with physical attributes such as chromosomes, hormone prevalence, and external and internal anatomy. *Gender* refers to the socially constructed roles, behaviors, activities, and attributes that a given society considers appropriate for boys and men or girls and women. These influence the ways that people act, interact, and feel about themselves. While aspects of biological sex are similar across different cultures, aspects of gender may differ.[1]

This definition points to the obvious fact that there are social norms for men and women, norms that vary across different cultures and that are not simply determined by biology. But it goes further in holding that gender is wholly "socially constructed"—that it is detached from biological sex. This idea has been an important part of a feminist movement to reform or eliminate traditional gender roles. In the classic feminist book *The Second Sex* (1949), Simone de Beauvoir wrote that "one is not born, but becomes a woman."[2] This notion is an early version of the now familiar distinction between sex as a biological designation and gender as a cultural construct: though one is born, as the APA explains, with the "chromosomes, hormone prevalence, and external and internal anatomy" of a female, one is socially conditioned to take on the "roles, behaviors, activities, and attributes" of a woman.

Developments in feminist theory in the second half of the twentieth century further solidified the position that gender is socially constructed. One of the first to use the term "gender" as distinct from sex in the social-science literature was Ann Oakley in her 1972 book, *Sex, Gender and Society.*[3] In the 1978 book *Gender: An Ethnomethodological Approach*, psychology professors Suzanne Kessler and Wendy McKenna argued that "gender is a social construction, that a world of two 'sexes' is a result of the socially shared, taken for granted methods which members use to construct reality."[4]

Anthropologist Gayle Rubin expresses a similar view, writing in 1975 that "Gender is a socially imposed division of the sexes. It is a product of

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the social relations of sexuality."[5] According to her argument, if it were not for this social imposition, we would still have males and females but not "men" and "women." Furthermore, Rubin argues, if traditional gender roles are socially constructed, then they can also be *de*constructed, and we can eliminate "obligatory sexualities and sex roles" and create "an androgynous and genderless (though not sexless) society, in which one's sexual anatomy is irrelevant to who one is, what one does, and with whom one makes love."[6]

The relationship between gender theory and the deconstruction or overthrowing of traditional gender roles is made even clearer in the works of the influential feminist theorist Judith Butler. In works such as *Gender Trouble: Feminism and the Subversion of Identity* (1990)[7] and *Undoing Gender* (2004)[8] Butler advances what she describes as "performativity theory," according to which being a woman or man is not something that one *is* but something that one *does*. "Gender is neither the causal result of sex nor as seemingly fixed as sex," as she put it.[9] Rather, gender is a constructed status radically independent from biology or bodily traits, "a free floating artifice, with the consequence that *man* and *masculine* might just as easily signify a female body as a male one, and *woman* and *feminine* a male body as easily as a female one."[10]

This view, that gender and thus gender identity are fluid and plastic, and not necessarily binary, has recently become more prominent in popular culture. An example is Facebook's move in 2014 to include 56 new ways for users to describe their gender, in addition to the options of male and female. As Facebook explains, the new options allow the user to "feel comfortable being your true, authentic self," an important part of which is "the expression of gender."[11] Options include *agender*, several *cis-* and *trans-* variants, *gender fluid*, *gender questioning*, *neither*, *other*, *pangender*, and *two-spirit*.[12]

Whether or not Judith Butler was correct in describing traditional gender roles of men and women as "performative," her theory of gender as a "free-floating artifice" does seem to describe this new taxonomy of gender. As these terms multiply and their meanings become more individualized, we lose any common set of criteria for defining what gender distinctions mean. If gender is entirely detached from the binary of biological sex, gender could come to refer to any distinctions in behavior, biological attributes, or psychological traits, and each person could have a gender defined by the unique combination of characteristics the person possesses. This *reductio ad absurdum* is offered to present the possibility that defining gender too broadly could lead to a definition that has little meaning.

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Alternatively, gender identity could be defined in terms of sex-typical traits and behaviors, so that being a boy means behaving in the ways boys typically behave—such as engaging in rough-and-tumble play and expressing an interest in sports and liking toy guns more than dolls. But this would imply that a boy who plays with dolls, hates guns, and refrains from sports or rough-and-tumble play might be considered to be a girl, rather than simply a boy who represents an exception to the typical patterns of male behavior. The ability to recognize exceptions to sex-typical behavior relies on an understanding of maleness and femaleness that is independent of these stereotypical sex-appropriate behaviors. The underlying basis of maleness and femaleness is the distinction between the reproductive roles of the sexes; in mammals such as humans, the female gestates offspring and the male impregnates the female. More universally, the male of the species fertilizes the egg cells provided by the female of the species. This conceptual basis for sex roles is binary and stable, and allows us to distinguish males from females on the grounds of their reproductive systems, even when these individuals exhibit behaviors that are not typical of males or females.

To illustrate how reproductive roles define the differences between the sexes even when behavior appears to be atypical for the particular sex, consider two examples, one from the diversity of the animal kingdom, and one from the diversity of human behavior. First, we look at the emperor penguin. Male emperor penguins provide more care for eggs than do females, and in this sense, the male emperor penguin could be described as more maternal than the female.[13] However, we recognize that the male emperor penguin is not in fact female but rather that the species represents an exception to the general, but not universal, tendency among animals for females to provide more care than males for offspring. We recognize this because sex-typical behaviors like parental care do not define the sexes; the individual's role in sexual reproduction does.

Even other sex-typical biological traits, such as chromosomes, are not necessarily helpful for defining sex in a universal way, as the penguin example further illustrates. As with other birds, the genetics of sex determination in the emperor penguin is different than the genetics of sex determination in mammals and many other animals. In humans, males have XY chromosomes and females have XX chromosomes; that is, males have a unique sex-determining chromosome that they do not share with females, while females have two copies of a chromosome that they share with males. But in birds, it is females, not males, that have and pass on the sex-specific chromosome.[14] Just as the observation that

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male emperor penguins nurture their offspring more than their partners did not lead zoologists to conclude that the egg-laying member of the emperor penguin species was in fact the male, the discovery of the ZW sex-determination system in birds did not lead geneticists to challenge the age-old recognition that hens are females and roosters are males. The only variable that serves as the fundamental and reliable basis for biologists to distinguish the sexes of animals is their role in reproduction, not some other behavioral or biological trait.

Another example that, in this case, only appears to be non-sex-typical behavior is that of Thomas Beatie, who made headlines as a man who gave birth to three children between 2008 and 2010.[15] Thomas Beatie was born a woman, Tracy Lehuanani LaGondino, and underwent a surgical and legal transition to living as a man before deciding to have children. Because the medical procedures he underwent did not involve the removal of his ovaries or uterus, Beatie was capable of bearing children. The state of Arizona recognizes Thomas Beatie as the father of his three children, even though, biologically, he is their mother. Unlike the case of the male emperor penguin's ostensibly maternal, "feminine" parenting behavior, Beatie's ability to have children does not represent an exception to the normal inability of males to bear children. The labeling of Beatie as a man despite his being biologically female is a personal, social, and legal decision that was made without any basis in biology; nothing whatsoever in biology suggests Thomas Beatie is a male.

In biology, an organism is male or female if it is structured to perform one of the respective roles in reproduction. This definition does not require any arbitrary measurable or quantifiable physical characteristics or behaviors; it requires understanding the reproductive system and the reproduction process. Different animals have different reproductive systems, but sexual reproduction occurs when the sex cells from the male and female of the species come together to form newly fertilized embryos. It is these reproductive roles that provide the conceptual basis for the differentiation of animals into the biological categories of male and female. There is no other widely accepted biological classification for the sexes.

But this definition of the biological category of sex is not universally accepted. For example, philosopher and legal scholar Edward Stein maintains that infertility poses a crucial problem for defining sex in terms of reproductive roles, writing that defining sex in terms of these roles would define "infertile males as females."[16] Since an infertile male cannot play the reproductive role for which males are structured, and an infertile

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female cannot play the reproductive role for which females are structured, according to this line of thinking, defining sex in terms of reproductive roles would not be appropriate, as infertile males would be classified as females, and infertile females as males. Nevertheless, while a reproductive system structured to serve a particular reproductive role may be impaired in such a way that it cannot perform its function, the system is still recognizably structured for that role, so that biological sex can still be defined strictly in terms of the structure of reproductive systems. A similar point can be made about heterosexual couples who choose not to reproduce for any of a variety of reasons. The male and female reproductive systems are generally clearly recognizable, regardless of whether or not they are being used for purposes of reproduction.

