Epigenetics, Preconception Tort Liability, and Public Health

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Epigenetics is an emerging science that studies how our behavior and environment can change the function of our genes without changing our genetic code. These changes can pass on to our children and grandchildren, for better or for worse. Epigenetic knowledge could change our understanding of human biology and individual responsibility. However, it is also ripe for misunderstanding. Commercial entities seek to capitalize on the hype to sell snake oil under the "epigenetic" label. In the popular press, reporters dramatize limited studies to create sensational headlines, often blaming parents for causing epigenetic harms to their children.

If this attitude toward epigenetics crosses over into law, the potential legal ramifications are staggering. Should a person be liable when their behavior causes epigenetic harms to their children, grandchildren, or descendants? A handful of legal scholars have analyzed epigenetic tort claims, predominantly arguing that epigenetic studies can prove causation under negligence law. Unfortunately, these efforts have a perturbing effect: parents are inevitably brought into debates couched in responsibility and liability toward their descendants. The regrettable reality raises the specter of legal action against parents.

This Article argues that parents should have no legal duty in tort law to prevent epigenetic harms to their children. Even if it were possible to prove causation, a duty to avoid epigenetic harms would intrude into the realm of one's personal life and gravely diminish one's right to control their own life. Epigenetic harms can arise long before individuals ever conceive a child, so a tort law duty would undermine one's privacy rights, personal autonomy, reproductive autonomy, and bodily integrity. Focusing solely on individual liability overlooks the nuances that epigenetics research reveals, namely the underlying root causes of behavior that form the social determinants of health. Attention should shift toward a collective, harm reduction-based approach in public health. Existing and innovative public health interventions may address the root causes of behavior to ameliorate harmful conduct. The potential of epigenetics in public health is beneficent, whereas tort liability may serve a deterrent or punitive role.

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INTRODUCTION

"Do you have a weakness for alcohol? Blame your great-grandmother! Drinking while pregnant 'increases the risk the next [three] generations will develop alcoholism.'"[1] "What a woman eats BEFORE she becomes pregnant affects her child's health for life."[2]

Drawing on the science of epigenetics, certain media encourages us to blame our health conditions or proclivity for substance abuse on our parents and ancestors.[3] Unfortunately, many of their claims are as misleading as they are dramatic. These claims treat inconclusive research evidence as if it were certain, unduly extrapolate rat studies to humans, and exploit epigenetic risk messaging that targets vulnerable populations.

A Daily Mail article in the United Kingdom exemplifies the problem.[4] The article cited a study conducted by Michael Nizhnikov et al. to explore the transgenerational transmission of prenatal alcohol exposure effects across three generations.[5] Scientists treated pregnant female rats with alcohol during late gestation and then analyzed alcohol consumption of their offspring in the next three generations. Moderate levels of gestational alcohol exposure increased the offspring's propensity to consume alcohol during infancy,[6] including the second and third generations who had no direct prenatal exposure. While the experiment

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1. Lisa Ryan, *Do You Have a Weakness for Alcohol? Blame Your Great-Grandmother! Drinking While Pregnant 'Increases the Risk the Next 3 Generations Will Develop Alcoholism,'* DAILY MAIL (Feb. 24, 2016, 6:55 PM EST), https://www.dailymail.co.uk/health/article-3462692/Do-weakness-alcohol-Blame-great-grandmother-Drinking-pregnant-increases-risk-3-generations-develop-alcoholism.html.

2. Fiona Macrae, *What a Woman Eats BEFORE She Becomes Pregnant Affects Her Child's Health for Life*, DAILY MAIL (Apr. 29, 2014, 1:18 PM EST), https://www.dailymail.co.uk/health/article-2615985/What-woman-eats-BEFORE-pregnant-affects-childs-health-life-Milk-green-veg-protein-effect-genes.html.

3. Daily Mail articles are a frequent source of scientific misinformation and extrapolation from animal studies to humans. *See, e.g.*, Alexandra Thompson & Natalie Rahhal, *Children Born to Mothers Older than 35 Are More Likely to Have Heart Problems—Even if They Were Conceived from Eggs Frozen Years Earlier*, DAILY MAIL (June 8, 2018, 2:32 PM EST), https://www.dailymail.co.uk/health/article-5816991/Children-born-mothers-older-35-likely-heart-problems.html; Stephen Adams, *Smoking Cannabis Can Harm Unborn Babies Who Were Conceived Years After Their Parents Stopped Using the Drug, Startling Study Suggests*, DAILY MAIL (June 3, 2018, 12:38 AM EST), https://www.dailymail.co.uk/health/article-5799165/Smoking-cannabis-harm-unborn-babies.html; *Mothers DO Pass on Pregnancy Stress—and Genetic Changes It Causes Can Be Passed Down for Several Years*, DAILY MAIL (Aug. 7, 2014, 9:03 AM EST), https://www.dailymail.co.uk/health/article-2718527/Mothers-pass-pregnancy-stress-genetic-changes-affect-pregnancies-generations-come-claims-study.html; Ben Spencer, *Why Eating Badly When You Are Pregnant Could Harm Your Grandchildren's Health*, DAILY MAIL (July 11, 2014, 12:27 PM EST), https://www.dailymail.co.uk/health/article-2688217/Why-eating-badly-pregnant-harm-grandchildrens-health.html. Time articles similarly extrapolated from bench and animal studies to convey preventive prescriptions that focuses on the maternal role in shaping her children's health. *See, e.g.*, Annie Murphy Paul, *How the First Nine Months Shape the Rest of Your Life*, TIME (Sept. 22, 2010, 10:16 AM EDT), https://time.com/84145/how-the-first-nine-months-shape-the-rest-of-your-life; John Cloud, *Why Your DNA Isn't Your Destiny*, TIME (Jan. 6, 2010), http://content.time.com/time/subscriber/article/0,33009,1952313,00.html.

4. Ryan, *supra* note 1. Daily Mail is a popular newspaper in the UK.

5. Michael E. Nizhnikov, Daniel O. Popoola & Nicole M. Cameron, *Transgenerational Transmission of the Effect of Gestational Ethanol Exposure on Ethanol Use-Related Behavior*, 40 ALCOHOLISM CLINICAL & EXPERIMENTAL RSCH. 497, 497 (2016).

6. Addiction (e.g., alcoholism) is not the same as higher probability (propensity) to use a substance.

provided evidence for the scientists' hypothesis that increased alcohol intake and sensitivity to its effects can be passed down for three generations, even if only the first generation was exposed in the womb,[7] several of their findings remained inconclusive pending future research.[8] Most importantly, the study was conducted on rats, and the researchers did not conclude that prenatal alcohol exposure caused alcoholism in subsequent generations.

Regrettably, the news article treated the study's results as conclusive in humans. It oversimplified the research by claiming that if your great grandmother consumed "even just a bit" of alcohol while pregnant, you would develop alcoholism.[9] Additionally, the article misquoted Professor Nicole Cameron, one of the scientists involved in the research study, by selectively deleting the part where she explicitly stated "our findings show that in the *rat*"[10] to misconstrue the overall health risk message as if it applied to human mothers. Furthermore, it utilized a sensational click-bait headline that not only misled the reader with false scientific information, but also conveyed the moral implication that we should blame our parents for our health problems.

Wide mistranslation of scientific concepts has become a general theme in news reporting and, in general, public discourse.[11] There is a growing tendency to rapidly and poorly translate basic concepts of biological science.[12] The result is an incentive to prematurely extrapolate animal epigenetic findings to promulgate prescriptive health risk messages in humans. These messages directly target mothers, expectant mothers, and women preparing for pregnancy.[13] These hyperbolic risk messages might be "taken to heart by parents, given authority by health care providers, and integrated into public health planning and policies [by overzealous policymakers]."[14] They also have the effect of disproportionately affecting sensitive and vulnerable populations, particularly those from poorer backgrounds. Epigeneticists have expressed

7. Nizhnikov et al., *supra* note 5, at 499.

8. *Id.* at 503 (for example, whether increased intake of alcohol in the first generation—those exposed to prenatal alcohol—could be due to a change in the "pharmacological reinforcing properties" of alcohol).

9. Ryan, *supra* note 1.

10. The initial statement was: "Our findings show that in the *rat*, when a mother consumes the equivalent of one glass of wine four times during the pregnancy, her offspring and grand-offspring, up to the third generation, show increased alcohol preference and less sensitivity to alcohol." (emphasis added). The news article removed the first part of the sentence. Nicole Cameron, *Alcohol Exposure During Pregnancy Affects Multiple Generations*, EUREKALERT! (Feb. 23, 2016), https://e3.eurekalert.org/news-releases/838995.

11. Michel Dubois, Séverine Louvel, Anne Le Goff, Catherine Guaspare & Patrick Allard, *Epigenetics in the Public Sphere: Interdisciplinary Perspectives*, 5 ENV'T EPIGENETICS 1, 7–8 (2019).

12. Eric T. Juengst, Jennifer R. Fishman, Michelle L. McGowan & Richard A. Settersten, Jr., *Serving Epigenetics Before Its Time*, 30 TRENDS GENETICS 427, 427 (2014); *see also* Jörg Niewöhner, *Epigenetics: Embedded Bodies and the Molecularisation of Biography and Milieu*, 6 BIOSOCIETIES 279, 293 (2011) ("It is easy to get caught up in the visionary rhetoric and begin to deal with potential implications outside the labs before the results are in").

13. Juengst et al., *supra* note 12; *see also* Martha Kenney & Ruth Müller, *Of Rats and Women: Narratives of Motherhood in Environmental Epigenetics*, 12 BIOSOCIETIES 23, 40 (2017).

14. Juengst et al., *supra* note 12.

concern about the repercussions of mistranslating epigenetics, including its social and political misuse.[15]

Furthermore, epigenetics is frequently oversimplified and misunderstood as a simple causal connection between parental or grandparental behavior and a negative health outcome in later generations. This is due, in part, to media and public discourse that engages in simplistic representations that ignore the nuances of epigenetics research. This includes ignorance to the basics of statistics on the differences between correlation, association, and causation.[16] The result is a public portrayal of epigenetics as simply a causal link between individual conduct and negative outcome.

While many studies referenced in news articles concern maternal conduct during pregnancy, public and scholarly discourses have already begun exploring the possibility of ascribing responsibility and imposing liability for preconception conduct. Legal scholars have analyzed the potential implications of epigenetic tort claims. The predominant argument is that epigenetic studies can prove causation under negligence law. One legal scholar argued for the expansion of tort law to hold parents liable for preconception negligence that causes epigenetic harms to their offspring.[17] While legal scholars' attention to causation is appropriate, they have mostly overlooked the broader ramifications of allowing tort claims for epigenetic harms in the first place. Most importantly, they overlook the role of duty as a gatekeeper to liability.

The public understanding of epigenetics also conflates parental blame and epigenetics in general. Subfields such as environmental epigenetics are hot topics because they investigate how an individual's social and material environment affects their physiology in ways that may then be transmitted to later generations.[18] "[M]aternal biology, behavior, and experiences [that influence] the epigenetic make-up of her progeny" lie at the heart of this discipline.[19] Public interest was piqued by the concept of external factors influencing both a parent and their child's health outcomes, and news articles sought to craft a narrative around this relationship.[20] Reporters interpreted

15. Juengst et al., *supra* note 12, at 428; Kenney & Müller, *supra* note 13, at 30; *see also* Ruth Müller et al., *The Biosocial Genome? Interdisciplinary Perspectives on Environmental Epigenetics, Health and Society*, 18 EMBO REPS. 1677, 1677 (2017).

16. Naomi Altman & Martin Krzywinski, *Association, Correlation and Causation*, 12 NATURE METHODS 899, 899 (2015).

17. Christopher J. Wiener, *Transgenerational Tort Liability for Epigenetic Disease*, 13 DEPAUL J. HEALTH CARE L. 319, 331–336 (2011).

18. Niewöhner, *supra* note 12, at 283–284 (the term "environment" broadly includes dietary intake, lifestyle and social experiences).

19. Kenney & Müller, *supra* note 13, at 24; Avijit Banik, Deepika Kandilya, Seshadri Ramya, Walter Stünkel, Yap Seng Chong & S. Thameem Dheen, *Maternal Factors that Induce Epigenetic Changes Contribute to Neurological Disorders in Offspring*, 8 GENES 1, 3–8 (2017); Inmaculada León, Silvia Herrero Roldán, María José Rodrigo, Maykel López Rodríguez, Jonah Fisher, Colter Mitchell & Agustín Lage-Castellanos, *The Shared Mother-Child Epigenetic Signature of Neglect Is Related to Maternal Adverse Events*, FRONTIERS PHYSIOLOGY, Aug. 2022, at 1, 8–10.

20. *See supra* notes 1–3 and accompanying text.

epigenetic studies in light of society's ingrained notions of parental duties and responsibilities. Consequently, news articles propagated the notion of blaming your parents for your disease risk or health outcome.

In this Article, I argue that centering on individual responsibility and liability for epigenetic harms to the offspring shifts attention away from issues of inequality and discrimination by scapegoating the very victims of those injustices. Instead, attention should be diverted toward material deprivation and social and political structures as root causes of allegedly harmful behavior.[21] Today, news and scholarship focus their attention on the mother and her behavior before and during pregnancy. Unfortunately, society has had a long history of blaming mothers for the ill health of their children.[22] The consequence is a disproportionate focus on the maternal role, and a downplaying of paternal, societal, and familial factors.[23] This entrenches maternal responsibility into a cycle of blame that ignores root societal factors that constrain or control behavioral choices. Focusing on parental liability is often another form of victim blaming. Attention should move away from empirically and morally questionable focus on individualistic blame, shifting instead toward a broader, population-based perspective. Specifically, I argue that existing public health interventions are better suited to address behavioral choices that may have epigenetic effects, including the underlying problems of socioeconomic inequality.[24]

This Article is divided into three Parts. Part I reviews the current state of epigenetic science. It explains the molecular mechanisms that make epigenetic modifications possible, with examples of epigenetic studies that support the existence of these mechanisms. It also reviews the inconclusive nature of current research, explains the pitfalls of extrapolating animal studies to humans to ascribe blame, and exposes the misuse of epigenetics by commercial entities. Part II argues that tort liability is not the best avenue to utilize epigenetic knowledge. A duty of care must exist before liability can be imposed. Imposing a legal duty to avoid epigenetic harms could severely undermine parental rights to privacy, personal autonomy, reproductive autonomy, and bodily integrity. Further, legitimate concerns arise from perpetual liability, the entrenchment of

21. Many scholarships have recognized epigenetics as reinforcing the problem of poverty. *See* Mark A. Rothstein, *Epigenetic Exceptionalism: Currents in Contemporary Bioethics*, 41 J.L., MED. & ETHICS 733, 734 (2013) (on how epigenetics manifest poverty as the link to harmful epigenetic exposures and which reinforces environmental justice concerns); Müller et al., *supra* note 15, at 1681 (which discussed poverty as the glaringly obvious problem highlighted by environmental epigenetics research); Michael B. Katz, *The Biological Inferiority of the Undeserving Poor*, SOC. WORK & SOC'Y, 2013, at 1, 8.

22. Sarah S. Richardson, Cynthia R. Daniels, Matthew W. Gillman, Janet Golden, Rebecca Kukla, Christopher Kuzawa & Janet Rich-Edwards, *Society: Don't Blame the Mothers*, 512 NATURE 131, 131–132 (2014).

23. *See* Charles W. Schmidt, *Chips off the Old Block: How a Father's Preconception Exposures Might Affect the Health of His Children*, 126 ENV'T HEALTH PERSPS. 1, 1–5 (2018).

24. Law Professor Mark Rothstein has argued epigenetics reinforces existing ethical issues such as access to healthcare, which is addressed in public health. *See* Rothstein, *supra* note 21.

blame into an already ingrained blame culture within society, and the potential for epigenetic discrimination. Misunderstandings of epigenetics may lead to a revival of past injustices in the field of genetics, such as eugenics and sterilization practices. This Article argues that epigenetics reinforces the problems of socioeconomic inequality and reveals the shifting of responsibility to the most marginalized individuals in society, such as racial and ethnic minorities and women. The law can more suitably address these issues under the umbrella of public health rather than tort law. Part III explains how existing public health interventions in the field of non-communicable diseases already work to ameliorate underlying socioeconomic inequalities that epigenetic studies have revealed. Innovative government measures incentivize and promote healthful behavior. These measures are further supported with proven case studies in various local jurisdictions. These cases argue that new epigenetic knowledge can provide robust evidence of the links between environment and disease risks. In turn, this knowledge can improve public health measures. Further, novel interventions such as epigenetic drug therapy can effectively reverse epigenetic modifications, but they must be sensitive to the individual's life stage. Part III ends with a summary of potential challenges to epigenetic-based interventions, such as high costs of implementation, but argues that greater awareness of epigenetic knowledge can facilitate greater public acceptance of these interventions.

I. EPIGENETICS, MECHANISMS, AND THE PUBLIC SPHERE

A. DEFINITION

The term "epigenetics" was first described in 1942 by Conrad Waddington to denote the poorly understood "complex of developmental processes" by which a fertilized zygote develops into a mature organism.[25] He referred to epigenetics as the study of "[causal] mechanism by which the genes of the genotype bring about phenotypic effects [during development]."[26] Waddington's original concept was, as molecular biologist Gary Felsenfeld summarized, "how can a single fertilized egg give rise to a complex organism with cells of varied phenotypes?"[27] Waddington's concept of epigenetics related to several branches of biology: it stood at the intersection between genetics,

25. C. H. Waddington, *The Epigenotype*, 41 INT'L EPIDEMIOLOGY 10, 10 (2012).

26. *Id.*; *see also* C. H. WADDINGTON, THE STRATEGY OF THE GENES 66 (Allen & Unwin 1957) (Phenotype refers to the observable characteristics of an individual. Genotype refers to the individual's collective set of genes or genetic makeup.).

27. Gary Felsenfeld, *A Brief History of Epigenetics*, 6 COLD SPRING HARBOR PERSPS. BIOLOGY 1, 2 (2014) (Professor Felsenfeld elaborated on the original meaning of epigenetics, which is "more broadly (and less precisely) to categorize all of the developmental events leading from the fertilized zygote to the mature organism—that is, all of the regulated processes that, beginning with the genetic material, shape the final product.").

developmental biology and ecology, all of which are rooted in evolutionary biology.[28] Today, this concept is called developmental biology.[29]

The definition of epigenetics has since transformed to reflect our understanding that all cells in an organism carry the same DNA, alongside increasing knowledge of the molecular mechanisms that regulate gene expression.[30] This definition has shifted toward a focus on the heritability of traits not associated with changes in the DNA sequence, but rather "with chemical modifications of DNA, or of the structural and regulatory proteins bound to it."[31]

Today, epigenetics is defined technically as "the study of mitotically and/or meiotically heritable changes in gene function that cannot be explained by changes in DNA sequence."[32] Generally, it is the study of how our behavior and environment can change the function of our genes without changing our genetic code.

In this Article, epigenetics is limited to its contemporary definition.[33] Part of the goal is to illustrate the many studies on parental roles, such as environmental epigenetics, conducted under this label. It will emphasize how the current portrayal of epigenetics has inspired questionable claims on parental responsibility and liability in the public sphere and legal scholarship.

B. MOLECULAR MECHANISMS

Epigenetic changes refer to the chemical modifications on DNA that do not change the DNA sequence.[34] They leave a mark called an epigenetic mark or tag. Epigenetic marks are "durable, have a propensity to spread, and can even be transmitted from one generation to the next."[35] The idea of epigenetic marks

28. Eva Jablonka & Marion J. Lamb, *The Changing Concept of Epigenetics*, 981 ANNALS N.Y. ACAD. SCIS. 82, 82–86 (2002).

29. David Haig, *The (Dual) Origin of Epigenetics*, 69 COLD SPRING HARBOR SYMPOSIA ON QUANTITATIVE BIOLOGY 67, 67 (2004).

30. Felsenfeld, *supra* note 27.

31. *Id.*

32. VICENZO E.A. RUSSO, ROBERT A. MARTIENSSEN & ARTHUR D. RIGGS, EPIGENETIC MECHANISMS OF GENE REGULATION 1 (1996). There are two types of cell division: mitosis and meiosis. Mitosis is the process of making new cells whereby one cell divides to form two identical daughter cells. The majority of cell division in the body is mitosis to ensure growth and the replacement of old, worn-out cells with new ones. Meiosis is the process of making gametes or sex cells (i.e., sperm or egg). In this process, each daughter cell holds only half of the total chromosomes, from 46 to 23. This is because during fertilization a sperm fuses with an egg to form a diploid zygote of 46 chromosomes, containing 23 chromosomes from the father and 23 from the mother. *See id.* at 3; TRYGVE O. TOLLEFSBOL, HANDBOOK OF EPIGENETICS: THE NEW MOLECULAR AND MEDICAL GENETICS 3 (Trygve O. Tollefsbolm ed., 2d ed. 2017).

33. While the changing definition of "epigenetics" is contentious, it is not unusual when we look at how the term "gene" has evolved over time. *See* Petter Portin & Adam Wilkins, *The Evolving Definition of the Term "Gene,"* 205 GENETICS 1353, 1353–1354 (2017).

34. Haig, *supra* note 29; Felsenfeld, *supra* note 27.

35. Mark A. Rothstein, Yu Cai & Gary E. Marchant, *The Ghost in Our Genes: Legal and Ethical Implications of Epigenetics*, 19 HEALTH MATRIX 1, 6 (2009). Each epigenetic change leaves an epigenetic mark.

being transmitted across generations remains contentious because reprogramming in the embryo and germ line are two barriers during which epigenetic marks are erased.[36] This makes it less likely for them to be inherited.[37] Epigenetic marks are also theorized to be reversible via epigenetic drug-targeted therapy to return an individual to a healthy state.[38]

Three key molecular mechanisms effect epigenetic marks: DNA methylation, histone modification, and noncoding RNA.[39] For instance, DNA methylation is the process of adding a methyl group to the CpG sites clustered

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They may be used to explain the transgenerational or intergenerational inheritance of a parent's experiences in their offspring. *See id.*; Zaneta M. Thayer & Amy L. Non, *Anthropology Meets Epigenetics: Current and Future Directions*, 117 AM. ANTHROPOLOGIST 722, 723 (2015).

36. A distinction between intergenerational and transgenerational inheritance must be clarified. Scientifically, they are two different types of inheritance. In legal literature, transgenerational inheritance is seemingly used synonymously with intergenerational inheritance to refer to the latter term's definition.

Through the female line, intergenerational inheritance refers to the transmission of epigenetic effects from the mother to the child, and possibly to the grandchild (epigenetic effects persisting for one or two generations). Through the male line, intergenerational inheritance refers to the transmission of epigenetic effects from the father to the child (epigenetic effects persisting for one generation).