The following analogy illustrates how a system can be recognized as having a particular purpose, even when that system is dysfunctional in a way that renders it incapable of carrying out its purpose: Eyes are complex organs that function as processors of vision. However, there are numerous conditions affecting the eye that can impair vision, resulting in blindness. The eyes of the blind are still recognizably organs structured for the function of sight. Any impairments that result in blindness do not affect the purpose of the eye—any more than wearing a blindfold—but only its function. The same is true for the reproductive system. Infertility can be caused by many problems. However, the reproductive system continues to exist for the purpose of begetting children.

There are individuals, however, who are biologically "intersex," meaning that their sexual anatomy is ambiguous, usually for reasons of genetic abnormalities. For example, the clitoris and penis are derived from the same embryonic structures. A baby may display an abnormally large clitoris or an abnormally small penis, causing its biological sex to be difficult to determine long after birth.

The first academic article to use the term "gender" appears to be the 1955 paper by the psychiatry professor John Money of Johns Hopkins on the treatment of "intersex" children (the term then used was "hermaphrodites").[17] Money posited that gender identity, at least for these children, was fluid and that it could be constructed. In his mind, making a child identify with a gender only required constructing sex-typical genitalia and creating a gender-appropriate environment for the child. The chosen gender for these children was often female—a decision that was not based on genetics or biology, nor on the belief that these children were "really" girls, but, in part, on the fact that at the time it was easier surgically to construct a vagina then it was to construct a penis.

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The most widely known patient of Dr. Money was David Reimer, a boy who was not born with an intersex condition but whose penis was damaged during circumcision as an infant.[18] David was raised by his parents as a girl named Brenda, and provided with both surgical and hormonal interventions to ensure that he would develop female-typical sex characteristics. However, the attempt to conceal from the child what had happened to him was not successful—he self-identified as a boy, and eventually, at the age of 14, his psychiatrist recommended to his parents that they tell him the truth. David then began the difficult process of reversing the hormonal and surgical interventions that had been performed to feminize his body. But he continued to be tormented by his childhood ordeal, and took his own life in 2004, at the age of 38.

David Reimer is just one example of the harm wrought by theories that gender identity can socially and medically be reassigned in children. In a 2004 paper, William G. Reiner, a pediatric urologist and child and adolescent psychiatrist, and John P. Gearhart, a professor of pediatric urology, followed up on the sexual identities of 16 genetic males affected by cloacal exstrophy—a condition involving a badly deformed bladder and genitals. Of the 16 subjects, 14 were assigned female sex at birth, receiving surgical interventions to construct female genitalia, and were raised as girls by their parents; 6 of these 14 later chose to identify as males, while 5 continued to identify as females and 2 declared themselves males at a young age but continued to be raised as females because their parents rejected the children's declarations. The remaining subject, who had been told at age 12 that he was born male, refused to discuss sexual identity.[19] So the assignment of female sex persisted in only 5 of the 13 cases with known results.

This lack of persistence is some evidence that the assignment of sex through genital construction at birth with immersion into a "gender-appropriate" environment is not likely to be a successful option for managing the rare problem of genital ambiguity from birth defects. It is important to note that the ages of these individuals at last follow-up ranged from 9 to 19, so it is possible that some of them may have subsequently changed their gender identities.

Reiner and Gearhart's research indicates that gender is not arbitrary; it suggests that a biological male (or female) will probably not come to identify as the opposite gender after having been altered physically and immersed into the corresponding gender-typical environment. The plasticity of gender appears to have a limit.

What is clear is that biological sex is not a concept that can be reduced to, or artificially assigned on the basis of, the type of external genitalia

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alone. Surgeons are becoming more capable of constructing artificial genitalia, but these "add-ons" do not change the biological sex of the recipients, who are no more capable of playing the reproductive roles of the opposite biological sex than they were without the surgery. Nor does biological sex change as a function of the environment provided for the child. No degree of supporting a little boy in converting to be considered, by himself and others, to be a little girl makes him biologically a little girl. The scientific definition of biological sex is, for almost all human beings, clear, binary, and stable, reflecting an underlying biological reality that is not contradicted by exceptions to sex-typical behavior, and cannot be altered by surgery or social conditioning.

In a 2004 article summarizing the results of research related to intersex conditions, Paul McHugh, the former chief of psychiatry at Johns Hopkins Hospital (and the coauthor of this report), suggested:

> We in the Johns Hopkins Psychiatry Department eventually concluded that human sexual identity is mostly built into our constitution by the genes we inherit and the embryogenesis we undergo. Male hormones sexualize the brain and the mind. Sexual dysphoria—a sense of disquiet in one's sexual role—naturally occurs amongst those rare males who are raised as females in an effort to correct an infantile genital structural problem.[20]

We now turn our attention to transgender individuals—children and adults—who choose to identify as a gender different from their biological sex, and explore the meaning of gender identity in this context and what the scientific literature tells us about its development.

Gender Dysphoria

While biological sex is, with very few exceptions, a well-defined, binary trait (male versus female) corresponding to how the body is organized for reproduction, *gender identity* is a more subjective attribute. For most people, their own gender identity is probably not a significant concern; most biological males identify as boys or men, and most biological females identify as girls or women. But some individuals experience an incongruence between their biological sex and their gender identity. If this struggle causes them to seek professional help, then the problem is classified as "gender dysphoria."

Some male children raised as females, as described in Reiner and colleagues' 2004 study, came to experience problems with their gender

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identity when their subjective sense of being boys conflicted with being identified and treated as girls by their parents and doctors. The biological sex of the boys was not in question (they had an XY genotype), and the cause of gender dysphoria lay in the fact that they were genetically male, came to identify as male, but had been assigned female gender identities. This suggests that gender identity can be a complex and burdensome issue for those who choose (or have others choose for them) a gender identity opposite their biological sex.

But the cases of gender dysphoria that are the subject of much public debate are those in which individuals come to identify as genders different from those based on their biological sex. These people are usually identified, and describe themselves, as "transgender."*

According to the fifth edition of the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-5*), gender dysphoria is marked by "incongruence between one's experienced/expressed gender and assigned gender," as well as "clinically significant distress or impairment in social, occupational, or other important areas of functioning."[21]

It is important to clarify that gender dysphoria is not the same as gender nonconformity or gender identity disorder. Gender nonconformity describes an individual who behaves in a manner contrary to the gender-specific norms of his or her biological sex. As the *DSM-5* notes, most transvestites, for instance, are not transgender—men who dress as women typically do not identify themselves as women.[22] (However, certain forms of transvestitism can be associated with late-onset gender dysphoria.[23])

Gender identity disorder, an obsolete term from an earlier version of the *DSM* that was removed in its fifth edition, was used as a psychiatric diagnosis. If we compare the diagnostic criteria for gender dysphoria (the current term) and gender identity disorder (the former term), we see that both require the patient to display "a marked incongruence between one's

* A note on terminology: In this report, we generally use the term *transgender* to refer to persons for whom there is an incongruity between the gender identity they understand themselves to possess and their biological sex. We use the term *transsexual* to refer to individuals who have undergone medical interventions to transform their appearance to better correspond with that of their preferred gender. The most familiar colloquial term used to describe the medical interventions that transform the appearance of transgender individuals may be "sex change" (or, in the case of surgery, "sex-change operation"), but this is not commonly used in the scientific and medical literature today. While no simple terms for these procedures are completely satisfactory, in this report we employ the commonly used terms *sex reassignment* and *sex-reassignment surgery*, except when quoting a source that uses "gender reassignment" or some other term.

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experienced/expressed gender and assigned gender."[24] The key difference is that a diagnosis of gender dysphoria requires the patient additionally to experience a "clinically significant distress or impairment in social, occupational, or other important areas of functioning" associated with these incongruent feelings.[25] Thus the major set of diagnostic criteria used in contemporary psychiatry does not designate all transgender individuals as having a psychiatric disorder. For example, a biological male who identifies himself as a female is not considered to have a psychiatric disorder unless the individual is experiencing significant psychosocial distress at the incongruence. A diagnosis of gender dysphoria may be part of the criteria used to justify sex-reassignment surgery or other clinical interventions. Furthermore, a patient who has had medical or surgical modifications to express his or her gender identity may still suffer from gender dysphoria. It is the nature of the struggle that defines the disorder, not the fact that the expressed gender differs from the biological sex.

There is no scientific evidence that all transgender people have gender dysphoria, or that they are all struggling with their gender identities. Some individuals who are not transgender—that is, who do not identify as a gender that does not correspond with their biological sex—might nonetheless struggle with their gender identity; for example, girls who behave in some male-typical ways might experience various forms of distress without ever coming to identify as boys. Conversely, individuals who do identify as a gender that does not correspond with their biological sex may not experience clinically significant distress related to their gender identity. Even if only, say, 40% of individuals who identify as a gender that does not correspond with their biological sex experience significant distress related to their gender identity, this would constitute a public health issue requiring clinicians and others to act to support those with gender dysphoria, and hopefully, to reduce the rate of gender dysphoria in the population. There is no evidence to suggest that the other 60% in this hypothetical—that is, the individuals who identify as a gender that does not correspond with their biological sex but who do not experience significant distress—would require clinical treatment.

The *DSM*'s concept of subjectively "experiencing" one's gender as incongruent from one's biological sex may require more critical scrutiny and possibly modification. The exact definition of gender dysphoria, however well-intentioned, is somewhat vague and confusing. It does not account for individuals who self-identify as transgender but do not experience dysphoria associated with their gender identity and who seek psychiatric care for functional impairment for problems unrelated to their

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gender identity, such as anxiety or depression. They may then be mislabeled as having gender dysphoria simply because they have a desire to be identified as a member of the opposite gender, when they have come to a satisfactory resolution, subjectively, with this incongruence and may be depressed for reasons having nothing to do with their gender identity.

The *DSM-5* criteria for a diagnosis of gender dysphoria in children are defined in a "more concrete, behavioral manner than those for adolescents and adults."[26] This is to say that some of the diagnostic criteria for gender dysphoria in children refer to behaviors that are stereotypically associated with the opposite gender. Clinically significant distress is still necessary for a diagnosis of gender dysphoria in children, but some of the other diagnostic criteria include, for instance, a "strong preference for the toys, games, or activities stereotypically used or engaged in by the other gender."[27] What of girls who are "tomboys" or boys who are not oriented toward violence and guns, who prefer quieter play? Should parents worry that their tomboy daughter is really a boy stuck in a girl's body? There is no scientific basis for believing that playing with toys typical of boys defines a child as a boy, or that playing with toys typical of girls defines a child as a girl. The *DSM-5* criterion for diagnosing gender dysphoria by reference to gender-typical toys is unsound; it appears to ignore the fact that a child could display an *expressed* gender—manifested by social or behavioral traits—incongruent with the child's biological sex but without *identifying* as the opposite gender. Furthermore, even for children who do identify as a gender opposite their biological sex, diagnoses of gender dysphoria are simply unreliable. The reality is that they may have psychological difficulties in accepting their biological sex as their gender. Children can have difficulty with the expectations associated with those gender roles. Traumatic experiences can also cause a child to express distress with the gender associated with his or her biological sex.

Gender identity problems can also arise with intersex conditions (the presence of ambiguous genitalia due to genetic abnormalities), which we discussed earlier. These disorders of sex development, while rare, can contribute to gender dysphoria in some cases.[28] Some of these conditions include complete androgen insensitivity syndrome, where individuals with XY (male) chromosomes lack receptors for male sex hormones, leading them to develop the secondary sex characteristics of females, rather than males (though they lack ovaries, do not menstruate, and are consequently sterile).[29] Another hormonal disorder of sex development that can lead to individuals developing in ways that are not typical of their genetic sex include congenital adrenal hyperplasia, a condition that can

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masculinize XX (female) fetuses.[30] Other rare phenomena such as genetic mosaicism[31] or chimerism,[32] where some cells in the individual's bodies contain XX chromosomes and others contain XY chromosomes, can lead to considerable ambiguity in sex characteristics, including individuals who possess both male and female gonads and sex organs.

While there are many cases of gender dysphoria that are not associated with these identifiable intersex conditions, gender dysphoria may still represent a different type of intersex condition in which the primary sex characteristics such as genitalia develop normally while secondary sex characteristics associated with the brain develop along the lines of the opposite sex. Controversy exists over influences determining the nature of neurological, psychological, and behavioral sex differences. The emerging consensus is that there may be some differences in patterns of neurological development in- and ex-utero for men and women.[33] Therefore, in theory, transgender individuals could be subject to conditions allowing a more female-type brain to develop within a genetic male (having the XY chromosomal patterns), and vice versa. However, as we will show in the next section, the research supporting this idea is quite minimal.

As a way of surveying the biological and social science research on gender dysphoria, we can list some of the important questions. Are there biological factors that influence the development of a gender identity that does not correspond with one's biological sex? Are some individuals born with a gender identity different from their biological sex? Is gender identity shaped by environmental or nurturing conditions? How stable are choices of gender identity? How common is gender dysphoria? Is it persistent across the lifespan? Can a little boy who thinks he is a little girl change over the course of his life to regard himself as male? If so, how often can such people change their gender identities? How would someone's gender identity be measured scientifically? Does self-understanding suffice? Does a biological girl become a gender boy by believing, or at least stating, she is a little boy? Do people's struggles with a sense of incongruity between their gender identity and biological sex persist over the life course? Does gender dysphoria respond to psychiatric interventions? Should those interventions focus on affirming the gender identity of the patient or take a more neutral stance? Do efforts to hormonally or surgically modify an individual's primary or secondary sex characteristics help resolve gender dysphoria? Does modification create further psychiatric problems for some of those diagnosed with gender dysphoria, or does it typically resolve existing psychiatric problems? We broach a few of these critical questions in the following sections.

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Gender and Physiology

Robert Sapolsky, a Stanford professor of biology who has done extensive neuroimaging research, suggested a possible neurobiological explanation for cross-gender identification in a 2013 *Wall Street Journal* article, "Caught Between Male and Female." He asserted that recent neuroimaging studies of the brains of transgender adults suggest that they may have brain structures more similar to their gender identity than to their biological sex.[34] Sapolsky bases this assertion on the fact that there are differences between male and female brains, and while the differences are "small and variable," they "probably contribute to the sex differences in learning, emotion and socialization."[35] He concludes: "The issue isn't that sometimes people believe they are of a different gender than they actually are. Remarkably, instead, it's that sometimes people are born with bodies whose gender is different from what they actually are."[36] In other words, he claims that some people can have a female-type brain in a male body, or vice versa.

While this kind of neurobiological theory of cross-gender identification remains outside of the scientific mainstream, it has recently received scientific and popular attention. It provides a potentially attractive explanation for cross-gender identification, especially for individuals who are not affected by any known genetic, hormonal, or psychosocial abnormalities.[37] However, while Sapolsky may be right, there is fairly little support in the scientific literature for his contention. His neurological explanation for differences between male and female brains and those differences' possible relevance to cross-gender identification warrant further scientific consideration.

There are many small studies that attempt to define causal factors of the experience of incongruence between one's biological sex and felt gender. These studies are described in the following pages, each pointing to an influence that may contribute to the explanation for cross-gender identification.

Nancy Segal, a psychologist and geneticist, researched two case studies of identical twins discordant for female-to-male (FtM) transsexualism.[38] Segal notes that, according to another, earlier study that conducted nonclinical interviews with 45 FtM transsexuals, 60% suffered some form of childhood abuse, with 31% experiencing sexual abuse, 29% experiencing emotional abuse, and 38% physical abuse.[39] However, this earlier study did not include a control group and was limited by its small sample size, making it difficult to extract significant interactions, or generalizations, from the data.

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Segal's own first case study was of a 34-year-old FtM twin, whose identical twin sister was married and the mother of seven children.[40] Several stressful events had occurred during the twins' mother's pregnancy, and they were born five weeks prematurely. When they were eight years old, their parents divorced. The FtM twin exhibited gender-nonconforming behavior early and it persisted throughout childhood. She became attracted to other girls in junior high school and as a teenager attempted suicide several times. She reported physical abuse and emotional abuse at the hand of her mother. The twins were raised in a Mormon household, in which transsexuality was not tolerated.[41] The twin sister had never questioned her gender identity but did experience some depression. For Segal, the FtM twin's gender nonconformity and abuse in childhood were factors that contributed to gender dysphoria; the other twin was not subject to the same stressors in childhood, and did not develop issues around her gender identity. Segal's second case study also concerned identical twins with one twin transitioning from female to male.[42] This FtM twin had early-onset nonconforming behaviors and attempted suicide as a young adult. At age 29 she underwent reassignment surgery, was well supported by family, met a woman, and married. As in the first case, the other twin was reportedly always secure in her female gender identity.

Segal speculates that each set of twins may have had uneven prenatal androgen exposures (though her study did not offer evidence to support this)[43] and concludes that "Transsexualism is unlikely to be associated with a major gene, but is likely to be associated with multiple genetic, epigenetic, developmental and experiential influences."[44] Segal is critical of the notion that the maternal abuse experienced by the FtM twin in her first case study may have played a causal role in the twin's "atypical gender identification" since the abuse "apparently *followed*" the twin's gender-atypical behaviors—though Segal acknowledges "it is possible that this abuse reinforced his already atypical gender identification."[45] These case studies, while informative, are not scientifically strong, and do not provide direct evidence for any causal hypotheses about the origins of atypical gender identification.