Through the female line, transgenerational inheritance refers to the transmission of epigenetic effects from the mother to the child, the grandchild, and possibly later generations (epigenetic effects persisting for three or more generations). Transgenerational inheritance begins with the great grandchild. Through the male line, transgenerational inheritance is defined as the same that persists for two or more generations. Transgenerational inheritance begins with the grandchild. These later generations fall under the transgenerational inheritance category because they exhibit the same persisting epigenetic changes despite their non-exposure to the "initial signal or environment that triggered the change." *See* Nicholas O. Burton & Eric L. Greer, *Multigenerational Epigenetic Inheritance: Transmitting Information Across Generations*, 127 SEMINARS CELL DEV. BIOLOGY 121, 123 (2022); Edith Heard & Robert A. Martienssen, *Transgenerational Epigenetic Inheritance: Myths and Mechanisms*, 157 CELL 95, 95 (2014); Michael K. Skinner, *What Is an Epigenetic Transgenerational Phenotype? F3 or F2*, 25 REPROD. TOXICOLOGY 1, 2–4 (2008); Niewöhner, *supra* note 12, at 285.

So far, transgenerational epigenetic inheritance has not been proven in human studies, except in plants and yeast. Available clinical evidence provides only indirect evidence. They include male children exposed to intrauterine undernourishment during the Dutch Famine produced offspring that developed obesity, glucose intolerance and coronary heart disease in adult life; transgenerational transmission of trauma in the offspring of Holocaust survivors, combat veterans, and refugee families; and a Norwegian longitudinal study finding third generation children of Vietnamese refugees had a high risk of mental disease when those refugees were diagnosed with post-traumatic stress disorder when they arrived in Norway. *See* Irene Lacal & Rossella Ventura, *Epigenetic Inheritance: Concepts, Mechanisms and Perspectives*, FRONTIERS MOLECULAR NEUROSCIENCE, Sept. 2018, at 1, 9–10.

37. Law Professor Fazal Khan wrote that "the mechanism of epigenetic traits being passed on to subsequent generations appears to be dependent upon epigenetic marks being incompletely 'erased' or else being erased but then added again during critical periods of germ cell (i.e., sperm and ova) development." *See* Fazal Khan, *Preserving Human Potential as Freedom: A Framework for Regulating Epigenetic Harms*, 20 HEALTH MATRIX 259, 270 (2010) (citing Roger G. Gosden & Andrew P. Feinburg, *Genetics and Epigenetics—Nature's Pen-and-Pencil Set*, 356 NEW ENG. J. MED. 731, 731–732 (2007)).

38. *Id.* at 263 n.5. The benefits of epigenetic therapy depend heavily on the individual's life stage. It does not mean that any mark can be reversed to return that individual to a healthy state. Professor Khan explained the effects may be irreversible depending on the individual's stage of development. For example, if the epigenetic mark affects "early childhood physical or mental development, reversing that epigenetic mark later in adult life will not undo the developmental changes that have already occurred." *Id.* In contrast, if an epigenetic mark "conveys an increased risk of late-onset disease, reversing that mark in early adulthood could dramatically alter that individual's disease risk." *Id.*

39. *See* TOLLEFSBOL, *supra* note 32, at 3.

upstream of a gene.[40] These methyl groups are the epigenetic marks. Because they can concentrate at gene promoter regions, they enable scientists to analyze their effects on regulating gene expression—either for better or for worse—[41] and how this leads to the associated phenotypic changes.[42] The study of these mechanisms provides an explanation as to how, for example, an environmental insult influences gene expression that leads to observable disease risks or health outcomes.[43] The totality of epigenetic changes within an organism is called the epigenome.

To illustrate the existence of these mechanisms, take a pair of identical twins. Both are genetically identical. Yet, significant phenotypic discordance exists between them as they age, live different lifestyles, and spend less of their lives together. One twin may have a better health outcome than the other. Epigenetics, but more specifically the workings of the molecular mechanisms, is proposed to explain their dissimilar health or medical histories.[44] This was first studied by Fraga et al. by examining twin pairs' overall content of DNA methylation and histone acetylation levels on peripheral lymphocytes.[45] The study revealed that twins who spent less time together and lived different lifestyles, when older, had greater levels of epigenetic modification and diverged more in their patterns of epigenetic modification.[46] By contrast, younger twin pairs exhibited almost identical gene expression patterns, meaning that they are more identical to each other than older twin pairs.[47] This study showed how DNA methylation and histone modifications are mechanistically linked,[48] and how the epigenetic differences in twin pairs explain their phenotypic discordance despite sharing a common genotype at birth.

1. DNA Methylation

DNA methylation is the most studied mechanism across species ranging from rats to nonhuman primates to humans. Generally, it is the covalent addition

40. *See id.* at 11–24 (DNA methylation is the covalent addition of methyl groups (CH_3) to the 5' position of cytosine (C) bases. This binding occurs at sites where a cytosine precedes a guanine (G) base. The cytosine and guanine base pair forms a CpG site or CpG dinucleotide (the p is the phosphate that links the C and G). CpG sites are clustered at upstream regions (or "promoter" region) of a gene to form CpG islands. The promoter region is where a promoter protein binds to initiate expression of the gene).

41. *See infra* notes 49–50 and accompanying text.

42. Rothstein et al., *supra* note 35, at 4–5.

43. *Id.* at 10.

44. Mario F. Fraga et al., *Epigenetic Differences Arise During the Lifetime of Monozygotic Twins*, 102 PNAS 10604, 10604 (2005).

45. *Id.* Peripheral lymphocytes are one of the several types of white blood cells that are part of the immune system to fight diseases and infection. *See generally* Abraham Kupfer & Hannah Kupfer, *Imaging immune cell interactions and functions: SMACs and the Immunological Synapse*, 15 SEMINARS IMMUNOLOGY 295 (2003).

46. *Id.* at 10609.

47. *Id.* at 10606.

48. DNA methylation is highly interrelated with histone modification and rely mechanistically on each other to maintain gene silencing and chromatin structure. *Id.* at 10609; *see also* Nathan R. Rose & Robert J. Klose, *Understanding the Relationship Between DNA Methylation and Histone Lysine Methylation*, 1839 BIOCHIMICA ET BIOPHYSICA ACTA 1362, 1362 (2014).

of methyl groups to cytosine bases (*i.e.*, DNA nucleobases—adenine (A), guanine (G), cytosine (C), thymine (T)—that make up the genetic code) at specific regions of a gene to either promote or suppress its expression.[49] The result is an increase or decrease in production of the specific protein for a particular function. The effects of methylation could be beneficial or harmful, depending on the gene. For instance, methylation of a tumor suppressor gene could be problematic because it prevents the gene's function in inhibiting cell proliferation and tumor development.[50] By contrast, methylation of an oncogene is a good thing because it suppresses the mutated gene that contributes to cancer development.[51]

Ian Weaver and colleagues' research on maternal care in rats is one of the best-known environmental epigenetics studies.[52] The study examined how maternal behavior or care in the form of licking and grooming (LG) and arched-back nursing (ABN) affected the offspring's reactivity to stress in later life. It showed how pups that received less emotional care exhibited more DNA methylation and less histone acetylation in the glucocorticoid receptor gene promoter in the hippocampus when compared to pups that received more emotional attention.[53] Consequently, these pups showed poorer stress responses when compared to pups that received more maternal care. Importantly, these differences were shown to be reversible with cross-fostering.[54] Offspring of less caring mothers were cross-fostered with more caring mothers, and offspring of more caring mothers were cross-fostered with less caring mothers. The result

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49. TOLLEFSBOL, *supra* note 32, at 11.

50. Rothstein et al., *supra* note 35, at 11.

51. *Id.* at 12. When the CpG islands are unmethylated, the promoter region is accessible allowing the promoter proteins to bind and initiate expression of the gene. When the CpG islands are methylated, the promoter region becomes less accessible for expression. Because DNA methylation is usually associated with gene silencing, gene regulation by this mechanism can be for better or for worse.

Enzymes called DNA methyltransferases (DNMT) affect the process of DNA methylation. There are three types: DNA methyltransferase 1 (DNMT1), DNA methyltransferase 3a, and DNA methyltransferase 3b (DNMT3a and DNMT3b). DNMT3a and DNMT3b are involved in de novo methylation by methylating DNA to establish DNA methylation patterns. DNMT1 is involved in maintenance methylation by methylating newly formed hemimethylated CpG sites during DNA replication to maintain the methylation patterns. Feinberg explains the process concisely: "[D]uring semiconservative DNA replication, a methylated CpG on the parent DNA strand is partnered with a newly synthesized unmethylated CpG on the daughter strand. DNA methyltransferase I searches out this hemimethylated DNA and places a new methyl group on the daughter CpG." *See* Andrew P. Feinberg, *Epigenetics at the Epicenter of Modern Medicine*, 299 JAMA 1345, 1345 (2008); Adrian Bird, *DNA Methylation Patterns and Epigenetic Memory*, 16 GENES & DEV. 6, 7–15 (2002); TOLLEFSBOL, *supra* note 32, at 11.

52. Ian C. G. Weaver, Nadia Cervoni, Frances A. Champagne, Ana C. D'alessio, Shakti Sharma, Jonathan R. Seckl, Sergiy Dymov, Moshe Szyf & Michael J. Meaney, *Epigenetic Programming by Maternal Behavior*, 7 NATURE NEUROSCIENCE 847, 847–852 (2004).

53. *Id.* Glucocorticoid receptor gene is broadly implicated in stress response. Glucocorticoid receptor proteins are produced in the hippocampus. During a fight or flight response, the hormone cortisol is released into the bloodstream that binds to GR proteins, which in turn causes the cell to send out calming signals. Ian Weaver and colleagues' study showed how maternal care made the pup's GR gene more active, which in turn made it easier for the pup to relax after stress exposure. In contrast, less maternal care resulted in a less active GR gene, which meant the pup took a longer time to relax after stress.

54. Weaver et al., *supra* note 52, at 848–49.

indicated reversal of the DNA methylation differences; less caring mothers' offspring that were cross-fostered with more caring mothers exhibited DNA methylation levels that were indistinguishable from that of offspring of the more caring mothers.[55]

Other well-known animal studies include the agouti mice, where researchers studied how maternal dietary methyl supplementation with extra folic acid, vitamin B12, choline, and betaine altered the coat color of the offspring from yellow to brown via increased DNA methylation of the agouti gene.[56] Expression of the agouti gene causes the yellow coat color.[57] Because the gene also relates to metabolism, offspring with yellow coat color are more susceptible to diseases such as obesity, diabetes, and cancer, and have dramatically shortened lifespans.[58] A later study also on the agouti mice studied how maternal exposure to bisphenol A (BPA)[59] shifted the coat color of the offspring toward yellow via decreased DNA methylation of the agouti gene.[60] The scientists counteracted this effect by adding dietary methyl supplementation to the maternal diet,[61] which negated the DNA hypomethylating effect of BPA.[62] In sum, early developmental exposure to BPA can change the offspring's phenotype, but maternal dietary supplements can counteract this change.

In addition to the twin example, other human research have suggested the sensitivity of the fetus to the mother's environmental exposures persist into adulthood.[63] One such study was conducted on twenty-five mother-newborn dyads from the eastern Democratic Republic of the Congo, a war-torn region where women were subject to extreme violence. The study investigated the effects of maternal prenatal stress—material deprivation, mundane stressors, or

55. *Id.* at 852.

56. Robert A. Waterland & Randy L. Jirtle, *Transposable Elements: Targets for Early Nutritional Effects on Epigenetic Gene Regulation*, 23 MOLECULAR & CELLULAR BIOLOGY 5293, 5296–5300 (2003).

57. *Id.* at 5293.

58. Hugh D. Morgan, Heidi G.E. Sutherland, David I.K. Martin & Emma Whitelaw, *Epigenetic Inheritance at the Agouti Locus in the Mouse*, 23 NATURE GENETICS 314, 314–317 (1999).

59. Bisphenol-A is a chemical used to manufacture polycarbonate plastics. It is associated with several health conditions, such as increased body weight, increased probability of breast and prostate cancer, changes in the reproductive function, type 2 diabetes, blood pressure, and cardiovascular disease. *See* Johanna R. Rochester, *Bisphenol A and Human Health: A Review of the Literature*, 42 REPROD. TOXICOLOGY 132, 142 (2013); Dana C. Dolinoy, Dale Huang & Randy L. Jirtle, *Maternal Nutrient Supplementation Counteracts Bisphenol A-induced DNA Hypomethylation in Early Development*, 104 PNAS 13056, 13056 (2007).

60. Dolinoy et al., *supra* note 59, at 13058.

61. *Id.* (supplementation were either methyl donors like folic acid or the phytoestrogen genistein).

62. *Id.*

63. Connie J. Mulligan, Nicole C. D'Errico, Jared Stees & David A. Hughes, *Methylation Changes at NR3C1 in Newborns Associate with Maternal Prenatal Stress Exposure and Newborn Birth Weight*, 7 EPIGENETICS 853, 853–55 (2012); Bastiaan T. Heijmans, Elmar W. Tobi, Aryeh D. Stein, Hein Putter, Gerard J. Blauw, Ezra S. Susser, P. Eline Slagboom & L. H. Lumey, *Persistent Epigenetic Differences Associated with Prenatal Exposure to Famine in Humans*, 105 PNAS 17046, 17049 (2008) (studying the effects of periconceptional exposure to famine in individuals during the Dutch Hunger Winter in 1944–1945 and finding the now-adults exposed in the womb had lower methylation in the IGF2 gene, which played a vital role in growth and development before birth; additionally finding support for the hypothesis that children's early-life environment plays an important role that persists throughout life).

war stress—on their newborns.[64] Researchers sought to test their hypothesis that prenatal stress may result in methylation upstream of the NR3C1 gene in newborns,[65] which may result in reduced birth weight. They found a correlation between prenatal stress and newborn methylation, with war stress having the strongest correlation.[66] Furthermore, they found newborn methylation to be strongly correlated with birth weight. The study found support for the researchers' hypothesis, while reinforcing the developmental origins of health and disease (DOHaD) hypothesis that an offspring's early development is directly related to disease risk in later life.[67]

2. Histone Modification

Histones are proteins that "provide structural support for a chromosome."[68] Because DNA consists of approximately three billion base pairs, it must undergo a packaging strategy to fit inside a cell's nucleus.[69] To do this, DNA wraps around octamers of histones, which are composed of two molecules each of the four core histone proteins.[70] This forms the nucleosomes, which are subunits of chromatin.[71] The chromatin structure comes in two distinct functional forms: euchromatin, which is a less condensed structure that enables accessibility of transcription factors for gene expression, and heterochromatin, which is a condensed structure that reduces accessibility of transcription factors for gene expression.[72] The chromatin structure fulfills essential functions such as "condensing DNA, preserving genetic information, and controlling gene expression."[73]

Generally, chemical modifications of the histones, also called histone modifications, play a vital role in regulating gene expression by altering the compactness of chromatin.[74] The most studied types of histone modifications are acetylation, methylation, and phosphorylation.[75] For instance, acetylation of

64. Mulligan et al., *supra* note 63, at 853.

65. The NR3C1 gene is involved in cell proliferation and differentiation, and expression of the gene may influence newborn birth weight. *Id.*

66. *Id.*

67. *See* D.J.P. Barker, *The Fetal and Infant Origins of Adult Disease*, 17 BMJ 1111, 1111 (1990); M.A. Hanson & P.D. Gluckman, *Developmental Origins of Health and Disease—Global Public Health Implications*, 29 BEST PRAC. & RSCH. CLINICAL OBSTETRICS & GYNECOLOGY 1, 2 (2014).

68. Daniel A. Gilchrist, *Histone*, NAT'L HUM. GENOME RSCH. INST. (Jan. 26, 2025), https://www.genome.gov/genetics-glossary/histone#:~:text=A%20histone%20is%20a%20protein,chromosome%20a%20more%20compact%20shape.

69. *What Is DNA?*, MEDLINEPLUS (Jan. 19, 2021), https://medlineplus.gov/genetics/understanding/basics/dna.

70. The four core histone proteins are H2A, H2B, H3, and H4. *See* TOLLEFSBOL, *supra* note 32, at 25–26.

71. The whole DNA-histone complex is called chromatin. *Id.*

72. TOLLEFSBOL, *supra* note 32, at 25.

73. *Id.* at 26.

74. *Id.*

75. *Id.* Other modifications include ubiquitination, sumoylation, ADP-riboslaytion, citrullination, and proline isomerization.

histone proteins will result in an open configuration of the chromosomal region to promote gene expression, while deacetylation results in compacting of the chromosome that renders it inactive.[76]

DNA methylation and histone modifications are mechanistically linked.[77] For instance, hypermethylation of DNA and deacetylation of histones will render the chromatin structure tightly coiled and transcriptionally inactive, which suppresses gene expression.[78] By contrast, hypomethylation of DNA and acetylation of histones will render the chromatin structure more accessible, and thus promote gene expression.[79]

3. Noncoding RNA

Noncoding RNAs (ncRNA) are those that do not get translated, like the mRNA, into a protein.[80] Noncoding RNAs are categorized into two types: small noncoding RNAs[81] and long noncoding RNAs.[82] While 90 percent of the genome is transcribed, only around one to two percent code for proteins (coding RNA) and the remaining are ncRNAs.[83]

ncRNAs function by attaching to coding RNA and, along with certain proteins, breaks down the coding RNA, thereby preventing it from being translated to make proteins.[84] ncRNAs may also recruit proteins to modify histones to regulate gene expression.[85] Many studies have shown "that non-coding RNAs play a significant role in epigenetic modification and can regulate expression at the level of the gene and the level of chromosome to control cell differentiation."[86]

C. MISTRANSLATION, OVERSIMPLIFICATION, MISUSE

The example discussed in the introduction is but one instance of how epigenetics is mistranslated in the media and public discourse.[87] Common themes include promulgating health risk messages that target parents with prescriptions on what they should or should not do. These messages are often bolstered by highlighting epigenetics as an emerging and novel science that

76. *Id.* at 35–39.
77. Rose & Klose, *supra* note 48; Fraga et al., *supra* note 44, at 10609.
78. TOLLEFSBOL, *supra* note 32, at 34.
79. *Id.* at 37–38.
80. *Id.* at 47.
81. Small noncoding RNAs contain less than 200 nucleotides. *See id.*
82. Long noncoding RNAs contain more than 200 nucleotides. *See id.*
83. *Id.*
84. *Id.* at 48.
85. *Id.*
86. Jian-Wei Wei, Kai Huang, Chao Yang & Chun-Sheng Kang, *Non-coding RNAs as Regulators in Epigenetics (Review)*, 37 ONCOLOGY REPS. 3, 4 (2017).
87. Mistranslation is not limited to the popular press. *See, e.g.*, Philip Cohen, *You Are What Your Mother Ate, Suggests Study*, NEWSCIENTIST (Aug. 4, 2003), https://www.newscientist.com/article/dn4017-you-are-what-your-mother-ate-suggests-study.

provides revolutionary insight, transforming our understanding of biology.[88] The unfortunate consequence is that epigenetic discourse on parental roles has transformed into prescriptions of parental duties and processes of responsibilization.[89] These prescriptions could negatively impact readers or information seekers who may be mothers, expectant mothers, or women preparing to become pregnant.

The popular press frequently portrays epigenetics as a simple causal connection between behavior and outcome.[90] This portrayal is too narrow and fails to account for environmental or other genetic-related factors that interplay with epigenetics. For example, a disease or condition can be caused solely by genetics, and not epigenetics, because other genes and cells in the body may also have a role in the disease onset.[91] Therefore, it is imperative to avoid generalizing epigenetic studies as conclusive and portraying the science as too simply a causal connection between behavior and outcome.

Extrapolating animal studies to humans is another example of oversimplifying epigenetics.[92] Doing so obfuscates important differences between species.[93] Extrapolation is not generally well-accepted because animal studies can be unreliable, poorly designed, conducted and analyzed, methodologically inadequate, and lacking in systematic reviews.[94] Animal studies cannot be equated to human studies for myriad reasons relating to biological differences, inadequate statistical power, variations in environmental insults, time or disease latency, and more.[95] Further, humans cannot be isolated from "confounding exposures in labs over a lifetime or several generations like

88. *See supra* notes 1–3 and accompanying text.

89. Richardson et al., *supra* note 22, at 131–32; Martine Lappe, *Epigenetics, Media Coverage, and Parent Responsibilities in the Post-Genomic Era*, 4 CURRENT GENETIC MED. REPS. 92, 94–96 (2016).

90. *See, e.g.*, *supra* notes 1–3 and accompanying text.

91. John M. Greally, *A User's Guide to the Ambiguous Word 'Epigenetics'*, 19 NATURE REVS. 207, 208 (2018).

92. But that is not to say that animal studies are unimportant. Rodent models are "complementary to human studies in that epigenetic changes can be measured in relevant tissues throughout the life span with controlled exposure protocols." *See* Laura S. Rozek, Dana C. Dolinoy, Maureen A. Sartor & Gilbert S. Omenn, *Epigenetics: Relevance and Implications for Public Health*, 35 ANN. REV. PUB. HEALTH 105, 110 (2014).

93. In science, all non-human studies are categorized as preclinical studies, while human studies are categorized as clinical studies. It is very difficult to prove causation in preclinical studies, and if it is proven then it provides a strong foundation to translate it into clinical study. Once causation is proved in clinical studies, then it can be used in specific causation in law. *See* Altman & Krzywinski, *supra* note 16, at 899.

94. *See* Aysha Akhtar, *The Flaws and Human Harms of Animal Experimentation*, 24 CAMBRIDGE Q. HEALTHCARE ETHICS 407, 408 (2015) (discussing how the unreliability of animal experimentation undermines scientific arguments that favored such practice); Pandora Pound & Merel Ritskes-Hoitinga, *Is It Possible to Overcome Issues of External Validity in Preclinical Animal Research? Why Most Animal Models Are Bound to Fail*, 16 J. TRANSLATIONAL MED. 304, 305–309 (2018) (explaining the poor rate of research translation from animals to humans is due to the "failure of preclinical animal models to predict clinical efficacy and safety" that is due to internal validity problems such as poor study design and lack of measures to control bias); Michael B. Bracken, *Why Animal Studies are Often Poor Predictors of Human Reactions to Exposure*, 101 J. ROYAL SOC'Y MED. 120, 121 (2009) (listing the key problems with extrapolating animal studies to humans).