A source of more information—but also inadequate to make direct causal inferences—is a case analysis by Mayo Clinic psychiatrists J. Michael Bostwick and Kari A. Martin of an intersex individual born with ambiguous genitalia who was operated on and raised as a female.[46] By way of offering some background, the authors draw a distinction between gender identity disorder (an "inconsistency between perceived gender identity and phenotypic sex" that generally involves "no discernible neuroendocri-

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nological abnormality"[47]), and intersexuality (a condition in which biological features of both sexes are present). They also provide a summary and classification scheme of the various types of intersex disorders. After a thorough discussion of the various intersex developmental issues that can lead to a disjunction between the brain and body, the authors acknowledge that "Some adult patients with severe dysphoria—transsexuals—have neither history nor objective findings supporting a known biological cause of brain-body disjunction."[48] These patients require thorough medical and psychiatric attention to avoid gender dysphoria.

After this helpful summary, the authors state that "Absent psychosis or severe character pathology, patients' subjective assertions are presently the most reliable standards for delineating core gender identity."[49] But it is not clear how we could consider subjective assertions more reliable in establishing gender identity, unless gender identity is defined as a completely subjective phenomenon. The bulk of the article is devoted to describing the various objectively discernible and identifiable ways in which one's identity as a male or female is imprinted on the nervous and endocrine system. Even when something goes wrong with the development of external genitalia, individuals are more likely to act in accordance with their chromosomal and hormonal makeup.[50]

In 2011, Giuseppina Rametti and colleagues from various research centers in Spain used MRI to study the brain structures of 18 FtM transsexuals who exhibited gender nonconformity early in life and experienced sexual attraction to females prior to hormone treatment.[51] The goal was to learn whether their brain features corresponded more to their biological sex or to their sense of gender identity. The control group consisted of 24 male and 19 female heterosexuals with gender identities conforming to their biological sex. Differences were noted in the white matter microstructure of specific brain areas. In untreated FtM transsexuals, that structure was more similar to that of heterosexual males than to that of heterosexual females in three of four brain areas.[52] In a complementary study, Rametti and colleagues compared 18 MtF transsexuals to 19 female and 19 male heterosexual controls.[53] These MtF transsexuals had white matter tract averages in several brain areas that fell between the averages of the control males and the control females. The values, however, were typically closer to the males (that is, to those that shared their biological sex) than to the females in most areas.[54] In controls the authors found that, as expected, the males had greater amounts of gray and white matter and higher volumes of cerebrospinal fluid than control females. The MtF transsexual brain volumes

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were all similar to those of male controls and significantly different from those of females.[55]

Overall, the findings of these studies by Rametti and colleagues do not sufficiently support the notion that transgender individuals have brains more similar to their preferred gender than to the gender corresponding with their biological sex. Both studies are limited by small sample sizes and lack of a prospective hypothesis—both analyzed the MRI data to find the gender differences and then looked to see where the data from transgender subjects fit.

Whereas both of these MRI studies looked at brain *structure*, a functional MRI study by Emiliano Santarnecchi and colleagues from the University of Siena and the University of Florence looked at brain *function*, examining gender-related differences in spontaneous brain activity during the resting state.[56] The researchers compared a single FtM individual (declared cross-gender since childhood), and control groups of 25 males and 25 females, with regard to spontaneous brain activity. The FtM individual demonstrated a "brain activity profile more close to his biological sex than to his desired one," and based in part on this result the authors concluded that "untreated FtM transsexuals show a functional connectivity profile comparable to female control subjects."[57] With a sample size of one, this study's statistical power is virtually zero.

In 2013, Hsaio-Lun Ku and colleagues from various medical centers and research institutes in Taiwan also conducted functional brain imaging studies. They compared the brain activity of 41 transsexuals (21 FtMs, 20 MtFs) and 38 matched heterosexual controls (19 males and 19 females).[58] Arousal response of each cohort while viewing neutral as compared to erotic films was compared between groups. All of the transsexuals in the study reported sexual attractions to members of their natal, biological sex, and exhibited more sexual arousal than heterosexual controls when viewing erotic films that depicted sexual activity between subjects sharing their biological sex. A "selfness" score was also incorporated into the study, in which the researchers asked participants to "rate the degree to which you identify yourself as the male or female in the film."[59] The transsexuals in the study identified with those of their preferred gender more than the controls identified with those of their biological gender, in both erotic films and neutral films. The heterosexual controls did not identify themselves with either males or females in either of the film types. Ku and colleagues claim to have demonstrated characteristic brain patterns for sexual attraction as related to biological sex but did not make meaningful neurobiological gender-identity comparisons among the three cohorts. In

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addition, they reported findings that transsexuals demonstrated psychosocial maladaptive defensive styles.

A 2008 study by Hans Berglund and colleagues from Sweden's Karolinska Institute and Stockholm Brain Institute used PET and fMRI scans to compare brain-area activation patterns in 12 MtF transgendered individuals who were sexually attracted to women with those of 12 heterosexual women and 12 heterosexual men.[60] The first set of subjects took no hormones and had not undergone sex-reassignment surgery. The experiment involved smelling odorous steroids thought to be female pheromones, and other sexually neutral odors such as lavender oil, cedar oil, eugenol, butanol, and odorless air. The results were varied and mixed between the groups for the various odors, which should not be surprising, since *post hoc* analyses usually lead to contradictory findings.

In summary, the studies presented above show inconclusive evidence and mixed findings regarding the brains of transgender adults. Brain-activation patterns in these studies do not offer sufficient evidence for drawing sound conclusions about possible associations between brain activation and sexual identity or arousal. The results are conflicting and confusing. Since the data by Ku and colleagues on brain-activation patterns are not universally associated with a particular sex, it remains unclear whether and to what extent neurobiological findings say anything meaningful about gender identity. It is important to note that regardless of their findings, studies of this kind cannot support any conclusion that individuals come to identify as a gender that does not correspond to their biological sex because of an innate, biological condition of the brain.

The question is not simply whether there are differences between the brains of transgender individuals and people identifying with the gender corresponding to their biological sex, but whether gender identity is a fixed, innate, and biological trait, even when it does not correspond to biological sex, or whether environmental or psychological causes contribute to the development of a sense of gender identity in such cases. Neurological differences in transgender adults might be the consequence of biological factors such as genes or prenatal hormone exposure, or of psychological and environmental factors such as childhood abuse, or they could result from some combination of the two. There are no serial, longitudinal, or prospective studies looking at the brains of cross-gender identifying children who develop to later identify as transgender adults. Lack of this research severely limits our ability to understand causal relationships between brain morphology, or functional activity, and the later development of gender identity different from biological sex.

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More generally, it is now widely recognized among psychiatrists and neuroscientists who engage in brain imaging research that there are inherent and ineradicable methodological limitations of *any* neuroimaging study that simply associates a particular trait, such as a certain behavior, with a particular brain morphology.[61] (And when the trait in question is not a concrete behavior but something as elusive and vague as "gender identity," these methodological problems are even more serious.) These studies cannot provide statistical evidence nor show a plausible biological mechanism strong enough to support *causal connections* between a brain feature and the trait, behavior, or symptom in question. To support a conclusion of causality, even epidemiological causality, we need to conduct prospective longitudinal panel studies of a fixed set of individuals across the course of sexual development if not their lifespan.

Studies like these would use serial brain images at birth, in childhood, and at other points along the developmental continuum, to see whether brain morphology findings were there from the beginning. Otherwise, we cannot establish whether certain brain features caused a trait, or whether the trait is innate and perhaps fixed. Studies like those discussed above of individuals who already exhibit the trait are incapable of distinguishing between *causes* and *consequences* of the trait. In most cases transgender individuals have been acting and thinking for years in ways that, through learned behavior and associated neuroplasticity, may have produced brain changes that could differentiate them from other members of their biological or natal sex. The only definitive way to establish epidemiological causality between a brain feature and a trait (especially one as complex as gender identity) is to conduct prospective, longitudinal, preferably randomly sampled and population-based studies.

In the absence of such prospective longitudinal studies, large representative population-based samples with adequate statistical controls for confounding factors may help narrow the possible causes of a behavioral trait and thereby increase the probability of identifying a neurological cause.[62] However, because the studies conducted thus far use small convenience samples, none of them is especially helpful for narrowing down the options for causality. To obtain a better study sample, we would need to include neuroimaging in large-scale epidemiological studies. In fact, given the small number of transgender individuals in the general population,[63] the studies would need to be prohibitively large to attain findings that would reach statistical significance.

Moreover, if a study found significant differences between these groups—that is, a number of differences higher than what would be

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expected by chance alone—these differences would refer to the average in a population of each group. Even if these two *groups* differed significantly for all 100 measurements, it would not necessarily indicate a biological difference among *individuals* at the extremes of the distribution. Thus, a randomly selected transgender individual and a randomly selected non-transgender individual might not differ on any of these 100 measurements. Additionally, since the probability that a randomly selected person from the general population will be transgender is quite small, statistically significant differences in the sample means are not sufficient evidence to conclude that a particular measurement is predictive of whether the person is transgender or not. If we measured the brain of an infant, toddler, or adolescent and found this individual to be closer to one cohort than another on these measures, it would not imply that this individual would grow up to identify as a member of that cohort. It may be helpful to keep this caveat in mind when interpreting research on transgender individuals.

In this context, it is important to note that there are no studies that demonstrate that any of the biological differences being examined have predictive power, and so all interpretations, usually in popular outlets, claiming or suggesting that a statistically significant difference between the brains of people who are transgender and those who are not is the cause of being transgendered or not—that is to say, that the biological differences determine the differences in gender identity—are unwarranted.

In short, the current studies on associations between brain structure and transgender identity are small, methodologically limited, inconclusive, and sometimes contradictory. Even if they were more methodologically reliable, they would be insufficient to demonstrate that brain structure is a cause, rather than an effect, of the gender-identity behavior. They would likewise lack predictive power, the real challenge for any theory in science.

For a simple example to illustrate this point, suppose we had a room with 100 people in it. Two of them are transgender and all others are not. I pick someone at random and ask you to guess the person's gender identity. If you know that 98 out of 100 of the individuals are not transgender, the safest bet would be to guess that the individual is not transgender, since that answer will be correct 98% of the time. Suppose, then, that you have the opportunity to ask questions about the neurobiology and about the natal sex of the person. Knowing the biology only helps in predicting whether the individual is transgender if it can improve on the original guess that the person is not transgender. So if knowing a characteristic of the individual's brain does not improve the ability to predict what group the patient belongs to, then the fact that the two groups differ at the mean is almost irrelevant.

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Improving on the original prediction is very difficult for a rare trait such as being transgender, because the probability of that prediction being correct is already very high. If there really were a clear difference between the brains of transgender and non-transgender individuals, akin to the biological differences between the sexes, then improving on the original guess would be relatively easy. Unlike the differences between the sexes, however, there are no biological features that can reliably identify transgender individuals as different from others.

The consensus of scientific evidence overwhelmingly supports the proposition that a physically and developmentally normal boy or girl is indeed what he or she appears to be at birth. The available evidence from brain imaging and genetics does not demonstrate that the development of gender identity as different from biological sex is innate. Because scientists have not established a solid framework for understanding the causes of cross-gender identification, ongoing research should be open to psychological and social causes, as well as biological ones.

Transgender Identity in Children

In 2012, the *Washington Post* featured a story by Petula Dvorak, "Transgender at five,"[64] about a girl who at the age of 2 years began insisting that she was a boy. The story recounts her mother's interpretation of this behavior: "Her little girl's brain was different. Jean [her mother] could tell. She had heard about transgender people, those who are one gender physically but the other gender mentally." The story recounts this mother's distressed experiences as she began researching gender identity problems in children and came to understand other parents' experiences:

> Many talked about their painful decision to allow their children to publicly transition to the opposite gender—a much tougher process for boys who wanted to be girls. Some of what Jean heard was reassuring: Parents who took the plunge said their children's behavior problems largely disappeared, schoolwork improved, happy kid smiles returned. But some of what she heard was scary: children taking puberty blockers in elementary school and teens embarking on hormone therapy before they'd even finished high school.[65]

The story goes on to describe how the sister, Moyin, of the transgender child Tyler (formerly Kathryn) made sense of her sibling's identity:

> Tyler's sister, who's 8, was much more casual about describing her transgender sibling. "It's just a boy mind in a girl body," Moyin

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> explained matter-of-factly to her second-grade classmates at her private school, which will allow Tyler to start kindergarten as a boy, with no mention of Kathryn.[66]

The remarks from the child's sister encapsulate the popular notion regarding gender identity: transgender individuals, or children who meet the diagnostic criteria for gender dysphoria, are simply "a boy mind in a girl body," or vice versa. This view implies that gender identity is a persistent and innate feature of human psychology, and it has inspired a gender-affirming approach to children who experience gender identity issues at an early age.

As we have seen above in the overview of the neurobiological and genetic research on the origins of gender identity, there is little evidence that the phenomenon of transgender identity has a biological basis. There is also little evidence that gender identity issues have a high rate of persistence in children. According to the *DSM-5*, "In natal [biological] males, persistence [of gender dysphoria] has ranged from 2.2% to 30%. In natal females, persistence has ranged from 12% to 50%."[67] Scientific data on persistence of gender dysphoria remains sparse due to the very low prevalence of the disorder in the general population, but the wide range of findings in the literature suggests that there is still much that we do not know about why gender dysphoria persists or desists in children. As the *DSM-5* entry goes on to note, "It is unclear if children 'encouraged' or supported to live socially in the desired gender will show higher rates of persistence, since such children have not yet been followed longitudinally in a systematic manner."[68] There is a clear need for more research in these areas, and for parents and therapists to acknowledge the great uncertainty regarding how to interpret the behavior of these children.

Therapeutic Interventions in Children

With the uncertainty surrounding the diagnosis of and prognosis for gender dysphoria in children, therapeutic decisions are particularly complex and difficult. Therapeutic interventions for children must take into account the probability that the children may outgrow cross-gender identification. University of Toronto researcher and therapist Kenneth Zucker believes that family and peer dynamics can play a significant role in the development and persistence of gender-nonconforming behavior, writing that

> it is important to consider both predisposing and perpetuating factors that might inform a clinical formulation and the development of

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> a therapeutic plan: the role of temperament, parental reinforcement of cross-gender behavior during the sensitive period of gender identity formation, family dynamics, parental psychopathology, peer relationships and the multiple meanings that might underlie the child's fantasy of becoming a member of the opposite sex.[69]

Zucker worked for years with children experiencing feelings of gender incongruence, offering psychosocial treatments to help them embrace the gender corresponding with their biological sex—for instance, talk therapy, parent-arranged play dates with same-sex peers, therapy for co-occurring psychopathological issues such as autism spectrum disorder, and parent counseling.[70]

In a follow-up study by Zucker and colleagues of children treated by them over the course of thirty years at the Center for Mental Health and Addiction in Toronto, they found that gender identity disorder persisted in only 3 of the 25 girls they had treated.[71] (Zucker's clinic was closed by the Canadian government in 2015.[72])

An alternative to Zucker's approach that emphasizes affirming the child's preferred gender identity has become more common among therapists.[73] This approach involves helping the children to self-identify even more with the gender label they prefer at the time. One component of the gender-affirming approach has been the use of hormone treatments for adolescents in order to delay the onset of sex-typical characteristics during puberty and alleviate the feelings of dysphoria the adolescents will experience as their bodies develop sex-typical characteristics that are at odds with the gender with which they identify. There is relatively little evidence for the therapeutic value of these kinds of puberty-delaying treatments, but they are currently the subject of a large clinical study sponsored by the National Institutes of Health.[74]

While epidemiological data on the outcomes of medically delayed puberty is quite limited, referrals for sex-reassignment hormones and surgical procedures appear to be on the rise, and there is a push among many advocates to proceed with sex reassignment at younger ages. According to a 2013 article in *The Times* of London, the United Kingdom saw a 50% increase in the number of children referred to gender dysphoria clinics from 2011 to 2012, and a nearly 50% increase in referrals among adults from 2010 to 2012.[75] Whether this increase can be attributed to rising rates of gender confusion, rising sensitivity to gender issues, growing acceptance of therapy as an option, or other factors, the increase itself is concerning, and merits further scientific inquiry into the family dynamics

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and other potential problems, such as social rejection or developmental issues, that may be taken as signs of childhood gender dysphoria.

A study of psychological outcomes following puberty suppression and sex-reassignment surgery, published in the journal *Pediatrics* in 2014 by child and adolescent psychiatrist Annelou L. C. de Vries and colleagues, suggested improved outcomes for individuals after receiving these interventions, with well-being improving to a level similar to that of young adults from the general population.[76] This study looked at 55 transgender adolescents and young adults (22 MtF and 33 FtM) from a Dutch clinic who were assessed three times: before the start of puberty suppression (mean age: 13.6 years), when cross-sex hormones were introduced (mean age: 16.7 years), and at least one year after sex-reassignment surgery (mean age: 20.7 years). The study did not provide a matched group for comparison—that is, a group of transgender adolescents who did not receive puberty-blocking hormones, cross-sex hormones, and/or sex-reassignment surgery—which makes comparisons of outcomes more difficult.