95. Bracken, *supra* note 94.

mice."[96] Finally, expert testimony based on epidemiological and animal studies to prove causation in humans is rarely regarded as scientifically reliable evidence. Courts have not accepted them as legally sufficient evidence of causation.[97]

To make matters worse, epigenetics has been slapped onto commercial products or services, such as epigenetic yoga,[98] epigenetic skincare,[99] or epigenetic supplements[100] to market to the gullible.[101] A Google search yields results with freelance writers making questionable recommendations for "epigenetic skincare" products using oversimplified explanations of the science.[102] These examples show how commercial entities and the public have hopped onto the "epigenetics hype"[103] bandwagon by capitalizing on its ambiguity, albeit an absence of studies supporting their marketing claims.

II. EPIGENETICS AND PARENTAL LIABILITY

Legal scholars have analyzed and speculated on the potential legal implications of epigenetics. Some have engaged with the utility of epigenetics in environmental law and toxic torts.[104] Others have focused on epigenetics' promise in negligence law, specifically on causation.[105] One prominent law professor outlined the various legal applications of epigenetics, such as

96. Khan, *supra* note 37, at 274.

97. *See, e.g.*, Merrell Dow Pharms., Inc. v. Havner, 953 S.W.2d 706, 720 (Tex. 1997) (stating that isolated reports should not be considered by courts because they are not scientifically reliable).

98. Dubois et al., *supra* note 11, at 7; Jennifer Karash-Eastman, *The Science of Yoga and Epigenetics*, KIDDING AROUND YOGA (Oct. 7, 2019), https://kiddingaroundyoga.com/blog/science-yoga-epigenetics/.

99. *See, e.g.*, *The Incredible Effects of Epigenetic Skincare*, LIRA CLINICAL, https://liraclinical.com/the-incredible-effects-of-epigenetic-skin-care/#:~:text=Epigenetic%20skincare%20focuses%20on%20the,%2C%20healthier%2C%20younger%2Dlooking%20skin (last visited Jan. 30, 2025).

100. *Who Are We?*, EPIGENETICS INT'L, https://www.epigenetics-international.com/about (last visited Nov. 9, 2024).

101. Greally, *supra* note 91, at 208.

102. *See, e.g.*, Rebecca Norris, *Epigenetic Skincare Can Actually Change You DNA–Here's What You Need to* Know, HELLOGIGGLES (Mar. 3, 2020), https://hellogiggles.com/beauty/epigenetic-skincare-products; Marcia Desanctis, *Can the Genes Responsible for Aging Be Altered by a Face Cream? These Skin-Care Companies Say Yes*, VOGUE (July 21, 2018), https://www.vogue.com/article/epigenetics-research-dna-gene-expression-smart-skin-care.

103. Ute Deichmann, *Epigenetics: The Origins and Evolution of a Fashionable Topic*, 416 DEVELOPMENTAL BIOLOGY 249, 252 (2016).

104. *See, e.g.*, Michael P. Vandenbergh, David J. Vandenbergh & John G. Vandenbergh, *Lamarck Revisited: The Implications of Epigenetics for Environmental Law*, 7 MICH. J. ENV'T & ADMIN. L. 1, 33 (2017); Kerriann Laubach, *Epigenetics and Toxic Torts: How Epidemiological Evidence Informs Causation*, 73 WASH. & LEE L. REV. 1019, 1051–52 (2016); Joseph Sanders, David L. Faigman, Peter B. Imrey & Philip Dawid, *Differential Etiology: Inferring Specific Causation in the Law from Group Data in Science*, 63 ARIZ. L. REV. 851, 883 (2021).

105. Nicholas P. Putz, *Developing Exposure-based Preconception Tort Liability: A Scientific Challenge to Traditional Tort Concepts*, 66 CATH. U. L. REV. 475, 493 (2016) (arguing to utilize epigenetics to establish preconception tort liability by treating duty and causation as operating on a sliding scale, where a higher degree of one requires less of the other); Wiener, *supra* note 17, at 331–36 (arguing for expanding tort law to hold parents liable for preconception negligence that causes epigenetic harms on their offspring).

regulation (environmental, food and drug, and occupational safety and health regulation), litigation (products liability), and discrimination in employment against fertile women.[106] Another examined the utility of epigenetics in reforming workplace law and education law to "make positive impacts on material environments."[107] And another suggested a regulatory framework to address epigenetic risk from specific substances even if conclusive proof of disease causation cannot be established.[108]

While scholars have written on the impact of epigenetics in various areas of law, including epigenetics and causation, there has not been an analysis on legal duty. This Part undertakes a traditional negligence analysis that questions whether liability should be imposed against parents for preconception negligence that causes epigenetic harms to their progeny.[109] Specifically, whether a parent owes a legal duty in preconception negligence to their future child.[110] One purpose of this Article is to seek to revive the traditional legal duty analysis—as a gatekeeper of liability—even if modern negligence law has largely shifted away from this approach. Therefore, it matters not whether the science used to prove causation is genetics, epigenetics, or another science.[111] Instead, it matters whether the parent owes a legal duty in the first place. If the parent owes no duty, then the future child and subsequent generations have no cause of action for preconception negligence.

This approach differs from existing literature that has argued—for different reasons—that an individual can be liable to their future children.[112] This

106. Rothstein et al., *supra* note 35, at 10–20.

107. Lucy A. Jewel, *The Biology of Inequality*, 95 DENV. L. REV. 609, 659 (2018).

108. Khan, *supra* note 37, at 310–322.

109. The same issue can be addressed under other subjects such as criminal law (for criminal responsibility) or constitutional law (for reproductive rights and justice), but this Article is focused on tort law, namely the legal duty inquiry under negligence, and specifically on individual liability.

110. Epigenetics may change the causation inquiry, but the legal duty question remains the same; the same issues on rights to privacy and personal autonomy arise. Further, these issues are more pronounced for preconception liability absent of a bright-line rule as to when a duty commences. The supposed time frame for preconception liability can vary between the age which the legislature or judiciary deems a good age to begin scrutiny and the time before conception. In other words, the time frame could be between the individuals' sexual maturation or childbearing age and when they conceive their child. A reasonable person might react intuitively that there was too much time between the conduct and subsequent injury to justify liability against the parent.

111. Modern negligence law recognizes a universal duty of care which makes duty a nonissue in most cases, but this Article argues that duty is necessary under traditional negligence law and that a duty must first exist between the plaintiff and the defendant before breach, causation and damages should be considered. *See, e.g.*, Thomas C. Galligan, Jr., *The Structure of Torts*, 46 FLA. ST. U. L. REV. 485, 496–513 (2019); Dilan A. Esper & Gregory C. Keating, *Abusing "Duty,"* 79 S. CAL. L. REV. 265, 268 (2006).

112. A few legal scholars have written on this issue in non-epigenetic contexts. While most conceded that children should be able to sue their parents for preconception negligence because precedents on third-party liability have recognized a cause of action, their rationale erred on the side of caution and hesitancy. Scholars recognized expansion of tort principles in this regard have tremendous implications to the woman's rights to privacy, bodily integrity and reproductive autonomy. However, each scholar differed in their reasoning for preconception liability, including their recommendations for limiting such liability. *See, e.g.*, Ron Beal, *"Can I Sue Mommy?" An Analysis of a Woman's Tort Liability for Prenatal Injuries to Her Child Born Alive*,

approach also seeks to add overlooked reasons as to why a duty should not be imposed. In addition to the oft-cited privacy and personal autonomy concerns, this Article draws attention to equally important concerns related to blame culture, race and reproduction, perpetual liability, epigenetic discrimination, and the question of who should bear the loss.

The duty issue is especially important because without clarifying the contours of the problem, parents can be subject to liability even before their child has been conceived. This threatens their right to control their own lives, infringing on their privacy rights, personal autonomy, reproductive autonomy, and bodily integrity.

Several questions arise. Does epigenetics require a different approach or can precedents in non-epigenetic contexts apply?[113] If precedents cannot apply, should parents owe a duty to their unconceived child?[114] Even if epigenetics can prove causation, should we hold parents liable in the absence of a legal duty? When should a duty be imposed? What standard of conduct is appropriate? What rights may be infringed if liability were to be imposed? Are there policy considerations that dictate this cause of action should not be sanctioned? These, I think, are crucial questions and they are addressed in the following Subparts.

A. PARENTAL LIABILITY FOR PRECONCEPTION EPIGENETIC HARMS

Subpart A explores the potential issue arising under the epigenetics label: parental liability for causing epigenetic harms to their offspring. It will summarize existing law on prenatal and preconception negligence and conclude that the law does not generally support parental liability for prenatal negligence,

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21 SAN DIEGO L. REV. 325, 363 (1984) (recognizing that in order for a woman to be liable, she must first owe a duty to the child, including the context of a not-yet-existing child. But recognition of a duty will largely undermine her rights to privacy and personal autonomy, and necessitate a standard that controls how they conduct their everyday lives); Douglas E. Carroll, Comment, *Parental Liability for Preconception Negligence: Do Parents Owe a Legal Duty to Their Potential Children?*, 22 CAL. W. L. REV. 289, 303–16 (1986) (arguing that parents could be held liable because most states have abrogated the doctrine of parental immunity and offering three suggestions for parental liability: (1) parents should be held liable if they had actual knowledge and acted or failed to act accordingly; (2) special statute of limitations should be enacted to diminish the possibility of unlimited liability on future generations; and (3) courts should engage in a case-by-case analysis to ascertain the parameters of such a cause of action); Vik Ed Stoll, *Preconception Tort—The Need for a Limitation* 44 MO. L. REV. 143, 149–53 (1979) (arguing that because *Renslow v. Mennonite Hospital* opened the possibility for parental liability, it is now possible for parents to be sued by their children). Stoll argued natural parents should not be liable for preconception negligence. *Id.* Stoll suggested for statutory limitations because statutes produce certainty and consistency, whereas allowing courts to decide the matter of parental liability will result in the opposite due to varying judicial application of tort concepts that may result in later expansion of limitations. *Id.*

113. Most epigeneticists agree that epigenetics is not distinct from genetics. *See* Kasia Tolwinski, *A New Genetics or an Epiphenomenon? Variations in the Discourse of Epigenetics Researchers*, 32 NEW GENETICS & SOC'Y 366, 373–75 (2013). Professor Rothstein had argued that epigenetics is not unique enough to justify its own laws and ethical rules. *See* Rothstein, *supra* note 21. Building on these researchers' works, I argue that epigenetics should not be treated differently in preconception negligence, and that precedents in prenatal and preconception negligence can sufficiently answer the question on parental liability for preconception epigenetic harms.

114. *See supra* note 112 and accompanying text.

even if the parental immunity doctrine has been abolished and courts now increasingly favor the child's right to be wellborn. It will further reveal that there is not yet a case where the child sought to sue their parent for preconception negligence.

Epigenetics raises the possibility of a legal issue: preconception tort liability for epigenetic harms. Advancement in research suggest that specific actions or patterns of behavior can be linked to adverse outcomes, such as disease or ill health, in individuals or their offspring. Proving this kind of causation has the potential to retroactively determine preconception negligence that caused epigenetic harms to the individual's offspring. In turn, this opens the door to parental liability for preconception epigenetic harms.

Contemporary studies, however, remain inconclusive, and most are conducted on animal models.[115] A struggle among researchers is how to control for confounding variables such as socioeconomic statuses that can explain a perceived phenomenon rather than the conduct as the sole cause.[116]

Law professor Christopher Wiener has endorsed the possibility of parental liability for preconception negligent conduct that causes epigenetic harms to their offspring.[117] He argued that parents should be liable for preconception negligence that damages the offspring's epigenome, and which in turn causes epigenetic diseases.[118] Specifically, he argues that because parents are the "nearest actor[s]" and "uniquely situated to prevent injury to their children," it is not unreasonable to hold them accountable.[119] He contends that voluntary conduct includes anything entirely within the parents' control, excluding involuntary exposure to chemicals or genes that the parents were born with.[120] Enabling the child to sue their parent serves two interests: it allows the child to recover for their injury and deters future misconduct deemed harmful to the child.[121] Furthermore, Wiener writes that "the child's unique material and emotional dependence on a parent should justify extending—not restricting—the parent's duty of care to the child."[122]

But Wiener's proposal seemingly places more value on the life of an unconceived child, while subordinating the value of the parent's life. His argument for imposing liability is premised on the theory that epigenetics could prove causation, and thus, it would be reasonable to hold the parent liable for

115. Juengst et al., *supra* note 12.

116. Caroline L. Relton & George Davey Smith, *Two-step Epigenetic Mendelian Randomization: A Strategy for Establishing the Causal Role of Epigenetic Processes in Pathways to Disease*, 41 INT'L J. EPIDEMIOLOGY 161, 166 (2012) ("Epigenetic biomarkers, like many other molecular biomarkers, are vulnerable to confounding by the 'usual' factors; age, sex, socio-economic position, diet, smoking, alcohol intake, etc.").

117. Wiener, *supra* note 17.

118. *Id.* at 332.

119. *Id.* at 333.

120. *Id.* at 332–33.

121. *Id.* at 333–34 (quoting Ronen Perry, *It's a Wonderful Life*, 93 CORNELL L. REV. 329, 350 (2008)).

122. *Id.*

any harmful, voluntary actions that may cause some defect to their future child. It situates the unconceived child and its potential rights as superior to the parent's.

The later-discussed cases show that parental liability for preconception negligence is not supported by precedent. At least, there is not yet a case where a child has sought to sue their parents for preconception negligence.[123] Without precedent, I argue that guiding principles and rationales from other prenatal negligence cases on parental liability are helpful. Courts have grappled with privacy and autonomy concerns in these cases, and the same concerns are more pronounced in preconception cases. Additionally, several issues addressed in prenatal cases are preconceptional in nature, such as preconception negligence cases concerning third-party liability.

There is a distinction between the family situation and the third parties situation. The latter concerns toxic tort cases involving companies, such as the pharmaceutical industry or companies that commercialize chemicals such as pesticides. In toxic torts, courts and legislatures have shown a willingness to allow second generation diethylstilbestrol (DES) victims to recover from drug manufacturers.[124] These cases reflect legislative and judicial sentiments of fairness and equity to provide victims an opportunity to obtain compensation they would otherwise be barred from, in part because of the latency of their injuries, and their inability to pinpoint the manufacturer at fault. Judicial rationale includes the policy of requiring the negligent manufacturers to bear the cost of the plaintiffs' injuries. But mechanically applying third-party liability rationale to parental liability is illogical because it overlooks the intricacies of the family situation—the parent-child relationship that is not found in any other plaintiff-defendant relationship.[125]

In a parental liability case, the balance of the parent's rights versus the unconceived child's rights (if any) is at stake.[126] Furthermore, concerns over

123. Throughout the Article, I use "parent" and "individual" interchangeably. Both refer to the same person, namely someone who at that time had not yet conceived their child. A parent refers to the same person who, later on, conceived their child and, within our context, faces preconception negligence claims for epigenetic harms.

124. *See infra* note 151; E.R. Squibb & Sons, Inc. v. Lloyd's & Cos., 241 F.3d 154, 181 (2d Cir. 2001).

125. As the *Stallman* and *Chenault* courts recognized, the difference between third-party liability and parental liability cases is that the former tends to involve an isolated conduct (e.g., automobile accident) that injures the child, while the latter involves every act or omission of the parent in their everyday lives that could have an impact on the child. *See* Stallman v. Youngquist, 531 N.E.2d 355, 357–61 (Ill. 1988); Chenault v. Huie, 989 S.W.2d 474, 476 (Tex. Ct. App. 1999). Requiring parents to submit to state scrutiny their day-to-day lives severely undermines their rights to privacy and personal, reproductive and bodily autonomy. Further, there is a unique and biological parent-child relationship that cannot be found in cases concerning third-party liability.

126. It seems easier to ascribe liability to third-party tortfeasors because the intimate parent-child relationship or the privacy and personal autonomy of the parent is not at stake. While the law has found liability for preconception negligence against third-party tortfeasors, the issue at hand is entirely different because it examines the potential personal relationship between a parent and their child. This potential relationship does not exist between a drug manufacturer and their customers. The relationship is solely commercial; the manufacturer produces a drug which the customer purchases for use. This relationship is governed in most cases

individual privacy and autonomy, along with other broader implications of liability, cannot be found outside the familial relationship. Therefore, caution should be exercised when comparing reasons to impose liability in the third parties situation versus the family situation.

B. LAW ON PRENATAL AND PRECONCEPTION TORTS

Subpart B summarizes the current law on prenatal and preconception negligence against third-party tortfeasors and parents. In each category, the issue examined is whether the child had a cause of action against the defendant.

1. Third-Party Liability

Children injured but born alive may have a cause of action against the third-party tortfeasor for prenatal negligence.[127] Recovery is allowed in most cases, including toxic exposure[128] and medical malpractice.[129]

Renslow v. Mennonite Hospital is the leading case in medical malpractice suits.[130] *Renslow* differs slightly from traditional prenatal injury cases because the negligent conduct occurred several years prior to the infant's conception.[131] The case was treated as a prenatal negligence case because the court viewed the issue from *when the fetus sustained its injuries*, which was after conception, and not when the tortious conduct occurred, which was years before its conception.[132]

In *Renslow*, the sole issue concerning the Illinois Supreme Court was whether a child had a cause of action against the hospital and its director of laboratories for the child's injuries resulting from preconception negligence committed against her mother.[133] There, a thirteen-year-old girl was negligently given a blood transfusion that was incompatible with her own blood type.[134] Years later, in her early twenties, she prematurely gave birth to a child who incurred permanent damage to various organs, her brain, and her nervous

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by strict products liability. But the relationship between a parent and child is personal. It entails a myriad of moral and legal obligations such that this relationship warrants critical analysis into whether liability should be ascribed. The minute details of such a relationship need to be consciously accounted for when rendering a decision for parental liability. Thus, a copy paste of the law for third-party liability to individual liability will not do. A proper rationale must exist to hold an individual liable for their actions that may harm their child years into the future.

127. Beal, *supra* note 112, at 331–32.

128. Lopez v. Sony Elecs., Inc., 420 P.3d 767, 769 (Cal. 2018).

129. Renslow v. Mennonite Hosp., 367 N.E.2d 1250, 1255 (Ill. 1977); Brucker v. Mercola, 886 N.E.2d 306, 308 (Ill. 2007); Hughson v. St. Francis Hosp. of Port Jervis, 459 N.Y.S.2d 814, 815–19 (N.Y. App. Div. 1983) (holding that an infant could sue for prenatal injuries arising from its mother's lack of informed consent to medical treatment).

130. 367 N.E.2d 1250 (Ill. 1977).

131. *See id*. at 1251.

132. *Id.*

133. *Id.*

134. *Id.*

system.[135] The mother brought a negligence suit on behalf of herself and her child against the defendants.[136]

In affirming the appellate court's opinion that the child had a valid claim against the defendants, the supreme court relied on two strands of reasoning.[137] First, it reviewed previous appellate courts' decisions that allowed relief to the infant for injuries sustained during a previable state.[138] The court reasoned that these cases "make it clear that a defendant may be held liable to a person whose existence was not apparent at the time of his act"[139] and therefore it was "illogical to bar relief for an act done prior to conception where the defendant would be liable for this same conduct had the child, unbeknownst to him, been conceived prior to his act."[140] Additionally, because of the nature of the parent-child relationship, where the child was harmed by the preconception negligence committed against its mother, the law "recognize[d] a limited area of transferred negligence."[141] This meant the defendants were liable to the child.

Much of the majority and concurring opinions revolved around the whether the injury from the negligent blood transfusion was foreseeable. In Justice Dooley's concurrence, he succinctly wrote, "it was foreseeable that this [thirteen-year-old] girl would grow up, marry and become pregnant."[142] Extending this logic, it was foreseeable that her child may suffer consequential birth defects. Moreover, the foreseeability of harm was bolstered by the fact that the defendants, the doctor and hospital, were held to the higher degree of knowledge and standard of care of experts.[143] The majority also relied on policy considerations, namely that medical science advancement had developed techniques that could "mitigate or . . . totally alleviate a child's prenatal harm."[144] Thus, the court decided it was logical to extend the defendants' duty of care to the child.[145]

Courts tend to recognize liability against third-party tortfeasors in preconception negligence.[146] Whether or not a court will impose liability

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135. *Id.*

136. *Id.* at 1250–51.

137. *Id.* at 1254–55.

138. *Id.* at 1252 (citing to Sana v. Brown, 183 N.E.2d 187, 187 (Ill. App. Ct. 1962); Daley v. Meier, 178 N.E.2d 691, 694 (Ill. App. Ct. 1961)).

139. *Renslow*, 367 N.E.2d at 1255.

140. *Id.*

141. *Id.* The court explained that because derivative actions—in which a husband or parent brings an action:

> For the loss of the wife's or child's services—are recognized, it demonstrates that the law has long recognized that a wrong done to one person may invade the protected rights of one who is intimately related to the first." It is because of the nature of the relationship between the parties harmed, here being the mother and her child, that "the law recognizes a limited area of transferred negligence.

Id.

142. *Id.* at 1258.

143. *Id.* at 1258–59.

144. *Id.* at 1255.

145. *Id.*

146. Julie A. Greenberg, *Reconceptualizing Preconception Torts*, 64 TENN. L. REV. 315, 320–27 (1997).

depends heavily on the facts and circumstances of each case, as well as the type of third-party tortfeasor. Preconception negligence cases include medical malpractice,[147] products liability,[148] automobile accidents,[149] workplace injury,[150] and wrongful life.[151]

147. *Renslow*, 367 N.E.2d at 1251 (becoming the first case to grant a child a cause of action for preconception negligence, even if it was labeled as a prenatal case); Torres v. Sarasota Cnty. Pub. Hosp. Bd., 961 So.2d 340, 342 (Fla. Dist. Ct. App. 2007); Yeager v. Bloomington Obstetrics & Gynecology, Inc., 585 N.E.2d 696, 696 (Ind. Ct. App. 1992); Lynch v. Scheininger, 744 A.2d 113, 115 (N.J. 2000).

148. In products liability cases, specifically DES litigation, courts have fashioned special rules giving exception to DES victims to enable recovery, despite the absence of identifying the specific drug manufacturer at fault. These rules include the market share theory and enacting a revival statute to remove the statute of limitations preventing victims from bringing their claim. *See* Hymowitz v. Eli Lilly & Co., 539 N.E.2d 1069, 1071–72 (N.Y. 1989) (applying the national market share liability to enable second-generation plaintiffs to seek compensation under several liability); McMahon v. Eli Lilly & Co., No. 82 C 2822, 1988 U.S. Dist. LEXIS 3405, at *8 (N.D. Ill. Apr. 14, 1988) (the only case that held the deceased third-generation plaintiff, represented by its mother, was entitled to recover for damages under a strict liability theory).

149. Hegyes v. Unjian Enters., Inc., 286 Cal. Rptr. 85, 89 (Cal. Ct. App. 1991) (holding that no duty existed between the child and third-party tortfeasor because there was no special relationship between the tortfeasor and the child's mother to give rise to a duty to the child); Taylor by Taylor v. Cutler, 703 A.2d 294, 295 (N.J. Super. Ct. App. Div. 1997) (following the same reasoning as in *Hegyes*).