In the study cohort, gender dysphoria improved over time, body image improved on some measures, and overall functioning improved modestly. Due to the lack of a matched control group it is unclear whether these changes are attributable to the procedures or would have occurred in this cohort without the medical and surgical interventions. Measures of anxiety, depression, and anger showed some improvements over time, but these findings did not reach statistical significance. While this study suggested some improvements over time in this cohort, particularly the reported subjective satisfaction with the procedures, detecting significant differences would require the study to be replicated with a matched control group and a larger sample size. The interventions also included care from a multidisciplinary team of medical professionals, which could have had a beneficial effect. Future studies of this kind would ideally include long-term follow-ups that assess outcomes and functioning beyond the late teens or early twenties.

Therapeutic Interventions in Adults

The potential that patients undergoing medical and surgical sex reassignment may want to return to a gender identity consistent with their biological sex suggests that reassignment carries considerable psychological and physical risk, especially when performed in childhood, but also in adulthood. It suggests that the patients' pre-treatment beliefs about an ideal post-treatment life may sometimes go unrealized.

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In 2004, Birmingham University's Aggressive Research Intelligence Facility (Arif) assessed the findings of more than one hundred follow-up studies of post-operative transsexuals.[77] An article in *The Guardian* summarized the findings:

> Arif…concludes that none of the studies provides conclusive evidence that gender reassignment is beneficial for patients. It found that most research was poorly designed, which skewed the results in favour of physically changing sex. There was no evaluation of whether other treatments, such as long-term counselling, might help transsexuals, or whether their gender confusion might lessen over time. Arif says the findings of the few studies that have tracked significant numbers of patients over several years were flawed because the researchers lost track of at least half of the participants. The potential complications of hormones and genital surgery, which include deep vein thrombosis and incontinence respectively, have not been thoroughly investigated, either. "There is huge uncertainty over whether changing someone's sex is a good or a bad thing," says Dr Chris Hyde, director of Arif. "While no doubt great care is taken to ensure that appropriate patients undergo gender reassignment, there's still a large number of people who have the surgery but remain traumatized—often to the point of committing suicide."[78]

The high level of uncertainty regarding various outcomes after sex-reassignment surgery makes it difficult to find clear answers about the effects on patients of reassignment surgery. Since 2004, there have been other studies on the efficacy of sex-reassignment surgery, using larger sample sizes and better methodologies. We will now examine some of the more informative and reliable studies on outcomes for individuals receiving sex-reassignment surgery.

As far back as 1979, Jon K. Meyer and Donna J. Reter published a longitudinal follow-up study on the overall well-being of adults who underwent sex-reassignment surgery.[79] The study compared the outcomes of 15 people who received surgery with those of 35 people who requested but did not receive surgery (14 of these individuals eventually received surgery later, resulting in three cohorts of comparison: operated, not-operated, and operated later). Well-being was quantified using a scoring system that assessed psychiatric, economic, legal, and relationship outcome variables. Scores were determined by the researchers after performing interviews with the subjects. Average follow-up time was approximately five years for subjects who had sex change surgery, and about two years for those subjects who did not.

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Compared to their condition before surgery, the individuals who had undergone surgery appeared to show some improvement in well-being, though the results had a fairly low level of statistical significance. Individuals who had no surgical intervention did display a statistically significant improvement at follow-up. However, there was no statistically significant difference between the two groups' scores of well-being at follow-up. The authors concluded that "sex reassignment surgery confers no objective advantage in terms of social rehabilitation, although it remains subjectively satisfying to those who have rigorously pursued a trial period and who have undergone it."[80] This study led the psychiatry department at Johns Hopkins Medical Center (JHMC) to discontinue surgical interventions for sex changes for adults.[81]

However, the study has important limitations. Selection bias was introduced in the study population, because the subjects were drawn from those individuals who sought sex-reassignment surgery at JHMC. In addition, the sample size was small. Also, the individuals who did not undergo sex-reassignment surgery but presented to JHMC for it did not represent a true control group. Random assignment of the surgical procedure was not possible. Large differences in the average follow-up time between those who underwent surgery and those who did not further reduces any capacity to draw valid comparisons between the two groups. Additionally, the study's methodology was also criticized for the somewhat arbitrary and idiosyncratic way it measured the well-being of its subjects. Cohabitation or any form of contact with psychiatric services were scored as equally negative factors as having been arrested.[82]

In 2011, Cecilia Dhejne and colleagues from the Karolinska Institute and Gothenburg University in Sweden published one of the more robust and well-designed studies to examine outcomes for persons who underwent sex-reassignment surgery. Focusing on mortality, morbidity, and criminality rates, the matched cohort study compared a total of 324 transsexual persons (191 MtFs, 133 FtMs) who underwent sex reassignment between 1973 and 2003 to two age-matched controls: people of the same sex as the transsexual person at birth, and people of the sex to which the individual had been reassigned.[83]

Given the relatively low number of transsexual persons in the general population, the size of this study is impressive. Unlike Meyer and Reter, Dhejne and colleagues did not seek to evaluate the patient satisfaction after sex-reassignment surgery, which would have required a control group of transgender persons who desired to have sex-reassignment surgery but did not receive it. Also, the study did not compare outcome

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variables before and after sex-reassignment surgery; only outcomes after surgery were evaluated. We need to keep these caveats in mind as we look at what this study found.

Dhejne and colleagues found statistically significant differences between the two cohorts on several of the studied rates. For example, the postoperative transsexual individuals had an approximately three times higher risk for psychiatric hospitalization than the control groups, even after adjusting for prior psychiatric treatment.[84] (However, the risk of being hospitalized for substance abuse was not significantly higher after adjusting for prior psychiatric treatment, as well as other covariates.) Sex-reassigned individuals had nearly a three times higher risk of all-cause mortality after adjusting for covariates, although the elevated risk was significant only for the time period of 1973–1988.[85] Those undergoing surgery during this period were also at increased risk of being convicted of a crime.[86] Most alarmingly, sex-reassigned individuals were 4.9 times more likely to attempt suicide and 19.1 times more likely to die by suicide compared to controls.[87] "Mortality from suicide was strikingly high among sex-reassigned persons, including after adjustment for prior psychiatric morbidity."[88]

The study design precludes drawing inferences "as to the effectiveness of sex reassignment as a treatment for transsexualism," although Dhejne and colleagues state that it is possible that "things might have been even worse without sex reassignment."[89] Overall, post-surgical mental health was quite poor, as indicated especially by the high rate of suicide attempts and all-cause mortality in the 1973–1988 group. (It is worth noting that for the transsexuals in the study who underwent sex reassignment from 1989 to 2003, there were of course fewer years of data available at the time the study was conducted than for those transsexuals from the earlier period. The rates of mortality, morbidity, and criminality in the later group may in time come to resemble the elevated risks of the earlier group.) In summary, this study suggests that sex-reassignment surgery may not rectify the comparatively poor health outcomes associated with transgender populations in general. Still, because of the limitations of this study mentioned above, the results also cannot establish that sex-reassignment surgery causes poor health outcomes.

In 2009, Annette Kuhn and colleagues from the University Hospital and University of Bern in Switzerland examined post-surgery quality of life in 52 MtF and 3 FtM transsexuals fifteen years after sex-reassignment surgery.[90] This study found considerably lower general life satisfaction in post-surgical transsexuals as compared with females who had at least one

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pelvic surgery in the past. The postoperative transsexuals reported lower satisfaction with their general quality of health and with some of the personal, physical, and social limitations they experienced with incontinence that resulted as a side effect of the surgery. Again, inferences cannot be drawn from this study regarding the efficacy of sex-reassignment surgery due to the lack of a control group of transgender individuals who did not receive sex-reassignment surgery.