150. *See, e.g.*, Hitachi Chem. Electro-Products v. Gurley, 466 S.E.2d 867, 869 (Ga. Ct. App. 1995) (holding that the child's claim must not be a derivative of their parents' claims and that the child is viewed as a third-party claimant and their claim must be based on their own injuries suffered while in utero). Few subsequent cases followed the same reasoning. *See, e.g.*, Ransburg Indus. v. Brown, 659 N.E.2d 1081, 1082 (Ind. Ct. App. 1995); IBM v. Liberty Mut. Fire Ins. Co., 303 F.3d 419, 422 (2d Cir. 2002).

151. Wrongful life is a cause of action brought by the infant, or usually through its parents, against a purported tortfeasor, usually the physician who has a duty to its mother. The infant claims that but for the physician's negligence, he would not have been born with the birth defects. *See, e.g.*, Kush v. Lloyd, 616 So.2d 415, 422 (Fla. 1992); *Lynch*, 744 A.2d at 120; Doolan v. IVF Am., 12 Mass. L. Rptr. 482, 483 (Mass. Super. Ct. 2000); Viccaro v. Milunsky, 551 N.E.2d 8, 12 (Mass. 1990).

Generally, courts have refused to allow the child to recover because: (1) it cannot be said that an impaired human life, even if "severely impaired," amounted to a legally cognizable injury, Grubbs *ex rel* Grubbs v. Barbourville Fam. Health Ctr., P.S.C., 120 S.W.3d 682, 689–90, 691 (Ky. 2003); (2) recognizing wrongful life claims would be "contrary to the intrinsic value and sanctity of human life" and mean non-existence or death is preferable to existence in any form or life, *id.* at 691; (3) it would necessitate calculation of damages through "creation of a hypothetical formula" for an intangible impairment that cannot be ascertained, Becker v. Schwartz, 386 N.E.2d 807, 812 (N.Y. 1978); (4) recognizing wrongful life claims could open the doors to implications that sound in eugenics, namely a quality of life ethic where the healthy is always favored over the infirm, Clark v. Child.'s Mem. Hosp., 955 N.E.2d 1065, 1083 (Ill. 2011); (5) it could enable the parent or judiciary to decide how "defective" a child is that given the chance they would have aborted it, Willis v. Wu, 607 S.E.2d 63, 71 (S.C. 2004); (6) the child "does not have the right not to be born, or the right to be born a whole functioning human being," Elizabeth F. Collins, *An Overview and Analysis: Prenatal Torts, Preconception Torts, Wrongful Life, Wrongful Death, and Wrongful Birth: Time For a New Framework*, 22 J. FAM. L. 677, 702–03 (1983); and (7) an "excessive economic burden would be placed on the medical profession if the courts grant a child and its parents full recovery for a tortiously caused birth," *id. See also* Azzolino v. Dingfelder, 337 S.E.2d 528, 533 (N.C. 1985).

Only a handful of courts, such as California, New Jersey and Washington, have held that a child may maintain a wrongful life action against the physician, albeit limiting recovery to special damages for extraordinary medical expenses. Special damages were permitted because of established precedents and because they were "certain and readily measurable." *See* Turpin v. Sortini, 643 P.2d 954, 965 (Cal. 1982); Procanik v. Cillo, 478 A.2d 755, 757 (N.J. 1984); Harbeson v. Parke-Davis, Inc., 656 P.2d 483, 495 (Wash. 1983).

Most courts that reject these claims have based their reasons on unlimited liability,[152] lack of duty,[153] and unwillingness to ascribe value to non-existence.[154] In general, judicial reasoning closely mirrored those in prenatal negligence.

2. Parental Liability

Prenatal negligence case law has long established that children generally have no cause of action against their parents for injuries arising from automobile accidents[155] or substance abuse.[156] A minority of cases has held the parent liable for prenatal negligence, but their reasoning erred on the side of caution to avoid undermining parental rights to privacy and personal autonomy. Usually, the court found the child had a cause of action against its parents up to the limits of their liability insurance coverage.[157] In non-negligence cases, such as dissatisfied life, courts have refused to recognize the child held a valid claim against their parent.[158]

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152. Elsheref v. Applied Materials, Inc., 167 Cal. Rptr. 3d 257, 265 (Cal. Ct. App. 2014); Albala v. City of New York, 429 N.E.2d 786, 787 (N.Y. 1981); Daniel S. Goldberg, *Against Genetic Exceptionalism: An Argument in Favor of the Viability of Preconception Genetic Torts*, 10 J. HEALTH CARE L. & POL'Y 259, 271 (2007) ("The major reason courts deny recovery for preconception genetic torts is fear of multiple-generation liability."); Greenberg, *supra* note 146, at 336 ("New York denies recovery . . . (as it does in all preconception actions) because of the fear of unlimited liability.").

153. *See supra* note 149.

154. *See supra* note 151.

155. Stallman v. Youngquist, 531 N.E.2d 355, 360 (Ill. 1988) (holding that a mother cannot be sued for prenatal negligence because doing so would intrude into her rights to privacy and personal autonomy); Cullotta v. Cullotta, 678 N.E.2d 717, 718 (Ill. App. Ct. 1997) (holding that no cause of action existed for maternal prenatal negligence in operating a vehicle that caused the death of the mother and her later-born child, because no legal duty was owed by the mother); Remy v. MacDonald, 14 Mass. L. Rptr. 483, 484 (Mass. Super. Ct. 2002) (following *Stallman*).

156. Chenault v. Huie, 989 S.W.2d 474, 476 (Tex. Ct. App. 1999) (following *Stallman*).

157. Other cases that held a child has or could have a cause of action against their parent. *See, e.g.*, Nat'l Cas. Co. v. N. Tr. Bank of Fla., N.A., 807 So. 2d 86, 86–87 (Fla. Dist. Ct. App. 2001) (holding that a parent is liable to the extent of their available liability insurance coverage); Cox v. Gaylord Container Corp., 897 So. 2d 1, 6 (La. Ct. App. 2005) (notwithstanding a statute providing that an unemancipated child cannot sue their parent for prenatal negligence, it is possible for the child—when they become of age or is emancipated—to bring a claim against their parent); Tesar v. Anderson, 789 N.W.2d 351, 362 (Wis. Ct. App. 2010) (holding that the mother's insurer was liable by virtue of the mother's breach of duty toward her fetus, following Justice Andrews' dissent on legal duty in *Palsgraf*); Bonte v. Bonte, 616 A.2d 464, 466 (N.H. 1992) (holding that there was no reason not to allow the child to sue his mother because existing case law allowed children to bring suit against third-party tortfeasors for causing their injuries in utero and because a child could sue his mother in tort for negligence by virtue of abolishing the parental immunity doctrine); Grodin v. Grodin, 301 N.W.2d 869, 871 (Mich. Ct. App. 1980) (holding that because Michigan case law did not exempt the mother from the class of persons who may be held liable for prenatal negligence, third-person liability applied in the same weight to the mother, subject to the protections of the parental immunity doctrine). The parental immunity doctrine applies only if (1) "the alleged negligent act involves an exercise of reasonable parental authority over the child," and (2) "the alleged negligent act involves an exercise of reasonable parental discretion with respect to the provision of food, clothing, housing, medical and dental services, and other care." *Grodin*, 301 N.W.2d at 870 (quoting Plumley v. Klein, 199 N.W.2d 169, 172 (1972)).

158. Zepeda v. Zepeda, 190 N.E.2d 849, 858–59 (Ill. App. Ct. 1963) (holding that a child born out of wedlock had no cause of action for dissatisfied life against his father, because it would create a new tort in wrongful life and open the floodgates to litigation).

Courts have rooted their rejection on personal autonomy and policy reasons.[159] In general, courts felt it would undermine the unique mother-child relationship, invade the privacy, bodily integrity, and reproductive autonomy of the mother, and that it would be impossible to create a judicially defined standard of care.[160] These reasons, discussed in the next Subpart, formed the bulk of the *Stallman* court's reasoning in rejecting the child's claim against their mother.[161] Subsequent cases relied heavily on *Stallman*'s rationale.[162]

a. Automobile Accidents

In *Stallman*, a child brought suit against her mother for prenatal injuries from an automobile collision due to negligent operation of her vehicle.[163] The issue before the court was "whether a cause of action exists by or on behalf of a fetus, subsequently born alive, against its mother for the unintentional infliction of prenatal injuries."[164] In denying the child's claim, the court based its reasons on the profound societal and legal implications that would result from the legal fiction of allowing a fetus to assert its right to begin life with a sound mind and body against its mother after birth.[165]

First, the court was unwilling to create a new tort.[166] Recognizing a legal right by a fetus to assert its right to begin life with a sound mind and body meant recognizing a legal duty, as opposed to a moral duty, on the part of the mother, "to effectuate the best prenatal environment possible."[167] Recognizing that legal right would create a new tort, namely a claim assertable by a fetus, "subsequently born alive, against its mother for the unintentional infliction of prenatal injuries."[168]

Second, the court did not recognize the child as having rights superior to the mother, even if such belief was held by others.[169] The court stated that some firmly believed that a woman's right to control her life should become subordinate to the fetus when she prepared for pregnancy or became pregnant.[170] This belief would result in prescriptions of what a mother should or should not do; anything that may harm the developing fetus should be prohibited, while anything that may benefit the fetus should be "mandated under penalty of law,

159. *See, e.g.*, *Stallman*, 531 N.E.2d at 361 ("[I]f a legally cognizable duty on the part of pregnant women to their developing fetuses is to be recognized, the decision must come from the legislature only after thorough investigation, study and debate.").

160. *Id.* at 360.

161. *Id.* at 361.

162. *See, e.g.*, Chenault v. Huie, 989 S.W.2d 474, 477–78 (Tex. Ct. App. 1999).

163. *Stallman*, 531 N.E.2d at 355.

164. *Id.* at 356–57.

165. *Id.* at 360 (refusing to recognize this legal right against the child's mother, even if it was recognized in third-party liability cases).

166. *Id.* at 359.

167. *Id.*

168. *Id.*

169. *Id.*

170. *Id.*

be it criminal or civil."[171] However, because any act or omission may benefit or injure her developing fetus, any conduct could render the mother liable to her subsequently born child. The court refused to accept this line of reasoning.[172]

Third, the court found there was no "legal duty to guarantee the mental health and physical health of another."[173] Recognizing a legal right to begin life with a sound mind and body assertable against the mother necessarily makes the mother the "guarantor of the mind and body of her child at birth."[174] This was not recognized in law. Further, if a legal duty was recognized, it would mean any act or omission that negatively impacted the child could be construed as a breach of such duty. This could transform the mother-child relationship such that both become "legal adversaries from the moment of conception until birth."[175]

Fourth, if a legal duty on the part of the mother was recognized, then a judicially defined uniform standard of conduct for pregnant women needed to be created.[176] The court emphasized the impossibility and undesirability of establishing such a standard and argued it was better for the legislature to decide.[177]

Fifth, allowing a child to sue his or her parent would overlook important factors unique to the mother-child relationship.[178] The relationship between a pregnant woman and her fetus is unlike the relationship between any other plaintiff and defendant. As the court emphasized, a mother is not within the class of third persons liable for their negligence to the child.[179] Treating a mother like a stranger, or like a third-person tortfeasor, is inappropriate because her relationship with her fetus is not adversarial, unlike the relationship between any other plaintiff and defendant. There is a precious bond between the mother and child; the mother goes through "biological changes of the most profound type, possibly at the risk of her own life" and the child "depends exclusively on [the mother] for everything necessary for life itself."[180] Logic does not demand that a mother go through these changes only to "bring forth an adversary into the world."[181]

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171. *Id.*
172. *Id.*
173. *Id.*
174. *Id.*
175. *Id.*
176. *Id.* at 360.
177. *Id.* at 361.
178. *Id.* at 360.
179. *Id.* (rejecting *Grodin* as governing precedent because the mother in a mother-child relationship was not a stranger, *Grodin* failed to address any "profound implications" resulting from recognizing such legal fiction, and the same court in a later case found *Grodin* to be erroneous); *see also* Renslow v. Mennonite Hosp., 367 N.E.2d 1250, 1255 (Ill. 1977) (holding that generally, a woman and her child have a legally cognizable cause of action against a third-person tortfeasor for the injury caused by their tortious acts on the mother before or during her pregnancy).
180. *Stallman*, 531 N.E.2d at 360.
181. *Id.*

Lastly, recognizing a cause of action in tort for maternal prenatal negligence would require "judicial scrutiny into the day-to-day lives of pregnant women [which] would involve an unprecedented intrusion into [their] privacy and [bodily] autonomy."[182] This, the court opined, was better suited for the legislature to decide "after thorough investigation, study and debate."[183] The court also contended that neither foreseeability of harm[184] nor causation[185] alone could result in a finding of a legal duty.[186]

b. Substance Abuse

Although *Chenault v. Huie* followed most of *Stallman*'s rationale, it seemingly held that parents could treat their bodies with impunity even to the detriment of the fetus.[187] *Chenault* was a case of maternal prenatal substance abuse that resulted in the offspring suffering from permanent and disabling injuries.[188] The case arose at a time when courts only recognized third-person liability for prenatal injury and had not yet expanded it to parents.[189] *Chenault* concerned whether a child could sue their mother for negligent or grossly negligent conduct while pregnant that caused the child's injuries.[190] In *Chenault*, the mother used illegal narcotics, including cocaine, throughout the course of her pregnancy.[191] After birth, the child's blood was found to contain traces of cocaine and alcohol, which manifested in developmental problems and cerebral palsy.[192] The child's sister, as her sole managing conservator, filed suit against the parents alleging that their negligent and grossly negligent conduct proximately caused the child to suffer her injuries.[193]

While the court did not engage in a reasonable foreseeability of harm analysis, it utilized the concept of legal duty and cited policy reasons to render

182. *Id.* at 361.

183. *Id.*

184. Leon Green, *Foreseeability in Negligence Law*, 61 COLUM. L. REV. 1401, 1417–1418 (1961) ("There are many factors other than foreseeability that may condition a judge's imposing or not imposing a duty in the particular case . . . .").

185. William L. Prosser, *Palsgraf Revisited*, 52 MICH. L. REV. 1, 24 (1953) ("[I]n a very real sense the consequences of an act go forward to eternity, and back to the beginning of the world. Any attempt to impose responsibility on such a basis would result in infinite liability for all wrongful acts, which would 'set society on edge and fill the courts with endless litigation.'" (quoting North v. Johnson, 59 N.W. 1012, 1013 (Minn. 1894))).

186. *Stallman*, 531 N.E.2d at 359–60.

187. Chenault v. Huie, 989 S.W.2d 474, 476 (Tex. Ct. App. 1999).

188. *Id.* at 475.

189. *Id.* One of Chenault's arguments was to expand the holding of *Delgado*'s third-person liability for prenatal injury to apply to parents' wrongful actions. The court rejected this proposal because the two cases cited—*Grodin* and *Bonte*—did not thoroughly explain their reasons and were thus unpersuasive. *Id.* at 476. Additionally, the court distinguished between the cases: *Grodin* and *Bonte* concerned application of the parental immunity doctrine, while Chenault concerned creation of a legal duty as a pre-requisite for a civil cause of action. *Id.*

190. *Id.* at 474.

191. *Id.* at 475.

192. *Id.*

193. *Id.*

its judgment in favor of the mother.[194] In denying the sister's appeal, the court rested its decision on several considerations: the unique symbiotic relationship between a mother and her fetus; the "inherent differences between imposing a duty on entirely separate individuals and imposing the same duty on a person biologically joined to the injured party" and the impossibility of pinpointing when a duty should be imposed.[195] It also addressed the notion of a "reasonable pregnant woman" standard but argued its infeasibility due to the myriad of socioeconomic factors and jurors' subjective beliefs that render such a standard unworkable.[196] The court recognized that criminal laws exist to address a person's use of illegal drugs and that imposing civil liability would not necessarily further discourage such conduct.[197] The court ended its decision opining that the threat of civil liability may have an inverse effect, specifically that it could prevent pregnant women from revealing "critical facts about their conduct to their physicians," which would result in "less than adequate prenatal care."[198]

The court acknowledged the mother's "conduct would likely, if not unquestionably, be found unreasonable under any standard of care."[199] However, the aforementioned difficulties justified against a finding of a duty. Recognizing a duty would, as the court wrote, have "far broader implications than simply holding drug-abusing mothers civilly liable to their later born children."[200]

Other cases presented with a similar issue have invoked the parental immunity doctrine, usually on the basis of maintaining family harmony, preserving parental authority, and preventing fraud and collusion.[201] But courts have, over time, peeled away its protection to the effect that most eventually abandoned the doctrine.[202] Some courts have also refused to impose liability, citing concerns about overextending traditional tort principles,[203] or viewing the

194. *Id.* at 477–78.

195. *Id.* at 476.

196. *Id.* at 477–78.

197. *Id.* at 478.

198. *Id.* at 478. The *Chenault* court neither condoned nor agreed with the defendant mother's course of conduct but situated the issue within a broader context in declining to hold the defendant liable: the privacy and personal autonomy rights that may be undermined if a legal duty was found. *Id.*

199. *Id.*

200. *Id.*

201. W. Roderick Bowdoin, *Parental Immunity: The Case for Abrogation of Parental Immunity in Florida*, 25 FLA. L. REV. 794, 794, 797–98 (1973).

202. Carroll, *supra* note 112, at 299–300; Bonte v. Bonte, 616 A.2d 464, 465–66 (N.H. 1992); Rousey v. Rousey, 528 A.2d 416, 416 (D.C. 1987); Kirchner v. Crystal, 474 N.E.2d 275, 276 (Ohio 1984); Falco v. Pados, 282 A.2d 351, 353 (Pa. 1971); Elam v. Elam, 268 S.E.2d 109, 112 (S.C. 1980). Other courts replaced the parental immunity doctrine with a "reasonable parent" rule or followed the approach under RESTATEMENT (SECOND) OF TORTS § 895G (AM. L. INST. 1979). *See, e.g.*, Gibson v. Gibson, 479 P.2d 648, 648 (Cal. 1971).

203. Remy v. MacDonald, 801 N.E.2d 260, 266. (Mass. Super. Ct. 2002) (holding that deciding on a legal duty is better suited for the legislature and state supreme court).

issue as one better suited for the legislature to decide.[204] For preconception negligence, there has yet to be a case where a child sought to sue its parents.[205]

C. DUTY OF CARE

Having provided an overview of the case law, Subpart C engages in a traditional negligence analysis to argue why individuals should not be liable for preconception negligence that causes epigenetic harms to their future children. Advancements in scientific research may someday make epigenetic evidence "more readily available for proving a plaintiff's case" on the causation issue.[206] Despite the overwhelming urge to impose liability due to this prospective evidence, I argue that a traditional negligence analysis should not ignore the duty of care element.[207] Without a duty of care, liability should not be imposed.[208] The importance of ascertaining a duty becomes more pronounced in preconception negligence because the inquiry places greater emphasis on what is at stake: privacy and personal autonomy.[209]

I argue that individuals should not owe a legal duty for preconception negligence that causes epigenetic harms to their progeny.[210] My rationale includes the following: there is no foreseeability of harm;[211] privacy and personal autonomy concerns outweigh the imposition of a duty; it is difficult to pinpoint when a duty arises; and policy considerations, such as blame culture, race and reproduction, unlimited liability, epigenetic discrimination, and the question of who should bear the loss, support a finding that no duty should be owed.

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204. *Id.* at 266–67.

205. The Court of Appeal of California recognized that there is not yet a case where a child sued their parents for preconception harm, apart from actions against third parties such as medical professionals or product liability manufacturers. *See* Elsheref v. Applied Materials, Inc., 167 Cal. Rptr. 3d 257, 263 (Cal. Ct. App. 2014).

206. Laubach, *supra* note 104, at 1055.

207. Here, I focus on the duty element before considering subsequent elements. Most of the aforementioned cases failed to analyze the existence of a duty between the parent and child. Courts have tended to assume duty existed without specifying why and how it arose.

208. I argue that anything prior to the knowledge of conception should not be assessed as liability against the parent. In a negligence claim, the first element is duty of care. This should be the starting point in a traditional negligence analysis before breach, causation, and damages are considered. Absent of duty, liability should not be imposed. *See* Palsgraf v. Long Island R.R. Co., 162 N.E. 99, 100–01 (N.Y. 1928); *see also* Prosser, *supra* note 185.

209. While the aforementioned cases concerned the mother and child, I argue that the judicial rationale should apply similarly to the father.

210. Another argument is the lack of a special relationship between the individual and their unconceived child. By virtue of the parent-child relationship, a duty can be said to arise where the parent owes a duty to their minor child to exercise reasonable care to avoid placing the child under unreasonable harm. Here, the individual cannot have a legally recognized relationship with their unconceived child such that a duty is owed; the child never existed during the preconception timeframe. It would be difficult to argue a special relationship, or any other legal relationship, existed such that the individual was bound and liable for any preconception negligence that may cause harm.

211. Beal, *supra* note 112, at 364–70.

1. Reasonable Foreseeability of Harm

The leading case on duty is *Palsgraf v. Long Island Railroad Co.*[212] There, the New York Court of Appeals addressed the issue of whether the defendant railroad company was liable for the negligence of its guard in pushing a man and causing him to drop his package of fireworks, which exploded and injured the plaintiff.[213] The court held that the defendant was not liable.[214] Justice Cardozo predicated his reasoning on analyzing whether the defendant owed a duty the plaintiff, based on a reasonable foreseeability of risk analysis.[215] Justice Cardozo held that, for a duty to exist, the defendant's conduct must involve some foreseeable risk "to another or to others within the range of apprehension."[216] There was no reasonable foreseeability of harm because "there was nothing in the situation to suggest to the most cautious mind that the parcel wrapped in newspaper would spread wreckage through the station."[217] Further, the plaintiff was not a reasonably foreseeable victim.[218] Even if the defendant breached its duty to the package owner, such a duty did not extend to the plaintiff, and she could not sue as a vicarious beneficiary.[219] In short, an ordinary person would not have foreseen a package wrapped in newspaper would contain fireworks and, to a lesser degree, that it would threaten the plaintiff's safety or cause harm to the plaintiff, who was far away from the train. Thus, the defendant was not liable.[220]

Palsgraf offers clear authority that a traditional negligence analysis begins with legal duty. This duty depends on a reasonable foreseeability of risk analysis. Without a duty, courts do not consider the remaining elements of negligence; there can be no breach of a duty that never existed between the plaintiff and the defendant. As Justice Cardozo succinctly wrote in finding a lack of duty owed to Mrs. Palsgraf, "the law of causation, remote of proximate, is thus foreign to the case before us. The question of liability is always anterior to the question of the measure of the consequences that go with liability."[221] Negligence is defined as "conduct which falls below the standard established by law for the protection of others against unreasonable risk of harm."[222]

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212. Palsgraf v. Long Island R.R. Co., 162 N.E. 99 (N.Y. 1928).