In 2010, Mohammad Hassan Murad and colleagues from the Mayo Clinic published a systematic review of studies on the outcomes of hormonal therapies used in sex-reassignment procedures, finding that there was "very low quality evidence" that sex reassignment via hormonal interventions "likely improves gender dysphoria, psychological functioning and comorbidities, sexual function and overall quality of life."[91] The authors identified 28 studies that together examined 1,833 patients who underwent sex-reassignment procedures that included hormonal interventions (1,093 male-to-female, 801 female-to-male).[92] Pooling data across studies showed that, after receiving sex-reassignment procedures, 80% of patients reported improvement in gender dysphoria, 78% reported improvement in psychological symptoms, and 80% reported improvement in quality of life.[93] None of the studies included the bias-limiting measure of randomization (that is, in none of the studies were sex-reassignment procedures assigned randomly to some patients but not to others), and only three of the studies included control groups (that is, patients who were not provided the treatment to serve as comparison cases for those who did).[94] Most of the studies examined in Murad and colleagues' review reported improvements in psychiatric comorbidities and quality of life, though notably suicide rates remained higher for individuals who had received hormone treatments than for the general population, despite reductions in suicide rates following the treatments.[95] The authors also found that there were some exceptions to reports of improvements in mental health and satisfaction with sex-reassignment procedures; in one study, 3 of 17 individuals regretted the procedure with 2 of these 3 seeking reversal procedures,[96] and four of the studies reviewed reported worsening quality of life, including continuing social isolation, lack of improvement in social relationships, and dependence on government welfare programs.[97]

The scientific evidence summarized suggests we take a skeptical view toward the claim that sex-reassignment procedures provide the hoped-for benefits or resolve the underlying issues that contribute to elevated mental health risks among the transgender population. While we work to stop maltreatment and misunderstanding, we should also work to study

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and understand whatever factors may contribute to the high rates of suicide and other psychological and behavioral health problems among the transgender population, and to think more clearly about the treatment options that are available.

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Conclusion

Accurate, replicable scientific research results can and do influence our personal decisions and self-understanding, and can contribute to the public discourse, including cultural and political debates. When the research touches on controversial themes, it is particularly important to be clear about precisely what science has and has not shown. For complex, complicated questions concerning the nature of human sexuality, there exists at best provisional scientific consensus; much remains unknown, as sexuality is an immensely complex part of human life that defies our attempts at defining all its aspects and studying them with precision.

For questions that are easier to study empirically, however, such as those concerning the rates of mental health outcomes for identifiable subpopulations of sexual minorities, the research does offer some clear answers: these subpopulations show higher rates of depression, anxiety, substance abuse, and suicide compared to the general population. One hypothesis, the social stress model—which posits that stigma, prejudice, and discrimination are the primary causes of higher rates of poor mental health outcomes for these subpopulations—is frequently cited as a way to explain this disparity. While non-heterosexual and transgender individuals are often subject to social stressors and discrimination, science has not shown that these factors alone account for the entirety, or even a majority, of the health disparity between non-heterosexual and transgender subpopulations and the general population. There is a need for extensive research in this area to test the social stress hypothesis and other potential explanations for the health disparities, and to help identify ways of addressing the health concerns present in these subpopulations.

Some of the most widely held views about sexual orientation, such as the "born that way" hypothesis, simply are not supported by science. The literature in this area does describe a small ensemble of biological differences between non-heterosexuals and heterosexuals, but those biological differences are not sufficient to predict sexual orientation, the ultimate test of any scientific finding. The strongest statement that science offers to explain sexual orientation is that some biological factors appear, to an unknown extent, to predispose some individuals to a non-heterosexual orientation.

The suggestion that we are "born that way" is more complex in the case of gender identity. In one sense, the evidence that we are born with

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a given gender seems well supported by direct observation: males overwhelmingly identify as men and females as women. The fact that children are (with a few exceptions of intersex individuals) born either biologically male or female is beyond debate. The biological sexes play complementary roles in reproduction, and there are a number of population-level average physiological and psychological differences between the sexes. However, while biological sex is an innate feature of human beings, gender identity is a more elusive concept.

In reviewing the scientific literature, we find that almost nothing is well understood when we seek biological explanations for what causes some individuals to state that their gender does not match their biological sex. The findings that do exist often have sample-selection problems, and they lack longitudinal perspective and explanatory power. Better research is needed, both to identify ways by which we can help to lower the rates of poor mental health outcomes and to make possible more informed discussion about some of the nuances present in this field.

Yet despite the scientific uncertainty, drastic interventions are prescribed and delivered to patients identifying, or identified, as transgender. This is especially troubling when the patients receiving these interventions are children. We read popular reports about plans for medical and surgical interventions for many prepubescent children, some as young as six, and other therapeutic approaches undertaken for children as young as two. We suggest that no one can determine the gender identity of a two-year-old. We have reservations about how well scientists understand what it even means for a child to have a developed sense of his or her gender, but notwithstanding that issue, we are deeply alarmed that these therapies, treatments, and surgeries seem disproportionate to the severity of the distress being experienced by these young people, and are at any rate premature since the majority of children who identify as the gender opposite their biological sex will not continue to do so as adults. Moreover, there is a lack of reliable studies on the long-term effects of these interventions. We strongly urge caution in this regard.

We have sought in this report to present a complex body of research in a way that will be intelligible to a wide audience of both experts and lay readers alike. Everyone—scientists and physicians, parents and teachers, lawmakers and activists—deserves access to accurate information about sexual orientation and gender identity. While there is much controversy surrounding how our society treats its LGBT members, no political

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or cultural views should discourage us from understanding the related clinical and public health issues and helping people suffering from mental health problems that may be connected to their sexuality.

Our work suggests some avenues for future research in the biological, psychological, and social sciences. More research is needed to uncover the causes of the increased rates of mental health problems in the LGBT subpopulations. The social stress model that dominates research on this issue requires improvement, and most likely needs to be supplemented by other hypotheses. Additionally, the ways in which sexual desires develop and change across one's lifespan remain, for the most part, inadequately understood. Empirical research may help us to better understand relationships, sexual health, and mental health.

Critiquing and challenging both parts of the "born that way" paradigm—both the notion that sexual orientation is biologically determined and fixed, and the related notion that there is a fixed gender independent of biological sex—enables us to ask important questions about sexuality, sexual behaviors, gender, and individual and social goods in a different light. Some of these questions lie outside the scope of this work, but those that we have examined suggest that there is a great chasm between much of the public discourse and what science has shown.

Thoughtful scientific research and careful, circumspect interpretation of its results can advance our understanding of sexual orientation and gender identity. There is still much work to be done and many unanswered questions. We have attempted to synthesize and describe a complex body of scientific research related to some of these themes. We hope that this report contributes to the ongoing public conversation regarding human sexuality and identity. We anticipate that this report may elicit spirited responses, and we welcome them.

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Part One: Sexual Orientation

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116. Andrea L. Roberts, M. Maria Glymour, and Karestan C. Koenen, "Does Maltreatment in Childhood Affect Sexual Orientation in Adulthood?," *Archives of Sexual Behavior* 42, no. 2 (2013): 161–171, http://dx.doi.org/10.1007/s10508-012-0021-9.

117. For those interested in the methodological details: this statistical method uses a two-step process where "instruments"—in this case, family characteristics that are known to be related to maltreatment (presence of a stepparent, parental alcohol abuse, or parental mental illness)—are used as the "instrumental variables" to predict the risk of maltreatment. In the second step, the predicted risk of maltreatment is employed as the independent variable and adult sexual orientation as the dependent variable; coefficients from this are the instrumental variable estimates. It should also be noted here that these instrumental variable estimation techniques rely on some important (and questionable) assumptions, in this case the assumption that the instruments (the stepparent, the alcohol abuse, the mental illness) do not affect the child's sexual orientation measures except through child abuse. But this assumption is not demonstrated, and therefore may constitute a foundational limitation of the method. Causation is difficult to support statistically and continues to beguile research in the social sciences in spite of efforts to design studies capable of generating stronger associations that give stronger support to claims of causation.

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122. For information on the study, see "National Health and Social Life Survey," Population Research Center of the University of Chicago, http://popcenter.uchicago.edu/data/nhsls.shtml.

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124. Laumann *et al.*, *The Social Organization of Sexuality*, 295.

125. The third iteration of Natsal from 2010 found, over an age range from 16 to 74, that 1.0% of women and 1.5% of men consider themselves gay/lesbian, and 1.4% of women and 1.0% of men think of themselves as bisexual. See Catherine H. Mercer *et al.*, "Changes in sexual attitudes and lifestyles in Britain through the life course and over time: findings from the National Surveys of Sexual Attitudes and Lifestyles (Natsal)," *The Lancet* 382, no. 9907 (2013): 1781–1794, http://dx.doi.org/10.1016/S0140-6736(13)62035-8. Full results of this survey are reported in several articles in the same issue of *The Lancet*.

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127. This figure is calculated from Table 8.2 in Laumann *et al.*, *The Social Organization of Sexuality*, 305.

128. For more information on the study design of Add Health, see Kathleen Mullan Harris *et al.*, "Study Design," The National Longitudinal Study of Adolescent to Adult Health, http://www.cpc.unc.edu/projects/addhealth/design. Some studies based on Add Health data use Arabic numerals rather than Roman numerals to label the waves; when describing or quoting from those studies, we stick with the Roman numerals.