213. *Id.* at 99.

214. *Id.* at 99–102.

215. *Id.*

216. *Id.* at 100–01.

217. *Id.* at 101. Elaborating further, the court held that "[i]f no hazard was apparent to the eye of ordinary vigilance, an act innocent and harmless, at least to outward seeming, with reference to her, did not take to itself the quality of a tort because it happened to be a wrong, though apparently not one involving the risk of bodily insecurity, with reference to someone else." *Id.* at 99–100.

218. There was no foreseeable risk of harm from the package to anyone, let alone to the plaintiff herself. Only the package holder and his companion likely knew of the risks, but not the defendant guards who helped the package holder onto the train.

219. *Palsgraf*, 162 N.E. at 99–100.

220. *Id.* at 101.

221. *Id.*

222. RESTATEMENT (SECOND) OF TORTS § 282 (AM. L. INST. 1965).

Environmental epigenetics raises a critical issue in negligence law about individual liability. Even if scientific advancement has progressed sufficiently to prove causation, there can be no liability without first identifying the existence of a legal duty.[223]

Often, tort law tracks social conventions when imposing liability. Individuals do not have carte blanche to act negligently because existing social conventions and moral obligations define their course of conduct. Society is more willing to ascribe responsibility and impose liability when an individual progresses closer toward a perceived important event. The event could be pregnancy, where women may be expected to take greater care of their health due to societal perceptions of the mother-child biology. Some even perceive women's rights as becoming second to the fetus because, at this stage, the mother lives her life not only for herself but for the fetus as well.[224] Similar social conventions and moral obligations may be expected of men. Social norms and conventions, regardless of correct scientific knowledge, impose expectations on what an individual should and should not do.

Because many of the studies cited in Part I concerned environmental effects on the individual and their progeny, this Part's hypothetical utilizes examples limited broadly to a lifestyle that includes dietary choices and stress. One study described at the outset concerned alcohol intake.[225] The study sought to develop insight into the epigenetic effects of alcohol across three generations of descendants.[226] Although the study was conducted on rats, one might imagine a hypothetical where the same was conducted on humans.[227] This time, however, suppose the independent variable is junk food. The same hypothetical could similarly apply to other dietary intake such as high consumption of cheap and empty carbohydrates or alcohol.[228]

Applying *Palsgraf*, one has to consider the foreseeable risk of injury to a victim when determining whether a duty exists. In my view, this hypothetical's analysis should be divided into incremental age groups, such as teenagers, young adults, and older adults. In each age group, there are also three potential groups of plaintiffs: their children, grandchildren, and descendants.

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223. Hegyes v. Unjian Enters., Inc., 286 Cal. Rptr. 85, 90 (Cal. Ct. App. 1991) ("In a preconception tort case, as in any negligence case, there is an overwhelming need to keep liability within reasonable bounds and to limit the areas of actionable causation by applying the concept of duty.").

224. Stallman v. Youngquist, 531 N.E.2d 355, 359 (Ill. 1988).

225. Nizhnikov et al., *supra* note 5.

226. *Id.*

227. Assuming the pitfalls of extrapolating animal models to human studies did not apply. *See id.* at 498.

228. Céline Tiffon, *The Impact of Nutrition and Environmental Epigenetics on Human Health and Disease*, 19 INT. J. MOLECULAR SCI. 1, 6 (2018) (explaining dietary patterns influence behavior and phenotype in the offspring). For instance, the Western diet is "high in saturated fats, red meats, and empty carbohydrates but low in fresh fruits and vegetables, whole grains, seafood, and poultry. . . . [And] has been linked to many diseases including hypertension, heart disease, diabetes, and obesity and it has generally been linked to an increased risk of cancer." *Id.* (footnotes omitted).

In the first group, it may be reasonable to ask whether the teenager will reasonably foresee harm from their junk food consumption toward their future children. It will seem farfetched to conclude so. Living a healthy life for the sake of an unconceived child is likely the least of the teenager's concerns. At this age and in modern times, it is more likely teenagers are concerned with finding success in society or pursuing higher education, rather than with society's perception of motherly or fatherly duties. The teenager likely does not consciously stop at every sip or bite to ponder the potential harm that their junk food consumption may cause to their descendants, nor do they stop at every instance of inhaling second-hand smoke to deliberate about the potential harm it could cause. Even if they do, it is likely with their own health in mind, not others'. The same could also apply to indulgence in drug use or even lack of exercise. The future offspring's well-being does not enter their health equation. In sum, the teenager does not foresee the risks associated with their conduct, nor the potential harm to their future children.

If a duty was imposed on adolescents, it would undermine general policy to allow children to mature and grow in an environment without being subject to liability at the same standards expected from adults. If the law finds a duty owed by the child, and hence liability to a later generation, or if the law holds the child to the same degree of care as an adult, then it would effectively be shifting "its eyes, ostrich-like, to the facts of life and to burden unduly the child's growth to majority."[229] It would contradict public policy to prevent a child from maturing through their own experiences.

Moreover, this is a broader inquiry into parental control and the educational system's teachings that influence the child's lifestyle choices. Parents likely exercise more control over their children's lives, especially lifestyle choices that reflect those of the parents or their expectations. Additionally, instructing and educating children on the consequences of epigenetic harms is within the purview of the educational system, assuming that epigenetics research and technology have advanced enough to enable the teachings of common epigenetic knowledge. Children cannot be expected to independently search this information, to be aware of the existence of epigenetic harms, or to be mindful of their future generations' well-being in the absence of guidance from some higher authority. Thus, in the first group, the relevant inquiry should focus on educational systems and parental guidance, rather than solely on a legal duty based on the teenager's choices.

What about young adults? Would they reasonably foresee the impact of their choices on their future children? If I asked a young adult whether they reasonably think their actions or omissions can harm themselves and their future children, they may likely respond positively to the first question but not the second. Arguably, they are more conscious of their decisions, although their

229. Harry Shulman, *The Standard of Care Required of Children*, 37 YALE L.J. 618, 618 (1928).

unconceived child would likely remain out of the health equation. Here, they reasonably foresee the harm to themselves, but not to the unconceived child.

The answer may vary depending on each individual's cultural, socioeconomical, and familial backgrounds. However, these backgrounds are not considered when the court determines the existence of a legal duty.[230] One may only hope that a jury would be sensitive to these variables when determining breach. For instance, a young adult from a particular cultural, socioeconomic, and familial background may be more prone to dwell on the consequences of their current behavior and thus the consequences on their unconceived children. Others may be less conscious of the same. While these varying factors play a role in decision-making, it remains arguable that the average person would not reasonably foresee the risks of epigenetic harms to their descendants as a direct result of their lifestyle choices.

Like the first group of teenagers, the existence of a duty may become less elusive as epigenetic knowledge becomes more widespread in the community. With advancement in epigenetics research and education about the impact of this subbranch of genetics, the informed may lean toward awareness and avoidance of lifestyle choices that are proven to harm the next generation. Individuals may exercise more caution when going about their days. While the current reasonable person may not foresee harm to their future children, as discoveries about the epigenetic harms that impact the health of future children emerge, and education around those impacts advances, the assessment of the foreseeability of harm, and thus, duty, will certainly adjust. It may be possible to find a duty based on such robust knowledge in the community.

For instance, in genetic counseling, a geneticist diagnoses the potential parents to determine if they are carriers of genetic disorders.[231] If they are, and the genetic counselor informs the potential parents of this knowledge, then "[f]oreseeability of injury to the child is at its maximum."[232] Similarly, if epigenetic knowledge is conclusive and common knowledge at the time an individual engages in activity that causes epigenetic harms to their future children, then one could argue the test for reasonable foreseeability of harm is satisfied. A relevant example is assisted reproductive technology (ART), which is fertility treatment.[233] Over the last decade, animal and human studies have reported that various steps in ART could disrupt the epigenetic reprogramming of embryos, a critical step in the embryo's development,[234] and this could

230. *See, e.g.*, Palsgraf v. Long Island R.R. Co., 162 N.E. 99, 99–100 (N.Y. 1928).

231. Carroll, *supra* note 112, at 303–04.

232. *Id.* at 304.

233. *Assisted Reproductive Technology (ART),* EUNICE KENNEDY SHRIVER NAT'L INST. OF CHILD HEALTH AND HUM. DEV. (June 18, 2024), https://www.nichd.nih.gov/health/topics/infertility/conditioninfo/treatments/art.

234. Epigenetic reprogramming involves the erasure (reset) of epigenetic marks present in "the maternal and paternal genomes of the newly formed zygote." M.C. Roy, Charles Dupras & Vardit Ravitsky, *The*

increase the risk of ART-conceived children developing late-onset diseases.[235] If prospective parents are adequately informed about the risks by healthcare professionals, shouldn't the existence of a duty be incontestable?[236]

What about the third group of older adults, one who is preparing to start a family or at an age where societal and familial expectations may pressure them to start a family? At this stage, it is possible that the adult is conscious of their health and the need to effectuate an acceptable environment for their not-too-distant child. A woman may be more mindful of her dietary and lifestyle choices and avoid conduct that may harm herself and her future child.[237] She has not conceived the fetus, yet her conscience may already be guiding her actions. A man may similarly be more mindful of his lifestyle and dietary choices in order to effectuate the best possible environment for his progeny. In this scenario, the adult reasonably foresees the risk of harm from their actions or omissions toward themselves and their unconceived child. Applying *Palsgraf* alone, the adult may thus owe a legal duty toward their unconceived child.

However, it may be argued that a general duty cannot exist where its breach would result in liability for all potential consequences. There may not be specific epigenetic knowledge or foreseeable epigenetic harms to the not-too-distant child. The adult may be mindful of their conduct because of current widespread knowledge about the harms of junk food consumption, but they may not know the epigenetic mechanisms that lead to a *specific* injury. Or that other types of injuries may manifest from junk food consumption which were not common knowledge at that time. For example, the adult may know generally that excess junk food intake during pregnancy can be harmful to themselves and their children.[238] Similarly, the adult may be cautious about preconception alcohol

Epigenetic Effects of Assisted Reproductive Technologies: Ethical Considerations, 8 J. DEVELOPMENTAL ORIGINS HEALTH & DISEASE 436, 437 (2017). It is an important step in the embryo's development and is "sensitive to environmental signals such as nutrition, hormones and drugs." *Id.* The disruption of epigenetic reprogramming can lead to "modifications that could have an impact on the resulting child's future health." *Id.*

235. *Id.* at 436–37.

236. Without state laws barring parental liability, it is possible to make out an argument for duty. Assuming informed consent was properly given, there is indeed foreseeability of harm as the prospective parents knew and understood the risks of conceiving via ART. Courts may balance public policy concerns, namely an individual's right to pursue fertility treatments (reproductive autonomy) versus a child's right to be wellborn. Moral and ethical considerations may also be relevant. What if the prospective parents, after innumerous failed attempts to conceive, knew that they wanted the child and are further committed to unconditionally love, care, and provide a nurturing environment for the child? It runs against common notions of morality to subject parents to legal liability for those very intentions.

237. For example, there are studies indicating the benefits of weight reduction in increasing fertility, or articles written on the benefits of heart health and delivery of a healthy baby. *See, e.g.*, Damian Best, Alison Avenell & Siladitya Bhattacharya, *How Effective Are Weight-Loss Interventions for Improving Fertility in Women and Men Who Are Overweight or Obese? A Systematic Review and Meta-Analysis of the Evidence*, 23 HUM. REPROD. UPDATE 681, 682 (2017); Kristin Samuelson, *First Get Your Heart in Shape. Then Get Pregnant.*, NW. NOW (Feb. 14, 2022), https://news.northwestern.edu/stories/2022/02/heart-health-before-pregnancy.

238. *Weight Gain During Pregnancy*, CDC (May 15, 2024), https://www.cdc.gov/maternal-infant-health/pregnancy-weight/index.html.

use due to its detrimental effects on the child's behavioral and cognitive functions.[239] But the same adult will not be aware that junk food intake can specifically cause their child to develop eating disorders and, thus, an increased risk for obesity in later life.[240] The same is true for other variables, such as alcohol intake, where the adult may not be aware that consumption can lead to conditions that can be transmitted to the next generations.[241]

Here, general knowledge about the harmful effects of junk food is widespread, but not the specific epigenetic knowledge or mechanisms that precipitate the injury in the child.[242] In short, the foreseeability of harm may be based not on epigenetic knowledge but rather on general knowledge that certain conduct may be harmful to the child. In order to justly impose a duty, there should be knowledge about the particular risk of harm created through specific conduct. Thus, there is no foreseeability of epigenetic harms to the child due to a lack of epigenetic knowledge, even if the child as a potential victim can be foreseen by virtue of the adult's conduct and proximity to conception. The adult cannot reasonably be held to owe a general duty to avoid any and all harm occasioned by their negligence.

Further, the issue of knowledge may ultimately dictate the standard of conduct on how an individual should use their body prior to conceiving the child. Drawing on legal scholar Ron Beal's insights, which aptly sum up the problem and which holds especially true for women but also for men:

> From common experience, it can probably be assumed that all women desire to have a child at some point in their lives; if not, they at least desire the freedom to *choose* whether or not to conceive. The mere desire to have a child may mean a woman should reasonably foresee that how she treats her body throughout her lifetime could ultimately injure her child. The logic of this argument may be consistent with the protection of the child to be well-born, but borders on the nonsensical in reality.[243]

If a duty is found to exist between the individual and their unconceived child, it will likely implicate a balance between the individual's freedom of bodily integrity and the fetus' right to be well-born.[244] The consequence of such

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239. For example, a study suggested paternal alcohol consumption before conception may increase the risk of child behavioral problems. Another study found an association between maternal alcohol consumption pre-pregnancy and deficiencies in their children's cognitive capability. *See, e.g.*, Min Luan, Xiaohua Zhang, Guanghong Fang, Hong Liang, Fen Yang, Xiuxia Song, Yao Chen, Wei Yuan & Maohua Miao, *Preconceptional Paternal Alcohol Consumption and the Risk of Child Behavioral Problems: A Prospective Cohort Study*, SCI. REPS., 2022, at 1, 4–9; Ulrik Schiøler Kesmodel et al., *The Association of Pre-Pregnancy Alcohol Drinking with Child Neuropsychological Functioning*, 122 BJOG 1728, 1733–37 (2015).

240. Begüm Harmancıoğlu & Seray Kabaran, *Maternal High Fat Diets: Impacts on Offspring Obesity and Epigenetic Hypothalamic Programming*, FRONTIERS GENETICS, May 2023, at 1, 6.

241. Nizhnikov et al., *supra* note 5.

242. But if epigenetic knowledge is common, the general tort rule applies, namely that an actor must rid himself of ignorance when engaging in certain conduct that involves a risk. *See* RESTATEMENT (SECOND) OF TORTS § 290 (AM. L. INST. 1965).

243. Beal, *supra* note 112, at 369.

244. *Id.* at 368.

tension may mean that an individual is subject to some stringent standard of conduct long before, or perhaps for their lifetime, the conception of their child.[245] And failure to abide by such a standard can result in legal liability.[246] In order to strike a better balance between the two competing rights, it may be less controversial to impose a duty at the time of actual knowledge of conception.[247]

In sum, this simplistic hypothetical suggests the first two groups of teenagers and young adults satisfy the *Palsgraf* test; there is no foreseeability of harm to a victim. The third group of older adults may fail because there is a foreseeable victim, but will need justification to argue the adult is liable for all harms resulting from their negligence to the child who did not exist at the time of the conduct. Further, a duty may be imposed if epigenetic harms are common knowledge.[248] Suppose advancement in epigenetic studies progresses sufficiently to enable the community to know the consequences of certain behaviors or exposure to their progeny. Now, it may be arguable that engaging in those conducts creates a foreseeable risk of injury to the offspring and possibly their descendants A legal duty may then be found between the individual and their unconceived child.

However, this will leave courts with the challenge of deciding whether an unconceived child's right to be well-born is important enough to severely undermine an individual's right to use their body as they please, and how far courts will be willing to overstep into the individual's life. The courts' position on this is well-documented. Foreseeability of harm alone is insufficient to give rise to a legal duty. Courts tend to consider many factors that influence their decision on whether to find a duty between the plaintiff and the defendant. For instance, the *Stallman* court relied predominantly on privacy and autonomy concerns, including other policies, in denying the plaintiff child a cause of action for prenatal negligence against her mother. *Chenault* followed the same

245. *Id.*

246. *Id.*

247. *Id.* at 367–68.

248. There remains uncertainty surrounding epigenetics, including the inconclusive nature of epigenetic studies. Additionally, researchers were cognizant that current research fails to consider socioeconomic factors as potential confounding variables. *See* Michèle Ramsay, *Genetic and Epigenetic Insights into Fetal Alcohol Spectrum Disorders*, GENOME MED., 2010, at 1, 4; Philip C. Haycock, *Fetal Alcohol Spectrum Disorders: The Epigenetic Perspective*, 81 BIOLOGY REPROD. 607, 615 (2009); Denis Viljoen, Julie Croxford, J. Phillip Gossage, Piyadasa W. Kodituwakku & Philip A. May, *Characteristics of Mothers of Children with Fetal Alcohol Syndrome in the Western Cape Province of South Africa: A Case Control Study*, 63 J. STUD. ON ALCOHOL 6, 6 (2002). Epigenetics remains far from definitively proving a causal link between action and outcome in humans. Due to the multifactorial nature of most diseases that can be ascribed to epigenetic harms, "it is unlikely that conclusive proof can be established showing that particular exposures lead to epigenetic risks that manifest into specific conditions." Khan, *supra* note 37, at 259, 280–81, 299; Steve C. Gold, *When Certainty Dissolves into Probability: A Legal Vision of Toxic Causation for the Post-Genomic Era*, 70 WASH. & LEE L. REV. 237, 276–81 (2013). Even so, diluted epigenetic knowledge is already disseminated in the public sphere that raises concern over misconceptions and misuse of science. At a time when epigenetic knowledge is still fluid, it would be unreasonable to hold such knowledge as satisfying foreseeability of harm, and thus the imposition of liability.

reasoning, but also emphasized the broader implications of legal duty on women's liberty in general. Other courts similarly raised the point that foreseeability alone is not enough to create a legal duty.[249]

2. Extreme Cases

This Subpart argues that extreme cases causing trauma can be considered an epigenetic tort and should give rise to a legal duty. It contrasts with the situations discussed earlier where the conduct is less attributable to the "harmful" label.

It cannot be argued that individuals should never owe a duty to their future children or even future generations in all instances. There are extreme cases where a duty should be imposed. For example, in situations where violence has caused trauma in such a way that we could consider it an epigenetic tort.[250] Intimate partner violence that causes epigenetic harms to both the partner and their subsequently born children is one such case.[251] Another example relates to war-related stress, as demonstrated in the Congo study, which found a strong correlation between maternal preconceptional and prenatal exposure to stress (psychosocial stress, war stress, material deprivation) and newborn birth weight, increasing the risk of developing adult-onset diseases.[252]

Societies often consider it reasonable to intrude into the realm of familial privacy to prevent serious harm to a child (*e.g.*, sexual abuse, violence).[253] This should translate into a duty for the parents to avoid violence or abuse to their children that further causes epigenetic harms.[254] Ample evidence from scientific literature suggests childhood maltreatment results in epigenetic modifications—DNA methylation—that change gene expression and manifest in severe physical

249. *See* Rodriguez v. Bank of the W., 75 Cal. Rptr. 3d 543, 550 (Cal. Ct. App. 2008) (relying on *Rowland v. Christian*, 443 P.2d 561 (Cal. 1968), holding that "foreseeability of harm or knowledge of danger, by itself, is insufficient to create a legally cognizable special relationship giving rise to a duty to prevent harm" (quoting Software Design & Application, Ltd. v. Hoefer & Arnett, Inc., 56 Cal. Rptr. 2d 756, 763 (Cal. Ct. App. 1996))); Cunis v. Brennan, 308 N.E.2d 617, 618 (Ill. 1974) ("The existence of legal duty is not to be bottomed on the factor of foreseeability alone." (citing Leon Green, *supra* note 184, at 1417–18); Leon Green, *supra* note 184, at 1417–18 ("[H]owever valuable the foreseeability formula may be . . . it is altogether inadequate for use by the judge as a basis of determining the duty issue and its scope . . . . There are many factors other than foreseeability that may condition a judge's imposing or not imposing a duty in the particular case . . . . If the foreseeability formula were the only basis of determining both duty and its violation . . . [d]uties would be so extended that many cases now disposed of on the duty issue would reach a jury on the fact issue of negligence.").

250. Other extreme examples of multigenerational epigenetic harms include the Dutch famine, Native populations in Canada, and victimization during Reconstruction. In all three cases, epigenetic petitions for reparations have already appeared, but reparations are generally sought from the government, not parents. It would be less appropriate to do so. *See* Maurizio Meloni, *Race in an Epigenetic Time: Thinking Biology in the Plural*, 68 BRIT. J. SOC. 389, 403 (2017).

251. K.M. Radtke, M. Ruf, H. M. Gunter, K. Dohrmann, M. Schauer, A. Meyer & T. Elbert, *Transgenerational Impact of Intimate Partner Violence on Methylation in the Promoter of the Glucocorticoid Receptor*, 1 TRANSLATIONAL PSYCHIATRY 1, 4 (2011).

252. Mulligan et al., *supra* note 63.

253. *See, e.g.*, *Child Sexual Abuse Prevention*, PREVENT CHILD ABUSE AM., https://preventchildabuse.org/what-we-do/child-sexual-abuse-prevention (last visited Feb. 8, 2025).

254. The terminology is Adverse Childhood Experience, abbreviated as ACE.

and mental health problems across the child's lifespan.[255] These include increased risk for myriad health problems,[256] comorbidities,[257] risks of premature mortality,[258] social, emotional and behavioral problems,[259] and even individual function.[260]

While these are prenatal and childhood experiences, they have roots in preconception harms toward the mother or father.[261] Studies have shown that mothers who show extreme disregard and insensitivity toward their children were themselves frequently exposed to "maltreatment in their infancy, [had] a history of adverse life events, early childbearing of many children, and intimate partner violence, and mostly had a low educational level and lived in families facing substantial economic hardship."[262] For instance, in situations involving

255. *See* Stephanie H. Parade, Lindsay Huffhines, Teresa E. Daniels, Laura R. Stroud, Nicole R. Nugent & Audrey R. Tyrka, *A Systematic Review of Childhood Maltreatment and DNA Methylation: Candidate Gene and Epigenome-Wide Approaches*, 11 TRANSLATIONAL PSYCHIATRY 1, 20–29 (2021); Charlotte A.M. Cecil, Yuning Zhang & Tobias Nolte, *Childhood Maltreatment and DNA Methylation: A Systematic Review*, 112 NEUROSCIENCE & BIOBEHAVIORAL REVS. 392, 392 (2020); Charles A. Nelson, Zulfiqar A. Bhutta, Nadine Burke Harris, Andrea Danese & Muthanna Samara, *Adversity in Childhood Is Linked to Mental and Physical Health Throughout Life*, 371 BMJ 1, 1–7 (2020); Bao-Zhu Yang, Huiping Zhang, Wenjing Ge, Natalie Weder, Heather Douglas-Palumberi, Francheska Perepletchikova, Joel Gelernter & Joan Kaufman, *Child Abuse and Epigenetic Mechanisms of Disease Risk*, 44 AM. J. PREVENTATIVE MED. 101, 104–06 (2013); Joel Gelernter, *The Epigenetics of Child Abuse*, YALE MED. MAG. (2014), https://medicine.yale.edu/news/yale-medicine-magazine/article/the-epigenetics-of-child-abuse.

256. Yang et al., *supra* note 255, at 101 ("[C]hild abuse is highly prevalent and associated with increased risk for a range of health problems including: cancer, cardiovascular disease, diabetes, psychiatric disorders, and other health problems.").

257. J.G.F.M. Hovens, E.J. Giltay, J.E. Wiersma, P. Spinhoven, B.W.J.H. Penninx & F.G. Zitman, *Impact of Childhood Life Events and Trauma on the Course of Depressive and Anxiety Disorders*, 126 ACTA PSYCHIATRICA SCANDINAVICA 198, 204–06 (2012) (finding childhood trauma is associated with "increased persistence of comorbidity and chronicity in adults" with anxiety and depression).

258. Parade et al., *supra* note 255, at 1 ("[A]dults with numerous adverse childhood experiences die nearly 20 years earlier than those with no early adversity.").

259. Charlotte A.M. Cecil, Essi Viding, Pasco Fearon, Danya Glaser & Eamon J. McCrory, *Disentangling the Mental Health Impact of Childhood Abuse and Neglect*, 63 CHILD ABUSE & NEGLECT 106, 108 (2017) (demonstrating that emotional abuse is associated with anxiety, depression, and conduct problems).

260. Andrea Danese, Terrie E. Moffitt, HonaLee Harrington, Barry J. Milne, Guilherme Polanczyk, Carmine M. Pariante, Riche Poulton & Avshalom Caspi, *Adverse Childhood Experiences and Adult Risk Factors for Age-Related Disease*, 163 ARCHIVES OF PEDIATRICS & ADOLESCENT MED. 1135, 1136–43 (2009) (explaining that compromised individual function includes educational attainment, employment prospects and income, relationship quality, and physical and mental health).

261. Andrea L. Roberts et al., *Exposure to Childhood Abuse is Associated with Human Sperm DNA Methylation*, 8 TRANSLATIONAL PSYCHIATRY 1, 7–9 (2018) (finding an association between men who have suffered childhood abuse and DNA methylations in their sperm, which may have implications for their offspring and development).

262. León et al., *supra* note 19, at 2; *see also* Silvia Herrero-Roldan, Inmaculada León, Juan Andrés Hernández-Cabrera & María José Rodrigo, *Improving Early Diagnosis of Child Neglect for a Better Response in Healthcare Settings*, 8 CHILD. 1, 10–11 (2021) (finding risky factors of child neglect include the mother's own history of physical neglect, depressive symptoms, and stressful family circumstances such as lack of finances); Tim M. Mulder, Kimberly C. Kuiper, Claudia E. van der Put, Geert-Jan J. M. Stams & Mark Assink, *Risk Factors for Child Neglect: A Meta-Analytic Review*, 77 CHILD ABUSE & NEGLECT 198, 205 (2018) (finding most risk factors for child neglect originated at the parental level, more specifically during the parent's own childhood and course of life, and included having a "history of antisocial/criminal offending, a history of

intimate partner violence, the child should arguably maintain a cause of action for preconception negligence against the father for conduct toward the mother that caused epigenetic harms, or vice versa if the roles are reversed.

While courts have not yet addressed a preconception negligence claim where the child sued the parent,[263] it is conceivable that in extreme cases, the child could frame such a claim as one of prenatal negligence.[264] *Renslow*, the earlier discussed medical malpractice case concerning preconception negligence, namely negligent blood transfusion to the mother that caused birth defects in her later-born child, was treated by the Illinois Supreme Court under prenatal negligence, which could serve as an analogy and foundation.[265] Specifically, the child may argue breach of a duty by the parent. It is reasonably foreseeable that harmful conduct directed toward the mother (or father) could cause epigenetic harms to them and their future child. Epigenetic modifications, such as DNA methylation resulting from the conduct, can be transmitted to the future child. As a result, the child manifests certain physical and mental health problems causally linked to this past conduct. Thus, the now-parent should be held liable using the same strategy employed in *Renslow*—by treating a preconception negligence case as one of prenatal negligence.

Another example concerns extensive substance abuse, such as that in *Chenault*, where the mother's excessive use of cocaine and alcohol manifested in developmental problems and cerebral palsy in the child.[266] What the court did not articulate was the likelihood that the defendant mother began abusing drugs prior to pregnancy. Logically, it would strike reasonable persons odd that an individual began abusing drugs, including psychoactive drugs such as heroin, cocaine, and alcohol, only during pregnancy. It is presumable that harmful conduct preceded the child's conception, as studies have shown dependence and addiction among chronic users.[267] The child, represented by her sister, brought suit against both parents, but later withdrew her claims against the father.[268] The court denied her negligence suit because Texas law did not recognize a legal

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mental/psychiatric problems, and a low educational level" and experiences of abuse in own childhood); Anna E. Austin, Jared W. Parrish & Meghan E. Shanahan, *Using Time-to-Event Analysis to Identify Preconception and Prenatal Predictors of Child Protective Services Contact*, 82 CHILD ABUSE & NEGLECT 83, 88 (2018) (discussing preconception adversities such as intimate partner violence, exposure to stressful life events, and substance use); Jessica Dym Bartlett, Maryna Raskin, Chie Kotake, Kristen D. Nearing & M. Ann Easterbrooks, *An Ecological Analysis of Infant Neglect by Adolescent Mothers*, 38 CHILD ABUSE & NEGLECT 723, 725 (2014) (risk factors for child neglect include maternal childhood history of maltreatment, intimate partner violence by either the partner or mother, and maternal mental health problems).

263. *See supra* note 210 and accompanying text.

264. *See, e.g., generally* Renslow v. Mennonite Hosp., 367 N.E.2d 1250 (Ill. 1977).

265. *See supra* notes 132–146 and accompanying text. Although I later argue that *Renslow* should not be followed in an individual liability case, here I argue the majority's logic in terms of the patient's continuing ability to conceive can be applied to extreme cases involving epigenetic torts.

266. Chenault v. Huie, 989 S.W.2d 474, 475 (Tex. Ct. App. 1999).

267. *See, e.g.*, Stephanie E. Wemm & Rajita Sinha, *Drug-Induced Stress Responses and Addiction Risk and Relapse*, 10 NEUROBIOLOGY STRESS 1, 1–8 (2019).

268. *Chenault*, 989 S.W.2d at 475.

duty between the mother and her unborn child.[269] However, an argument can likely be made for a legal duty under epigenetic tort against individuals who, in extreme cases, abuse substances continuously, even if they intentionally or negligently remain oblivious about the harmful effects. The general tort principle obligates individuals to relieve themselves of ignorance when engaging in risky conduct.[270]

3. Privacy and Personal Autonomy

Having argued that a duty should not be imposed on individuals for preconception negligence causing epigenetic harms, except in extreme cases, this Subpart delves into the potential and pragmatic consequences of imposing a duty, such as unduly restricting life choices that contravene recognized rights to privacy and personal autonomy and undermining one's right to control one's own life.

Courts such as those in *Stallman* and *Chenault* have utilized policy arguments against imposing a duty in a parental liability context because doing so would undermine the unique parent-child relationship, invade the privacy, bodily integrity, and reproductive autonomy of the parent, and pose the challenge of creating a judicially defined standard of care.[271] This Article takes a similar position. Privacy and personal autonomy are concerns in prenatal parental liability and are more pronounced in the preconception context.

One instance where personal autonomy is undermined is when a duty is imposed based on the grounds that an individual has the continuing ability to conceive. This concern is magnified when looking at the issue of *when* to impose a duty. As previously stated, an individual engaging in harmful conduct that can cause epigenetic injury to their future children may be subject to a legal duty. Further, as Beal reasoned, it is more likely than not that an individual has a desire to, at some point in their life, have children,[272] or at least have the choice to decide whether to have children.[273] If courts were to impose a duty on individuals based on the premise that epigenetic harms are common knowledge and therefore epigenetic injuries to their children are reasonably foreseeable, this would necessarily limit what individuals can and cannot do long before their progeny's conception. Granted, imposing a duty may not completely restrict all harmful conduct, because individuals must act as a reasonable person would, and this depends on a balance of the expected costs and benefits of the behavior. While this balancing test is used to determine a breach of duty, it is not apparent to individuals without legal knowledge. They may fear liability and avoid all harmful conduct entirely, thereby not only limiting the exercise of their

269. *Id.* at 477.
270. *See supra* note 242.
271. *See supra* notes 167–205 and accompanying text.
272. Beal, *supra* note 112, at 369.
273. *Id.*

autonomy but also severely undermining their enjoyment of life. For instance, fear of liability may make them reluctant to participate in expected social indulgences. All the while, they would be subject to a duty due to their continuing ability to conceive, even if they choose not to conceive during their lifetime.

This logic faults the individual while focusing entirely on the well-being of a non-existent child. The non-existent child should not hold any rights superior to the individual. Imposing a duty would subordinate the individual's rights to the unconceived child and directly implicate the individual's autonomy over decisions involving reproduction. In essence, imposing a duty may overstep into the private realm of one's life and thus undermine one's right to control one's own life.

Concerns over the individual's privacy and autonomy are more pronounced in preconception negligence. The timeframe between the alleged negligence and the subsequent injury to the child could span months, years, or even decades. During this time, the law remains unclear whether an individual owes a legal duty to their unconceived child and what standard of conduct is required of them.[274] Imposing a duty for preconception conduct would severely limit one's personal right to control one's own life.

These concerns were recognized in *Stallman* and *Chenault* in the prenatal context. The *Stallman* court refused to impose a duty in part because doing so would subject women to state scrutiny in virtually all decisions that women must make in bringing a pregnancy to term. Further, it would put a mother and her newborn at odds with each other by allowing the child to have "rights hostile to and assertable against [the parent]."[275] This creates an adversarial relationship between the parent and child. It also ignores the unique parent-child relationship not found in any other plaintiff-defendant relationship. Logic "does not demand that a pregnant woman be treated in a court of law as a stranger to her developing fetus."[276] Finally, the *Stallman* court refused to impose a duty because scrutinizing individuals' day-to-day lives would be an "unprecedented intrusion" into their privacy and bodily autonomy.[277]

The *Chenault* court similarly regarded both concerns as more important than the child's right to be well-born. According to the court, the imposition of a duty would require pinpointing when a duty arises. The only precedent the court cited was *Renslow*, which held a hospital liable for negligence that occurred eight years before the plaintiff conceived her child.[278] Applying the same rationale would require every parent to "maintain [their] body in the best possible reproductive condition so long as it was reasonably foreseeable [they]

274. *See supra* note 210 and accompanying text.
275. Stallman v. Youngquist, 531 N.E.2d 355, 360 (Ill. 1988).
276. *Id.*
277. *Id.* at 361.
278. *See supra* notes 130–145 and accompanying text.

might bear a child at some point in the future."[279] This could affect almost every aspect of the individual's life for years prior to conception, including their diet, physical and sexual activity, and choice of work.[280] Texas law did not recognize any duty that had such "far reaching ramifications."[281] Thus, among other reasons, the court refused to impose a duty on the parent.

Chenault appears jarring because the court seemingly held that the parent could treat their body with impunity during pregnancy.[282] Although the court conceded the mother's behavior would "likely, if not unquestionably, be found unreasonable under any standard of care,"[283] it refused to recognize a legal duty to her fetus. Broader implications of holding a parent liable were greater than simply "holding drug-abusing mothers civilly liable to their later born children."[284]

The negative implication of *Chenault* is that a parent can treat their body with impunity for many years before pregnancy and still avoid tort liability.[285] However, a view like this seems extreme because in reality, many do not in fact abuse their body to the same extent as the parent did in *Chenault*. The positive implication is that courts are cognizant of the privacy and autonomy of individuals, and favor protecting these rights when balancing them with the right of the child to be well-born.

While an extreme case like *Chenault* is uncommon, the level and period of exposure to substances are certainly factors examined in epigenetic studies. Preconception and, more commonly, prenatal studies examine these two factors.[286] For instance, in the rat study described above, researchers studied how a pregnant rat's chronic exposure to alcohol resulted in offspring developing a tendency for alcohol.[287] Another study on the agouti gene found similarities in rats to the physical phenotypes associated with fetal alcohol syndrome in humans, namely changes in the progeny's postnatal body weight

279. Chenault v. Huie, 989 S.W.2d 474, 477 (Tex. Ct. App. 1999).

280. *Id.*; *see also* Dawn E. Johnsen, *The Creation of Fetal Rights: Conflicts with Women's Constitutional Rights to Liberty, Privacy, and Equal Protection*, 95 YALE L.J. 599, 619 (1986) (listing areas of an individual's life that would need to be monitored by the state to enforce fetal rights or regulate behavior during pregnancy).

281. *Chenault*, 919 S.W.2d at 477.

282. *Chenault* concerned the mother's substance abuse during pregnancy that caused the child's birth defects. *Id.* at 475.

283. *Id.* at 478.

284. *Id.*

285. *See supra* notes 274–277 and accompanying text. This is based on the reasoning that substance abuse likely preceded the pregnancy and does not begin only during pregnancy.

286. Numerous studies were conducted on the impact of prenatal exposure or behavior on the offspring. Recently, more studies have examined the paternal effects of preconception conduct, such as alcohol consumption. Few maternal studies were conducted on the same issue, because preconception effects in women are "invariably influenced by alcoholic behavior that persists into pregnancy and by malnutrition and socioeconomic status." *See, e.g.*, Ramsay, *supra* note 248; *see also, e.g.*, Haycock, *supra* note 248, at 613; Viljoen et al., *supra* note 248, at 7; K. Michael Hambidge, et al., *Preconception Maternal Nutrition: A Multi-Site Randomized Controlled Trial*, 14 BMC PREGNANCY & CHILDBIRTH 1, 2 (2014).

287. Nizhnikov et al., *supra* note 5.

and skull size and shape.[288] These studies provide a useful and relevant model for the effects of alcohol intake in humans and help us better understand the consequences of alcohol consumption at a molecular level. They may also have relevance in negligence law as research produces knowledge informing the public of the ill effects of alcohol at any critical life stage.

In a state that favors the child's right to be well-born, courts may be inclined to impose a duty of care. In *Chenault*, the child was born with defects proximately caused by her mother's drug use during, and possibly before, pregnancy.[289] Epigenetics differs in its potential to prove the causation element. Courts may be less amenable to privacy and autonomy arguments. When an individual engages in voluntary, habitual, and extreme exposure to harmful substances, which creates a risk of harm toward their offspring, and which is causally proven by epigenetics, it becomes difficult to avoid any liability. Even the *Chenault* court conceded that the mother's behavior would certainly be unreasonable under any standard of care, but refused to impose a duty due to its broader implications on women's privacy and autonomy.[290] Thus, it is arguable that a duty should be imposed. However, predicting whether juries will be sensitive to the contextual differences when determining whether the parent had breached their standard of care remains complicated.[291]

Furthermore, physical intrusion into the private realm of one's life becomes clearer in epigenetic cases. According to Wiener's proposal to hold parents liable under the epigenetic theory, doing so could mean—at an extreme—submitting the parent to prolonged clinical studies[292] or state monitoring initiatives to document every act and omission in their daily lives that could be tied to the harm suffered by the child.[293] Self-reporting could also be used to backtrack to the parent's past, but fears of civil liability could deter honest reporting or incentivize misreporting. Imposing preconception liability may even deter individuals from conceiving for fear of civil (and possibly criminal) liability from voluntary actions that they did not know carried legal repercussions. In

288. Nina Kaminen-Ahola, Arttu Ahola, Murat Maga, Kylie-Ann Mallitt, Paul Fahey, Timothy C. Cox, Emma Whitelaw & Suyinn Chong, *Maternal Ethanol Consumption Alters the Epigenotype and the Phenotype of Offspring in a Mouse Model*, 6 PLOS GENETICS 1, 5–6 (2010).

289. *Chenault*, 989 S.W.2d at 475.

290. *Id.* at 476.

291. Contextual differences refer to different "socio-economic backgrounds; the well-educated and the ignorant; the rich and the poor; those women [and men] who have access to good health care . . . and those who, for an infinite number of reasons, have not had access to any health care services." Stallman v. Youngquist, 531 N.E.2d 355, 360 (Ill. 1988). While traditional tort principles apply only a uniform reasonable person standard, policy dictates that contextual differences should be taken into consideration. How to control for these differences, including jurors' subjective beliefs, to produce consistency and predictability have been debated. *See id.*; *Chenault*, 989 S.W.2d at 477–78.

292. Clinical research could be observational studies that "monitor people in normal settings" or clinical trials that "test a medical, surgical, or behavioral intervention in people." *See What Are Clinical Trials and Studies?*, NAT'L INST. ON AGING (Mar. 22, 2023), https://www.nia.nih.gov/health/what-are-clinical-trials-and-studies.

293. *Stallman*, 531 N.E.2d at 360.

essence, the individual would be required to subordinate their right to control their life for the greater good, meaning the good health of successive generations.[294] In doing so, the individuals would be obligated to forsake their privacy and autonomy rights to judicial scrutiny. This extremity, however, may not occur, because the court is required only to decide on liability based on available evidence.[295]

Every day, individuals engage in voluntary yet inherently risky behaviors like driving, biking, or rollerblading. Every act or omission holds a risk, whether high or low, of harming themselves, another, or their potential offspring. Tort law requires the individual to exercise care to avoid unreasonable risks that harm another person. Any time we engage in an activity that creates a risk of harm, we are subject to potential liability if we injure another person.

But frequently, these incidents are straightforward and almost immediate, and injuries are not latent. Damages are also easier to quantify. Epigenetic harms pose a novel dimension to what is normally perceived as harmful behavior, and these harms can be latent by manifesting only in later life.[296] Further, epigenetic harms can be complex due to their interplay with potentially varied causes, such as other genes and cells in the body.[297]

We tend to equate smoking, drinking, and substance abuse during pregnancy with harmful conduct that can injure another party, usually one's offspring. However, the same perception does not apply to poor nutrition, lack of exercise, or stressful lifestyles. Requiring compliance with some type of standard of care because a duty is imposed will surely result in some prescriptions of what nutrition a man or woman should incorporate into their daily lives, or what jobs they can or cannot do for the sake of their future children. Imposing a duty to avoid these conducts may restrict a person's control over their own life.

Risks are part of everyday life. Certain behaviors should be recognized as natural and acceptable risks and should not result in subjecting individuals to legal liability. As argued in Part III, conduct relating to lifestyle and diet are better suited for public health interventions. It would seem unreasonable to mandate healthful conduct for the welfare of one's future children under the penalty of civil liability.

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294. In civil cases, such as negligence suits brought by a child against their parents, the burden of proof is on the plaintiff child to show that their parent's preconception conduct failed to conform with some judicially created standard of conduct reflective of accepted notions of appropriate behavior. *See,* e.g., *Stallman*, 531 N.E.2d at 360; *Chenault*, 989 S.W.2d. at 477–78.

295. *See, e.g.*, *Stallman*, 531 N.E.2d at 360. For instance, in automobile accidents, courts hold drivers liable for unreasonable conduct while driving. They are not compelled to monitor. Liability is imposed based on available evidence.

296. *See, e.g.*, Robert Barouki, Peter D. Gluckman, Philippe Grandjean, Mark Hanson & Jerrold J. Heindel, *Developmental Origins of Non-Communicable Disease: Implications for Research and Public Health*, 11 ENV'T HEALTH 1, 7 (2012).

297. Greally, *supra* note 91.

4. When Should a Duty Arise?

Whether to impose a legal duty also raises the questions of *when* a duty should commence and what standard of conduct courts should create. This Article will only address the first issue because it argues that a duty does not exist between an individual and their future child. Therefore, this Article does not consider the standard of conduct, which is a question more closely related to breach of a duty of care.[298]

When is it appropriate for an individual's legal duty to avoid epigenetic harms toward their unconceived children to begin? If a duty to avoid epigenetic harms were imposed, courts would need to pinpoint when it arises. Pinpointing when a duty should arise is fraught with difficulties. This is especially true for preconception cases, and even more so for cases dealing with epigenetic harms that may be traced back to actions taken long ago, possibly even across generations.

Legal scholar Beal has argued that a duty, if any, is better imposed at the point when the individual has knowledge of conception.[299] The same reasoning

298. While breach is not considered at length in this Article, the standard of conduct inquiry may still be fraught with difficulties. That is if the court engages in a breach analysis; courts will generally not usurp the role of the factfinder in defining the standard of care unless reasonable minds will not differ on the issue at bar. The *Stallman* court conceded the difficulty of determining what objective standard to guide a jury in finding whether the mother did all that was necessary in order not to breach a legal duty to not interfere with her fetus' separate and independent right to be wellborn. In addition to the objective standard, it would be difficult to ascertain whether the jury is sensitive to factors such as differential socioeconomic statuses, religion, education, lifestyle, diet, personal beliefs, environmental exposure and more when determining whether an individual breached its standard of conduct (the "same or similar circumstances"). Further, what if a duty is imposed on a child of tender age to care for their epigenetic health and their future children's? Should the above factors be considered under the child standard of an ordinary person standard? A child is subject to the child standard (unless he or she engages in adult conduct) which inquires whether a child of similar age, intelligence and experience would engage in the same conduct. But would this be appropriate? Or should the inquiry fall on the parent who has direct control over the child's life? In such a case, it could mean a grandchild suing their grandparent for instilling in their parent choices that injured them and their ability to live a life free of epigenetic harms. In essence, it may involve questions over how far liability should extend.