129. See Table 1 in Ritch C. Savin-Williams and Kara Joyner, "The Dubious Assessment of Gay, Lesbian, and Bisexual Adolescents of Add Health," *Archives of Sexual Behavior* 43, no. 3 (2014): 413–422, http://dx.doi.org/10.1007/s10508-013-0219-5.

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133. "Research Collaborators," The National Longitudinal Study of Adolescent to Adult Health, http://www.cpc.unc.edu/projects/addhealth/people.

134. J. Richard Udry and Kim Chantala, "Risk Factors Differ According to Same-Sex and Opposite-Sex Interest," *Journal of Biosocial Science* 37, no. 04 (2005): 481–497, http://dx.doi.org/10.1017/S0021932004006765.

135. Ritch C. Savin-Williams and Geoffrey L. Ream, "Prevalence and Stability of Sexual Orientation Components During Adolescence and Young Adulthood," *Archives of Sexual Behavior* 36, no. 3 (2007): 385–394, http://dx.doi.org/10.1007/s10508-006-9088-5.

136. *Ibid.*, 388.

137. *Ibid.*, 389.

138. *Ibid.*, 392–393.

139. *Ibid.*, 393.

140. Miles Q. Ott *et al.*, "Repeated Changes in Reported Sexual Orientation Identity Linked to Substance Use Behaviors in Youth," *Journal of Adolescent Health* 52, no. 4 (2013): 465–472, http://dx.doi.org/10.1016/j.jadohealth.2012.08.004.

141. Savin-Williams and Joyner, "The Dubious Assessment of Gay, Lesbian, and Bisexual

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Adolescents of Add Health."

142. *Ibid.*, 416.

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144. For more analysis of inaccurate responders in the Add Health surveys, see Xitao Fan *et al.*, "An Exploratory Study about Inaccuracy and Invalidity in Adolescent Self-Report Surveys," *Field Methods* 18, no. 3 (2006): 223–244, http://dx.doi.org/10.1177/152822X06289161.

145. Savin-Williams and Joyner were also skeptical of the Add Health survey data because the high proportion of youth reporting same-sex or both-sex attractions (7.3% of boys and 5.0% of girls) in Wave I was very unusual when compared to similar studies, and because of the dramatic reduction in reported same-sex attraction a little over a year later, in Wave II.

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153. *Ibid.*, 15.

154. *Ibid.*, 15–16.

155. For example, see Bailey, "What is Sexual Orientation and Do Women Have One?," 43–63; Peplau *et al.*, "The Development of Sexual Orientation in Women," 70–99.

156. Lisa M. Diamond, *Sexual Fluidity* (Cambridge, Mass.: Harvard University Press, 2008), 52.

157. Lisa M. Diamond, "Was It a Phase? Young Women's Relinquishment of Lesbian/Bisexual Identities Over a 5-Year Period," *Journal of Personality and Social Psychology* 84, no. 2 (2003): 352–364, http://dx.doi.org/10.1037/0022-3514.84.2.352.

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158. Diamond, "What Does Sexual Orientation Orient?," 173–192.

159. This conference paper was summarized in Denizet-Lewis, "The Scientific Quest to Prove Bisexuality Exists."

160. A. Lee Beckstead, "Can We Change Sexual Orientation?," *Archives of Sexual Behavior* 41, no. 1 (2012): 128, http://dx.doi.org/10.1007/s10508-012-9922-x.

Part Two: Sexuality, Mental Health Outcomes, and Social Stress

1. Michael King *et al.*, "A systematic review of mental disorder, suicide, and deliberate self harm in lesbian, gay and bisexual people," *BMC Psychiatry* 8 (2008): 70, http://dx.doi.org/10.1186/1471-244X-8-70.

2. The researchers who performed this meta-analysis initially found 13,706 papers by searching academic and medical research databases, but after excluding duplicates and other spurious search results examined 476 papers. After further excluding uncontrolled studies, qualitative papers, reviews, and commentaries, the authors found 111 data-based papers, of which they excluded 87 that were not population-based studies, or that failed to employ psychiatric diagnoses, or that used poor sampling. The 28 remaining papers relied on 25 studies (some of the papers examined data from the same studies), which King and colleagues evaluated using four quality criteria: (1) whether or not random sampling was used; (2) the representativeness of the study (measured by survey response rates); (3) whether the sample was drawn from the general population or from some more limited subset, such as university students; and (4) sample size. However, only one study met all four criteria. Acknowledging the inherent limitations and inconsistencies of sexual orientation concepts, the authors included information on how those concepts were operationalized in the studies analyzed—whether in terms of same-sex attraction (four studies), same-sex behavior (thirteen studies), self-identification (fifteen studies), score above zero on the Kinsey scale (three studies), two different definitions of sexual orientation (nine studies), three different definitions (one study). Eighteen of the studies used a specific time frame for defining the sexuality of their subjects. The studies were also grouped into whether or not they focused on lifetime or twelve-month prevalence, and whether the authors analyzed outcomes for LGB populations separately or collectively.

3. 95% confidence interval: 1.87–3.28.

4. 95% confidence interval: 1.69–2.48.

5. 95% confidence interval: 1.23–1.92.

6. 95% confidence interval: 1.23–1.86.

7. 95% confidence interval: 1.97–5.92.

8. 95% confidence interval: 2.32–7.88.

9. Wendy B. Bostwick *et al.*, "Dimensions of Sexual Orientation and the Prevalence of Mood and Anxiety Disorders in the United States," *American Journal of Public Health* 100, no. 3 (2010): 468–475, http://dx.doi.org/10.2105/AJPH.2008.152942.

10. *Ibid.*, 470.

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11. The difference in health outcomes between women who identify as lesbians and women who report exclusive same-sex sexual behaviors or attractions is a good illustration of how the differences between sexual identity, behavior, and attraction matter.

12. Susan D. Cochran and Vickie M. Mays, "Physical Health Complaints Among Lesbians, Gay Men, and Bisexual and Homosexually Experienced Heterosexual Individuals: Results From the California Quality of Life Survey," *American Journal of Public Health* 97, no. 11 (2007): 2048–2055, http://dx.doi.org/10.2105/AJPH.2006.087254.

13. Christine E. Grella *et al.*, "Influence of gender, sexual orientation, and need on treatment utilization for substance use and mental disorders: Findings from the California Quality of Life Survey," *BMC Psychiatry* 9, no. 1 (2009): 52, http://dx.doi.org/10.1186/1471-244X-9-52.

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62. An additional clarification may be helpful with regard to research studies of this kind. Significant differences in the means of sample populations do not entail predictive power of any consequence. Suppose that we made 100 different types of brain measurements in cohorts of transgender and non-transgender individuals, and then calculated the means of each of those 100 variables for both cohorts. Statistical theory tells us that, due to mere chance, we can (on average) expect the two cohorts to differ significantly in the means of 5 of those 100 variables. This implies that if the significant differences are about 5 or fewer out of 100, these differences could easily be by chance and therefore we should not ignore the fact that 95 other measurements failed to find significant differences.

63. One recent paper estimates that 0.6% of the adult U.S. population is transgender. See Andrew R. Flores *et al.*, "How Many Adults Identify as Transgender in the United States?" (white paper), Williams Institute, UCLA School of Law, June 30, 2016, http://williamsinstitute.law.ucla.edu/wp-content/uploads/How-Many-Adults-Identify-as-Transgender-in-the-United-States.pdf.

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65. *Ibid.*

66. *Ibid.*

67. American Psychiatric Association, "Gender Dysphoria," *DSM-5*, 455. Note: Although the quotation comes from the *DSM-5* entry for "gender dysphoria" and implies that the listed persistence rates apply to that precise diagnosis, the diagnosis of gender dysphoria was formalized by the *DSM-5*, so some of the studies from which the persistence rates were drawn may have employed earlier diagnostic criteria.

68. *Ibid.*, 455.

69. Kenneth J. Zucker, "Children with gender identity disorder: Is there a best practice?," *Neuropsychiatrie de l'Enfance et de l'Adolescence* 56, no. 6 (2008): 363, http://dx.doi.org/10.1016/j.neurenf.2008.06.003.

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85. 95% confidence interval: 1.8–4.3.

86. MtF transsexuals in the study's 1973–1988 period showed a higher risk of crime compared to the female controls, suggesting that they maintain a male pattern for criminality. That study period's FtM transsexuals, however, did show a higher risk of crime compared to the female controls, perhaps related to the effects of exogenous testosterone administration.

87. 95% confidence intervals: 2.9–8.5 and 5.8–62.9, respectively.

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