Moreover, jury decisions involve inherently subjective values that cannot be easily controlled for, such as personal views or beliefs based on social norms or even prejudicial or stereotypical beliefs. The result can be inconsistent and unpredictable jury verdicts, and the consequences can be far-reaching. For example, an already indigent person may be subject to further civil liability which does no justice to him or her than a wealthy person who may afford the penalties of their conduct. In environmental epigenetics, an individual's environment is likely different from the next individual, and thus the influences that impact expression of certain genes will also likely be different. The outcome for each individual will not be the same. Therefore, inconsistencies in jury verdicts can be more harmful to the individual's potential perpetual liability than the unconceived child's injuries. *See Stallman*, 531 N.E.2d at 360.

As a solution, courts and legal scholars have argued creation of a standard of conduct that is fair and encompassing to differential circumstances may be within the expertise and resources of the legislature. Having a standard governed by statute may create certainty and predictability and may even reflect the aforesaid differences among individuals. However, like judicial decisions, statutory language can be expanded or limited through judicial reasoning to produce inconsistency and unpredictability. *See id.* at 361; Chenault v. Huie, 989 S.W.2d 474, 478 (Tex. Ct. App. 1999); Carroll, *supra* note 112; Stoll, *supra* note 112, at 151.

299. Beal, *supra* note 112, at 362–70.

holds true, and with more strength, in the preconception context.[300] Returning to our hypothetical's third group, a duty may arise when individuals plan to conceive a child. This can mean that from the time they plan to conceive until the time the child is born, they must restrict their conduct to avoid harm. In other words, they are not free to use their bodies as they please.[301] This ties to concerns over privacy and personal autonomy, and more broadly to one's liberty. The earlier discussion concluded that courts will be required to balance between one's liberty and an unconceived child's right to be wellborn.[302] At the very least, a duty should not be imposed on individuals prior to conception.

If a duty is imposed at the point of conception, as public policy favors,[303] doing so would still be beset with challenges. In practice, how does one ascertain when exactly a child is conceived and, thus, when to impose a legal duty?

Case law and legal scholarship have detailed this difficulty. For instance, the *Chenault* court wrote that many women may be unaware of their pregnancy for weeks or even months after conception.[304] Legal scholar Ron Beal identified three reasons preventing timely awareness of conception: (1) the difficulty of diagnosing with certainty whether a woman is, in fact, pregnant during the early stages of pregnancy, (2) various emotional and economic factors that commonly prevent a woman from seeing a physician to determine if she is pregnant, and (3) the difficulty of ascertaining whether the standard of conduct is different for women in different situations, such as women intending to become pregnant versus women merely capable of becoming pregnant.[305] For these reasons, courts and scholars have expressed skepticism about the practicality of imposing a duty at the point of conception.[306]

Instead, Beal argued that courts may have to "accept the time of actual knowledge of pregnancy to be the point when they impose a legal duty of care."[307] This stems from a fairness perspective that highlights the reluctance to impinge on an individual's autonomy long before they actually conceive a child.

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300. Without defining the limits of duty, individuals would live in "constant fear that any accident or 'error' in judgment could be deemed 'unacceptable'" and become the basis for a civil suit, or even criminal prosecution. *See* Johnsen, *supra* note 280, at 607.

301. The issue becomes more complex when we consider scenarios such as individuals actively trying to conceive, but are unsuccessful for weeks, months, or even years. *See* Beal, *supra* note 112, at 366.

302. *See supra* notes 274–297 and accompanying text.

303. *See* Peter B. Babin, *Preconception Negligence: Reconciling an Emerging Tort*, 67 GEO. L.J. 1239, 1247 (1979); A.A. White, *The Right of Recovery for Prenatal Injuries*, 12 LA. L. REV. 383, 395–96 (1952); Beal, *supra* note 112, at 362.

304. Chenault v. Huie, 989 S.W.2d 474, 477 (Tex. Ct. App. 1999).

305. Beal, *supra* note 112, at 367–68.

306. *See, e.g.*, *Chenault*, 989 S.W.2d at 477; Beal, *supra* note 112, at 365–68.

307. Beal, *supra* note 112, at 368. The court in *Chenault* argued this solution still faces difficulty because (1) knowledge of one's pregnancy depends on varying factors such as health, general physical condition, and emotional state, (2) in many cases, a woman may be unaware of her pregnancy until long after the damage has been done to her fetus, and (3) a woman's initial awareness of her pregnancy may depend on whether the pregnancy was intentional or unintentional. In any event, the difficulty in pinpointing duty obligates the woman to "regulate her lifestyle, for potentially long periods of time, based on the possibility that she *might* be pregnant."

An example of how courts might invade an individual's autonomy by imposing a duty long before conception is the mechanical application of *Renslow* toward parental liability in preconception negligence cases.[308] As stated earlier, *Renslow* imposed a legal duty on the hospital and its director of laboratories for negligently giving the plaintiff a blood transfusion with blood that was incompatible with her own.[309] Their negligence resulted in the plaintiff's child, born almost a decade later, having birth defects.[310] By imposing a duty almost a decade prior to the child's conception, the court sent a message that tortfeasors can owe a legal duty to a non-existent person and can be held liable many years later.[311]

From an ordinary tort law standpoint, this is a reasonable solution. The negligence of the third party caused the injuries suffered by the plaintiff or their children. For instance, employers are held liable for children born with birth defects attributed to their parents' exposure to toxic chemicals during their employment.[312] Similarly, in products liability (and sometimes negligence) cases, manufacturers are liable to children born with birth defects because their mothers ingested their drug during pregnancy.[313] Courts have allowed these second-generation plaintiffs to sue for damages on the market-share theory but stopped short at the third generation.[314]

However, the opposing argument, as reflected in Justice Ryan's dissent in *Renslow*, is that the concepts of duty and foreseeability should not be extended and distorted "beyond the bounds of reason."[315] There, he expressed dissatisfaction with the majority's overly sympathetic opinion that favored the plaintiff at the expense of the general public.[316] The magnitude of the holding was that hospitals could remain liable for years, and possibly decades, because a duty was imposed as early as age thirteen.

Justice Ryan argued the majority's sympathy for the injured plaintiffs and enabling them to sue so far into the past has rendered the burden on the public

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Although it is not perfect, imposing a duty after knowledge of conception offers a fairer solution that avoids compromising the individual's privacy and autonomy during the preconception timeframe. *Chenault*, 989 S.W.2d at 477.

308. Some assumptions need to be made if *Renslow* is to apply to parental liability for preconception negligence. First, third-party liability cases apply equally to parental liability cases. Second, negligence can be traced back as early as adolescence. Third, liability can be perpetual by extending for decades until the individual's first child is conceived. *See* Renslow v. Mennonite Hosp., 367 N.E.2d 1250, 1250–56 (Ill. 1977).

309. *Id.* at 1251–52.

310. *Id.* at 1251.

311. *Id.* at 1255–56.

312. Ledeaux by Ledeaux v. Motorola Inc., 101 N.E.3d 116, 121–31 (Ill. App. Ct. 2018).

313. *See supra* note 151; E.R. Squibb & Sons, Inc. v. Lloyd's & Cos., 241 F.3d 154, 168 (2d Cir. 2001).

314. Diethylstilbestrol cases are an example of how courts enabled children born with birth defects to sue for damages caused by the manufacturers' drug. *See E.R. Squibb & Sons, Inc.*, 241 F.3d at 168–69; *see also infra* text accompanying note 391.

315. *Renslow*, 367 N.E.2d at 1266 (Ryan, J., dissenting).

316. Generally, litigation results where there is insurance involved. In *Renslow*, the majority's opinion, which advocates spreading costs to the public based on the doctrine of "spread the risk," has the effect of increasing overall medical insurance premiums by passing on the added costs to consumers. *Id.* at 1263.

unbearable.[317] Specifically, he underlined the majority's advancement of the "spread-the-risk" doctrine that depends on the "deep pockets" of the public.[318] This approach distributes compensation to victims over a broad base, resulting in higher insurance premiums or "as cost of doing business."[319] The underlying rationale was that "every injured person is entitled to compensation, and that the loss should fall upon the defendant, who is better able to distribute the cost."[320] Ultimately, this distribution is borne by the public. Unfortunately, the "ever expanding and enlarging [of] the area of potential recovery" has led to an increasing burden that may no longer be bearable.[321] For instance, automobile insurance rates have reached "absurd heights," premiums for health insurance are consistently rising, and the "overbearing cost of medical malpractice insurance, with its attendant social ills, has become a matter of common knowledge."[322] Instead, Justice Ryan suggested legislative action to provide for no-fault compensation for actual loss.[323] His dissent focused on the social consequences of the majority's opinion that extended and distorted the concepts of duty and foreseeability.[324]

Further, mechanically applying a third-party liability case to parental liability ignores the intricacies of the parent-child relationship.[325] It may even restrict individuals' liberty long before they have even decided to conceive a child. Moreover, third-party liability cases tend to involve one-time conduct that causes injuries to the child. Cases concerning parental liability, especially potential cases brought under epigenetics, involve a course of conduct that manifests in latent injuries in the child; many factors can be intervening variables that bring about the harm.[326] Absent conclusive science that can definitively point toward those factors, it is difficult to assign liability without ignoring the significance of its social implications.

Returning to the first two groups in our earlier junk food hypothetical, if the holding of *Renslow* is mechanically applied to individual liability cases, then it means that the adolescent or young adult could be liable to their future children at as early as age thirteen (the plaintiff's age in *Renslow* when she was negligently given an incompatible blood transfusion). Liability commencing at this age is perturbing because it could span decades until the individual conceives a child. If an individual owed a legal duty at thirteen years old and gave birth at the age of forty, then nearly thirty years would have elapsed during which time they could be liable for innumerable acts or omissions that caused

317. *Id.*
318. *Id.* at 1265.
319. *Id.*
320. *Id.* at 1263.
321. *Id.* at 1266.
322. *Id.* at 1265.
323. *Id.* at 1266.
324. *Id.*
325. *See supra* note 126 and accompanying text.
326. Khan, *supra* note 37, at 280–81.

harm to their child. It is even more complicated if the child sues at the age of majority or later, which means the individual is liable for nearly half a century. It also means that the child, who was non-existent when their parents were thirteen, held rights superior to their parents' that may dictate the quality of life they must lead for their benefit. A decision enabling children to sue decades into the past would further ignore conduct that is largely attributable to socioeconomic and other constraints beyond their parents' control. Imposing a duty at such an early age broadly implicates the individual's constitutional liberty and could send the message that the current generation's welfare is less valuable than their children's.[327]

It could also create dissonance for the child and future generations' welfare. Courts that impose a legal duty on the child's parent, whether at thirteen years old or whenever they engage in sexual activity, will have to apply that same duty and accompanying standard of conduct to that child when they reach the same age. In their bid to protect the child's welfare prior to conception, courts will effectively undermine those very protections as soon as the child reaches the age at which their parents were imposed a legal duty. Socioeconomic and other limiting factors may go unattended, depending on whether the jury is sensitive to them, and this cycle continues without actually remedying the root causes of problematic behavior.

Analogizing Justice Ryan's dissent to individual liability, we would witness something similar, namely an excessive burden on an individual's privacy and personal autonomy, if courts allowed the child to sue far into their parent's past. In prenatal cases, courts have consistently been asked to decide whether the balance of parental rights and the fetus's right to be well-born should be tilted in either party's favor.[328] The issue that must be addressed in preconception negligence is whether the unconceived child's right to be well-born is more important, such that it can severely limit the parent's right to control their own life. In recent times, it seems the child's right has slowly encroached on the parent's.[329]

While few courts have allowed parental prenatal negligence claims, should liability be expanded to include preconception conduct? Some legal scholars

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327. Another scenario is whether to impose a duty on individuals who engage in sexual activity. This means a duty could be imposed by age 16. An attorney could argue that by virtue of the sexual intercourse itself, or even unprotected intercourse, the individual knew or should have known that a child could be conceived. Thus, it is enough to impose a duty. But this would again run counter to the privacy and autonomy concerns that courts and scholars have vigorously defended. It could also instill uncertainty or fear in doing virtually anything because of potential liability years into the future. *See* Chenault v. Huie, 989 S.W.2d 474, 477 (Tex. Ct. App. 1999); Stallman v. Youngquist, 531 N.E.2d 355, 359 (Ill. 1988); Johnsen, *supra* note 280, at 606–07; Judith Kahn, *Of Woman's First Disobedience: Forsaking a Duty of Care to Her Fetus—Is This a Mother's Crime?*, 53 BROOK. L. REV. 807, 831 (1987); Beal, *supra* note 112, at 366.

328. *See supra* notes 159–205 and accompanying text.

329. *See supra* text accompanying notes 201–202. For instance, most courts have abrogated the parental immunity doctrine because the underlying rationale to protect family harmony is no longer sound in contemporary society. This enabled courts to permit children a cause of action against their parents for prenatal negligence.

have argued affirmatively because the injured child should not go without compensation or that their rights should be fully protected.[330] Others have expressed caution and reluctance, considering the individual's privacy, autonomy, and familial perspectives.[331] For instance, legal scholar Vik Stoll argued that children should not be prevented from seeking recovery for injuries attributed to preconception negligence, but their natural parents must be excluded, by statute, from the class of defendants.[332] His rationale was based on protecting the family harmony.[333] Without drawing a line in the sand, the expansion of tort law to hold individuals liable as far as age thirteen has far-reaching consequences.

These consequences may be realized in jurisdictions that allow recovery for prenatal injuries caused by preconception negligence, as was the case in *Renslow*. There is greater tension between an individual's bodily autonomy and a child's right to be well-born. If states allowed the child to seek compensation for their parent's preconception negligence, it would require the parent to make "decisions at a time when she [or he] most likely has not even considered whether or not to have a child."[334] The consequence is subjecting the parent to a "standard of conduct for [their] entire lifetime prior to the conception of [their] child which could result in legal liability."[335]

The above illustrates the injustice resulting from the imposition of a duty so far into the past. As William Prosser wrote, "liability must stop somewhere short of the freakish and the fantastic."[336] With the added potential of transgenerational liability under epigenetics, individual liability could stretch across generations,[337] and individuals could be subject to stale claims. If a duty were imposed at as early as age thirteen, or as soon as individuals are sexually active, it could open the doors to claims that are both freakish and fantastic. Individuals with a continuing ability to conceive could effectively be subject to stringent standards of conduct not otherwise required of others. These lend further support to the idea that a duty is better and more fairly imposed after knowledge of conception.

The next Subpart discusses broader implications of finding a duty between an individual and their future children, namely implications on blame culture, race and reproduction, perpetual liability, epigenetic discrimination, and the policy question of who bears the loss.

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330. *E.g.*, Wiener, *supra* note 17; Carroll, *supra* note 112, at 314–315 and accompanying text.

331. Beal, *supra* note 112, at 362–70; Stoll, *supra* note 112, at 152 (arguing that while the child should be permitted to recover, their natural parents must be excluded through statutory limitations in order to strike a balance between the rights of the infant injured from preconception negligence and the public interest in minimizing stale claims and ensuring liability is not expanded too far); Kahn, *supra* note 327.

332. Stoll, *supra* note 112.

333. *Id.* at 152.

334. Beal, *supra* note 112, at 368.

335. *Id.*

336. Prosser, *supra* note 185, at 27.

337. *See supra* notes 35–37 and accompanying text.

5. Broader Implications of Legal Duty

Policies may justify against imposition of parental liability for preconception negligence. In this Part, I explain how imposing liability mirrors the so-called "blame culture" in society, where parents are subject to blame for their children's ill health while root causes of poor conduct, such as societal constraints, are disregarded. I also explain how the imposition of parental liability for preconception negligence risks reviving past concerns over race and reproduction. Additionally, due to the multigenerational nature of epigenetic harms, there is a possibility for perpetual liability to successive generations. Further, the risks of epigenetic discrimination and misuse of epigenetic information are concerning. Finally, I address the public policy consideration of who should bear the loss.

a. Blame Culture

In Part I, I described how epigenetics research has been couched in terms of parental responsibility. These studies were used by the popular press to promulgate premature health risk messaging and maternal blame. Recognition of a legal duty for preconception negligence could further entrench the existing blame culture against parents.

Parental, especially maternal, blame has historically stemmed from inconclusive and misperceptions of science,[338] including society's expectations of parental duties. In society's bid to protect the health of fetuses, it has stigmatized and even criminalized drinking during pregnancy despite existing science demonstrating that moderate drinking posed no adverse effects in children.[339] Women were called "refrigerator mothers" and blamed for their children's autism.[340] Similarly, societal fear over "crack babies" has led to prosecution against mothers deemed as crack addicts, resulting in imprisonment, having their children taken away, and losing social benefits.[341]

The consequence of these inconclusive and misperceptions of science was a culture of blame entrenched in society that blamed mothers for the ill health of their children.[342] This focus deflected attention from root causes of behavior such as differential socioeconomic statuses. Further, it stigmatized certain behaviors and portrayed them as the cause of their children's poor outcomes. As law professor Dorothy Roberts wrote within the criminal prosecution context, which also holds true in the context of civil punishment: "prosecuting crack-addicted mothers shifts public attention from poverty, racism, and a deficient

338. Richardson et al., *supra* note 22.

339. *Id.* at 131.

340. *Id.* at 132.

341. *See* Dorothy E. Roberts, *Punishing Drug Addicts Who Have Babies: Women of Color, Equality, and the Right of Privacy*, 104 HARV. L. REV. 1419, 1421–22 (1991); Richardson et al., *supra* note 22, at 132.

342. Richardson et al., *supra* note 22.

health care system, *implying instead that poor infant health results from the depraved behavior of individual mothers*."[343]

In epigenetics, the narrative has somehow transformed from a promising science into one of finger-pointing. As sociology professor Martyn Pickersgill wrote succinctly: "epigenetic ideas seem increasingly folded into constructions of women as responsible for fetuses not yet even conceived. When epigenetics collides with maternal health, the purported novelty of epigenetics often supports processes of responsibilization and individualization."[344]

Parental blame is evident in headlines and claims made by the popular press and, in some instances, is implied in scholarship. Popular press articles have exaggerated the implications of epigenetic studies and, through epigenetic risk messaging, have transformed the studies into prescriptions and proscriptions of what parents should and should not do.[345] They promulgate blame on mothers by using sensational headlines, misquoting researchers' words, making generalizations, or misunderstanding the research.[346] These include conflation of a tendency for alcohol with alcoholism as a disease, promulgating that smoking cannabis years before conception renders the child more likely to smoke and use cannabis as a teenager, or that girls born to stressed mothers are more likely to give birth prematurely.[347] Most of these claims extrapolate animal studies to humans without acknowledging the inconclusiveness of the research.[348] Additionally, they often fail to recognize that animal studies are conducted in strictly controlled environments, which are not representative of the diverse environments encountered by humans. The consequences are far-reaching and may further entrench blame into an already existing and ingrained blame culture in society.

Socio-legal scholar Ilke Turkmendag argued, within the context of maternal epigenetic responsibility, that epigenetics research focusing on the mother effectively treats the woman's body "as a vessel in which future generations can be shaped."[349] Turkmendag noted that current epigenetics research fails to account for deeper social and economic problems.[350] It creates blame against mothers by merely "*illustrat[ing]* rather than *interrogat[ing]* existing stereotypes about maternal agency and responsibility."[351] In other

343. DOROTHY E. ROBERTS, KILLING THE BLACK BODY: RACE, REPRODUCTION AND THE MEANING OF LIBERTY 179 (Vintage Books 2d ed. 2017) (emphasis added).

344. Martyn Pickersgill, *Negotiating Novelty: Constructing the Novel Within Scientific Accounts of Epigenetics*, 55 SOCIO. 600, 602 (2021).

345. *See supra* notes 1–3 and accompanying text.

346. *See supra* notes 1–3 and accompanying text.

347. *See supra* note 1–3.

348. *See supra* notes 1–3 and accompanying text.

349. Ilke Turkmendag & Ying-Qi Liaw, *Maternal Epigenetic Responsibility: What Can We Learn From the Pandemic?*, 25 MED., HEALTH CARE & PHIL. 483, 485 (2022).

350. *Id.*

351. *Id.* (quoting Martha Kenney & Ruth Müller, *Of Rats and Women: Narratives of Motherhood in Environmental Epigenetics*, 12 BIOSOCIETIES 23, 23 (2017)).

words, although research into epigenetic mechanisms might shed light on fetal development, the focus on maternal bodies and stereotypes of women's agency and responsibility risk detracting attention from social, economic and familial structures that constrain an individual's choices.[352] These factors, most of which are beyond one's control, can "significantly affect one's nutrition, lifestyle, physical and mental health issues,"[353] all of which may risk epigenetic harms to the offspring or future generations.

For instance, the COVID-19 pandemic has illuminated that certain factors such as housing, exposure to toxins, food insecurity, and stressors (including domestic violence) are beyond an indigent person's control.[354] Even in the absence of the pandemic, these burdens already exist. They feed into the stress experienced by women. Thus, it is not helpful to suggest a woman to live a less stressful life (recommending the opposite of what a research study finds) because the suggestion fails to capture the sources of stress and anxiety that are broadly attributed to societal, political, and environmental factors. Without isolating and addressing these root causes, it is not helpful to simply blame parents in general.

In essence, while epigenetic studies examine maternal impact on their offspring's health, the scholarly and popular press interpretations are that it is really about the well-being of the child and future generations, rather than the mother (or father). Turkmendag calls this "maternal epigenetic responsibility," which is the "responsibility for women at reproductive age to control, protect and nourish their reproductive health to create the best micro-environment for their potential offspring and the next generations."[355]

Blame also plays a role in controlling behavior, especially where it is derived from authoritative guidance. In June 2021, the World Health Organization published the first draft of its action plan (2022–2023) to "reduce the harmful use of alcohol as a public health priority and considerably reduce morbidity and mortality . . . as well as associated social consequences, and with that to improve the health and well-being of populations globally."[356] The controversy of the draft lies in its inclusion of "women of childbearing age" in its language. The report states that

> Appropriate attention should be given to prevention of the initiation of drinking among children and adolescents, prevention of drinking among

352. *Id.* at 488–92.

353. *Id.* at 487.

354. *Id.* at 488–92; *see also* Rebekah L. Rollston & Sandro Galea, *The Coronavirus Does Discriminate: How Social Conditions are Shaping the COVID-19 Pandemic,* HARV. MED. SCH. CTR. FOR PRIMARY CARE: PERSPS. IN PRIMARY CARE (May 5, 2020), https://info.primarycare.hms.harvard.edu/review/social-conditions-shape-covid.

355. *See* Turkmendag & Liaw, *supra* note 349, at 486.

356. WORLD HEALTH ORG., *GLOBAL ALCOHOL ACTION PLAN 2022-2030 TO STRENGTHEN IMPLEMENTATION OF THE GLOBAL STRATEGY TO REDUCE THE HARMFUL USE OF ALCOHOL: FIRST DRAFT* 11 (2021), https://cdn.who.int/media/docs/default-source/alcohol/action-plan-on-alcohol_first-draft-final_formatted.pdf?sfvrsn=b690edb0_1&download=true.

> pregnant women and *women of childbearing age*, and protection of people from pressures to drink, especially in societies with high levels of alcohol consumption where heavy drinkers are encouraged to drink even more.[357]

This language meant that "women of reproductive age, which is between 15 and 49 years as defined by the WHO, regardless of their reproductive plans, should [abstain from] drinking alcohol."[358] The repercussion of such language not only risks the earlier mentioned blame against mothers but also risks reviving past stigmatization of alcohol consumption during pregnancy and criminalization of this "unacceptable" behavior.

One caveat, however, is that literature has sought to push back against the focus on the mother and to spotlight paternal effects because they play important roles in shaping the epigenome of their offspring.[359] But merely arguing for an attention shift toward paternal effects will not resolve the societal, political, and environmental constraints. It will still result in scrutiny over similar stereotypes such as paternal agency and responsibility, including what a male should and should not do during his lifetime. The misguided belief that parents are in full control of their progeny's lives and health outcomes avoids acknowledging these root causes of conduct. In turn, this risks provoking "ethical concerns related to the dangers of medicalizing personal behavior, of making individuals responsible for what are larger social failures, and of insinuating public health concerns into familial reproductive decision making."[360]

Finally, while the literature and popular press do not explicitly target marginalized populations, the consequences of blame allocation or epigenetic risk messaging directly impact these groups. The socioeconomic constraints increase the likelihood of these groups falling into categories associated with poor behavior.[361] Unfortunately, apart from ascribing blame to these populations, not enough attention is spent on studying their varying socioeconomic statuses. Epigenetics researchers acknowledge the need for studies to consider socioeconomic status as a possible confounding variable.[362] Other scholars have also recognized that epigenetics reinforces socioeconomic disparities among racial and ethnic minorities, including women,[363] and that attention should shift away from blame toward those differences. By centering on individual responsibility and liability, it deflects concern from inequality and discrimination by scapegoating the very victims of those injustices.

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357. *Id.* at 17 (emphasis added).

358. Turkmendag & Liaw, *supra* note 349, at 484.

359. *See supra* notes 22–23 and accompanying text.

360. Juengst et al., *supra* note 12, at 428.

361. They include factors such as income, education, occupation, residence, and others.

362. *See* Wiener, *supra* note 17, at 335–36 and accompanying text; *see also* Viviana J. Mancilla, Noah C. Peeri, Talisa Silzer, Riyaz Basha, Martha Felini, Harlan P. Jones, Nicole Phillips, Meng-Hua Tao, Srikantha Thyagarajan & Jamboor K. Vishwanatha, *Understanding the Interplay Between Health Disparities and Epigenomics*, FRONTIERS GENETICS, Aug. 2020, at 1, 9.

363. *See supra* note 21 and accompanying text.

Concerns over epigenetics-related blame led political science professor Maria Hedlund to argue that societal expectations and perceptions of parental duties are tied to a backward-looking responsibility model.[364] Present notions of causal responsibility are backward-looking in that they seek an identifiable actor to ascribe responsibility for their actions.[365] Hedlund acknowledged the difficulty of establishing complex causal relations because "social, economic, political, and other material and ideational structural conditions would also affect epigenetic processes, directly by contributing to physical and mental stress and wellbeing, [and] indirectly by constraining and enabling individual choices."[366] By focusing on this responsibility model, nothing is done to improve the bad situation.[367] Society is left with ascribing "arduous responsibility" on individuals for the health outcomes of their descendants.[368] She contended that a forward-looking model is appropriate because it considers these structural constraints and places responsibility on those with "power and capacity" in "decision-making and mitigating harm."[369]

In sum, treating parental conduct as the main cause of their progeny's ill health fails to consider the intermediate conduct that is attributable to a root cause in the causal chain. This root cause refers to the abovementioned unequal constraints that contribute to the conduct.[370] Although one might argue that the mother is the nearest actor to prevent harm to her offspring, her actions may be caused by systemic failings beyond her control. It is essential to seek a better solution when navigating the challenge of imposing parental liability for preconception epigenetic torts.

b. Race and Reproduction

Historically, women, particularly those who were poor and people of color, were punished for their behavior during pregnancy, namely for prenatal crimes.[371] For instance, Roberts wrote that Black mothers were separated from their children upon birth and jailed when traces of drugs were found in the

364. Maria Hedlund, *Epigenetic Responsibility*, 3 MED. STUD. 171, 172 (2012).

365. *Id.* at 175–76.

366. *Id.* at 179.

367. *Id.* at 177. Various other scholars have drawn attention to this tendency in the maternal blame context. *See* Richardson et al., *supra* note 22, at 131; Kenney & Müller, *supra* note 13, at 25. Additionally, focusing on the "bad situation" often impinges on disadvantaged groups constrained by unequal social and economic structures. *See* Hedlund, *supra* note 364, at 179; Ilina Singh, *Human Development, Nature and Nurture: Working Beyond the Divide*, 3 BIOSOCIETIES 308, 308–19 (2012).

368. Hedlund, *supra* note 364, at 171.

369. *Id.* at 171, 178.

370. I argue the causal connection begins broadly with society, followed by parental conduct, and ends with the children's health.

371. Roberts, *supra* note 341, at 1427, 1480. Black mothers have historically been devalued because of a racial hierarchy that demeaned Black motherhood. Devaluation of Black motherhood was effectuated in three aspects: "control of Black women's reproductive lives during slavery, the abusive sterilization of Black women and other women of color during this century, and the disproportionate removal of Black children from their families." *Id.* at 1427.

child's umbilical cord.[372] The separation of mother and child prevented the child from having the family and also failed to address the underlying issue of the mother's drug addiction.[373]

Past practices that undermined women's reproductive autonomy and bodily integrity through sterilization laws and eugenics practices were also concerns.[374] Eugenic practices in the past offer lessons about the abuse of sterilization laws that forced the sterilization of poor, drug-addicted women.[375] In actuality, eugenic sterilization laws were a "brutal imposition of society's restrictive norms of motherhood."[376] Sterilization laws punished people who departed from social norms by determining those who are "burdens on society"[377] as unworthy of procreation.

Yet, the undermining of women's reproductive autonomy and bodily integrity was not limited to women of color. In *Buck v. Bell*, where Justice Holmes famously declared "three generations of imbeciles are enough,"[378] Carrie Buck—a White woman—was not sterilized by salpingectomy because she was feeble-minded or mentally disabled, but because she was perceived to be deviating from society's social and sexual norms.[379]

These examples emphasize the dangers of excessive state and judicial control over the woman's reproductive autonomy and their bodies. Scholars argued such control hid behind the name of science—then under genetics and heredity—to mask "racist and classist judgments about who deserves to bear children."[380] Allowing state and judicial interference into an individual's private life are a cause for concern. Under epigenetics, they may revive similar dangers

372. ROBERTS, *supra* note 343, at 159–201.

373. Roberts, *supra* note 341, at 1421 n.8 ("[T]he range of state intrusions on pregnant women's autonomy includes[:] jailing pregnant women; placing the child in protective custody; allowing tort suits by children against their mothers for negligent conduct during pregnancy; ordering forced medical treatment performed on pregnant women; depriving mothers of child custody based on acts during pregnancy; upholding employer policies excluding fertile women from the workplace; and placing greater restrictions on access to abortion." (citations omitted)).

374. ROBERTS, *supra* note 343, at 23, 105 (describing how women were objectified for sexual gratification or for the commercial gains of their progeny and explaining that eugenic practices included forced sterilization or contraceptives such as Norplant for women who received governmental welfare); Alexandra Stern, *Forced Sterilization Policies in the US Targeted Minorities and Those with Disabilities—and Lasted into the 21st Century*, THE CONVERSATION (Aug. 26, 2020, 8:20 AM EDT), https://theconversation.com/forced-sterilization-policies-in-the-us-targeted-minorities-and-those-with-disabilities-and-lasted-into-the-21st-century-143144.

375. Roberts, *supra* note 341, at 1471–76; *see also* ROBERTS, *supra* note 343, at 56–104.

376. Roberts, *supra* note 341, at 1474.

377. *Id*. at 1473 (burdens include intellectual disabilities, mental illness, epileptics, and criminals).

378. Buck v. Bell, 274 U.S. 200, 207 (1927).

379. Roberts, *supra* note 341, at 1474 n.274 (citing Stephen Jay Gould, *Carrie Buck's Daughter*, 2 CONST. COMMENT. 331, 336 (1985)).

380. *Id.* at 1474; *see also* Katz, *supra* note 21, at 7; Maurizio Meloni, *Epigenetics for the Social Sciences: Justice, Embodiment, and Inheritance in the Postgenomic Age*, 34 NEW GENETICS & SOC'Y 125, 142–43 (2015). Professor Meloni wrote, "[W]hen the broader political conditions deteriorate, even good scientific ideas such as Mendelian inheritance can easily be turned into ammunitions for race or class discrimination." *Id.* at 142. Here, he raised potential similar concerns with epigenetics, even if epigenetic therapy to reverse epigenetic marks can be an answer against fears of a "new biological racism or classism under epigenetic guises." *Id.* at 143.

reminiscent of eugenics practices through genetics. While this view is extreme, it is not altogether implausible.

Epigenetics scholars recognized the potential for epigenetics to be misused to open the doors to "epi-eugenics."[381] As genetics professor Eric Juengst wrote, "premature epigenetic risk messaging . . . has the potential to open doors to 'epi-eugenics' through increased social pressure on prospective parents to undergo preconception and prenatal testing for epigenetic alterations."[382] Professor Mark Rothstein cautioned under the theory of epigenetic inheritance:

> The prospect of adverse health conditions persisting through several generations is likely to increase the social pressure on prospective parents to prevent the transmission of epigenetic effects. Thus, once epigenetic testing and pregnancy avoidance or termination become an option for prospective parents, epigenetic harms could become highly stigmatized and the moral responsibility could shift from those entities responsible for the environmental exposures to the parents who failed to respond "appropriately" to the risk by preventing or terminating the pregnancy.[383]

These concerns are conspicuous if courts imposed a legal duty on individuals long before they have even decided to conceive a child, and if such duty extended perpetually or until its birth.

c. Unlimited Liability

Even if an individual owes a legal duty to their immediate children,[384] it cannot be argued that they owe the same duty to their grandchildren or descendants. This is a question of fair judgment and the result must be practical. Here, it is impractical and would surely shock any reasonable person's conscience to be held perpetually liable for one's own negligence toward future generations. Damages would need to be substantially limited and quantified.

Courts have tended to preclude individuals not directly exposed to harmful agents from succeeding in their claims for damages on the fear that liability may be extended beyond manageable bounds. For instance, the *Enright* court based its refusal on policy considerations to allow third-generation diethylstilbestrol (DES) plaintiffs to seek compensation: there was no justification to recognize a multigenerational cause of action, and liability must be subject to "manageable limits" whereby only those who ingested or were exposed to the drug directly or in-utero have a valid claim.[385]

Scholarship concerning perpetual liability is voluminous.[386] In the DES cases, legal scholars have made compelling arguments for and against

381. Juengst et al., *supra* note 12, at 428.

382. *Id.*

383. Rothstein et al., *supra* note 35, at 60.

384. *See* Beal, *supra* note 112, at 362–70; Carroll, *supra* note 112.

385. Enright v. Eli Lilly & Co., 570 N.E.2d 198, 202, 203–204 (N.Y. 1991).

386. *See, e.g.*, Carroll, *supra* note 112, at 313–14; Greenberg, *supra* note 146, at 344–45; John B. Maynard, Note*, Third-Generation-DES Claims*, 27 NEW ENG. L. REV. 241, 283 (1992).

liability.[387] Law professor Julie Greenberg asserted the unlimited liability argument is unsound because no such case has been brought before the courts.[388] Courts should not deny recovery in "all or most preconception actions because of a fear that has not been realized and may never occur."[389] If such a case arises, then limitations may be adopted.[390] Additionally, John Maynard contended that once policy considerations such as opening the floodgates are stripped, it makes no sense to prohibit third-generation victims from seeking compensation for DES injuries.[391]

But epigenetics adds a new dimension to this problem. Epigenetic harms could indeed be self-perpetuating if proven under the transgenerational inheritance theory. Epigenetic markers can be acquired through various exposures, such as diet, lifestyle, and environment, that affect the expression of specific genes, whether for better or for worse.[392] These markers are durable and can pass onto the offspring, causing them to either continue to exhibit beneficial or harmful epigenetic changes.[393] Although epigenetics remains far from proving cause and effect in humans,[394] and the multifactorial genesis of disease has yet to be accounted for,[395] it is possible for perpetual liability to become a genuine concern.

Existing epidemiological studies on humans have suggested evidence of epigenetic mechanisms and epigenetic inheritance, but the causal link is inconclusive, especially for transgenerational inheritance.[396] Experiences of grandparents were shown to influence the wellbeing of their grandchildren. For instance, the Dutch Famine study found that offspring of prenatally undernourished fathers, but not mothers, were heavier and more obese than

387. Lawrence S. Maitin, Case Brief, Grover v. Eli Lilly & Co.*: Should Preconception Tort Liability Be Recognized in Ohio?*, 2 J. PHARMACY & L. 121, 125–26 (1993) (arguing that unlimited liability is no basis for denying a cause of action); John G. Taylor, *Defendant Liability to Plaintiffs Neither Conceived Nor Born at the Time of Initial Exposure to a Toxic Substance or Drug*, 4 PRODS. LIAB. L.J. 224, 231–32 (1993) (arguing that the concern over unlimited liability is unfounded); *see e.g.*, Margaret M. Hershiser, Case Note*, Preconception Tort Liability—The Duty to Third Generations:* Enright v. Eli Lilly & Co., 24 CREIGHTON L. REV. 1479, 1513 (1991) (arguing that the granddaughter should be permitted to recover because she was no less a victim of DES than her mother or grandmother).

388. Greenberg, *supra* note 146, at 344–45.

389. *Id.* at 345.

390. *Id.*

391. Maynard, *supra* note 386, at 285.

392. *See supra* notes 44–48 and accompanying text. The twin study serves as a great example illustrating how twins can have different epigenomic profiles from diverging diets, lifestyle, and environment. *See also supra* notes 50–51 and accompanying text (explaining how certain epigenetic marks can produce a positive or negative effect on the individual's health outcome).

393. *See supra* notes 35–36 and accompanying text.

394. Professor Khan explained that human studies "showing cause and effect for diseases through epigenetic mechanisms are much more difficult to design and ethically perform." Khan, *supra* note 37, at 274; *see also* Turkmendag & Liaw, *supra* note 349, at 486 ("[M]any scientific findings in epigenetics are too preliminary to provide a solid evidence base for recommendations to change daily living.").

395. Khan, *supra* note 37, at 280–81.

396. *See supra* note 36 and accompanying text.

offspring of fathers and mothers who were not prenatally undernourished.[397] Consequently, they may suffer increased rates of chronic disease in later life.[398] Other studies have shown parental diet influences the health of their children. For example, a study examining maternal intake of fish found that increased intake was correlated with their children having higher cognitive test scores.[399] Another study found that higher maternal intake of calcium resulted in lower offspring blood pressure.[400]

When, and if, these problems are brought under a preconception tort claim, courts will be faced with the intricate question of whether and how liability should be limited. Without drawing arbitrary boundaries on liability, one unfortunate generation could become more susceptible to claims from later generations. This would raise questions of fairness and justice. For instance, the now-parent may be born with existing epigenetic injuries attributed to their own parents, and which are transmitted to their own children. They could not choose their own epigenome, nor control the epigenetic health of their children. As law Professor Eric Rakowski asked, "Would they be required to sue their parents to obtain the cash to pay their own children?"[401] An extremist consequence may be one where individuals are deterred from bearing children due to fears of perpetual liability to future generations.

An epigenetic claim against a grandparent or ancestor could result in difficulty proving causation because the causal chain can be "very attenuated and indirect."[402] Because of the multifactorial genesis of a disease, the large timeframe between the grandparental exposure that affected the grandchild, and the many intervening variables that make the causal chain attenuated, it would be difficult "for a trier of fact to attribute more than fifty percent blame to any given agent."[403] And reliance on inconclusive or faulty evidence on transgenerational inheritance that somehow passes the *Daubert* admissibility standard could result in injustice. In this situation, "some parents might face the prospect of greater liabilities than other parents through no fault of their own."[404]

Further, if a legal duty were imposed upon a generation of individuals as soon as they reached sexual maturity, or age thirteen under *Renslow*,[405] then it is possible for this generation to be subject to a multitude of stale claims years

397. M. Veenendaal, R. Painter, S. de Rooij, P. Bossuyt, J. van der Post, P. Gluckman, M. Hanson & T. Roseboom, *Transgenerational Effects of Prenatal Exposure to the 1944–45 Dutch Famine*, 120 BJOG 548, 550–52 (2013).

398. *Id.*

399. Elizabeth Pennisi, *A Low Number Wins the GeneSweep Pool*, 300 SCI. 1484, 1484 (2003).

400. Matthew W. Gillman, Sheryl L. Rifas-Shiman, Ken P. Kleinman, Janet W. Rich-Edwards & Steven E. Lipshultz, *Maternal Calcium Intake and Offspring Blood Pressure*, 110 CIRCULATION 1990, 1993–95 (2004).

401. Eric Rakowski, *Who Should Pay for Bad Genes?*, 90 CALIF. L. REV. 1345, 1366 (2002).

402. Khan, *supra* note 37, at 280.

403. *Id.*

404. Rakowski, *supra* note 401.

405. Renslow v. Mennonite Hosp., 367 N.E.2d 1250, 1250–56 (Ill. 1977).

into the future brought by their descendants. The broader implications are an inability to control one's own life, a fear of liability for virtually every voluntary conduct, and potentially a growing trend to avoid having children at all.

When imposing perpetual liability, another concern is situations where it is not possible to hold a parent, grandparent, or ancestor liable or financially responsible. For instance, a parent may have passed right after the child was born or before the child could bring a claim. Or they may have no financial means to satisfy damages awarded to the child.[406] Thus, it is important to predefine the legal duty of individuals or prospective parents to care for the epigenetic health of their future children, including their own.

d. Epigenetic Discrimination

As epigenetics research progresses, epigenetic information may be used in ways that risk epigenetic discrimination in access to goods and services, specifically through the potential misuse of epigenetic information for insurance or employment purposes. Epigenetic tests can "soon provide additional layers of predictive information, complementary to genetic information, about an individual's disease risk profile or response to specific treatments. They could also provide information about someone's past exposures to physico-chemical (*e.g.*, toxic pollutants, cosmetics) and psychosocial (*e.g.*, familial stress, social adversity) disruptors of epigenetic mechanisms."[407] What if this predictive information is used by employers when deciding whether to employ the individual or by insurance companies when deciding the individual's eligibility for coverage or whether to charge the individual a higher premium? An individual already subject to a legal duty may thus be unable to advance in society and care for their own and their future children's epigenetic health, perpetuating the potential root causes of illness. This form of epigenetic discrimination may disproportionately burden individuals belonging to already

406. In situations like this, creating a compulsory insurance plan could be one solution. Law Professor Eric Rakowski suggested that, in a *just state*, parents are responsible in the first instance for remedying their children's genetic disadvantages. Parents would be required to pay a "fixed sum per child into an insurance pool that would be used to compensate any children that were born genetically disadvantaged." Rakowski, *supra* note 401, at 1398. This avoids rendering the defect child as a public charge unless the parents defaulted on this obligation. A similar insurance scheme for epigenetic disadvantages could be mandated to compensate children and later generations born with defects arising from epigenetic harms. *Id.* at 1366.

However, given the complexity of ascertaining cause and effect, it may be challenging to quantify the "fixed sum" that a parent is responsible to contribute into the insurance pool. Furthermore, environmental epigenetics is broad and almost any action or omission can produce some form of harmful epigenetic change transmissible to the next generation and manifested in some physical or mental anomaly. Which epigenetic harm or condition should be covered under this insurance plan? And for how long? As Professor Khan recognized, an epigenetic mark that affects early childhood physical or mental development cannot be reversed if the developmental changes have already occurred. This change is permanent. Would the parent be responsible for the lifetime of the child? *See* Khan, *supra* note 37, at 263.

407. Charles Dupras, Lingqiao Song, Katie M. Saulnier & Yann Joly, *Epigenetic Discrimination: Emerging Applications of Epigenetics Pointing to the Limitations of Policies Against Genetic Discrimination*, FRONTIERS GENETICS, June 2018, at 1, 1.

vulnerable groups. In effect, they may be prevented from escaping their unfortunate situations at all.

While the Genetic Information Non-discrimination Act (GINA) was enacted to provide protection to individuals against denial of health insurance or employment based on genetic predisposition to disease, there is not yet statutory protection for the misuse of epigenetic information.[408] Professor Rothstein suggested amending GINA to include epigenetics within its governing language because "it is difficult to discern any unique principles [in ethics and law] differing from those applicable to genetics" to justify creating epigenetic-specific laws (epigenetic exceptionalism) and that existing genetic-specific laws are broad enough to include epigenetics.[409] This may be an effective solution for epigenetic discrimination.

e. Who Should Bear the Loss?

Lastly, liability for epigenetic harms raises the policy question of who should bear the loss. There are at least three parties to whom the costs of relieving epigenetic disadvantages might be assessed: the injured children, their parents, and the community. In simpler negligence cases where the parent has evidently injured the child through his or her negligent conduct, it is easy to apportion liability to make the parent bear the costs of the child's injury. In situations where the parent could not have reasonably foreseen the victim or harm thereof, it would be unjust to make him bear the costs. Similarly, it would be unjust to make the child bear the costs, especially where she had no control over her well-being or birth without defects. "In these cases there is no justice to be had."[410]

According to Rakowski, parents would, in a just state, be responsible and liable.[411] But epigenetics conspicuously highlights how differential social, political, environmental, and financial statuses are factors for less-than-acceptable behavior, which are linked to epigenetic harms to the offspring. It may be unfair to hold parents financially responsible if the epigenetic harms to their offspring were beyond their control. For instance, these harms may be a result of differential statuses, or the parents themselves may have been born with these epigenetic conditions which were then transmitted to their children.

It may be arguable that epigenetic harms to offspring are a public charge until the point where public health and other interventions have sufficiently ameliorated structural constraints for poor behavior. At this point, liability and responsibility shift back to the individual, which begins after knowledge of conception. Before then, it may be unfair and unjust to impose civil penalties on

408. Rothstein, *supra* note 21, at 735.
409. *Id.*
410. Prosser, *supra* note 185, at 17.
411. Rakowski, *supra* note 401, at 1398.

individuals to care for their epigenetic health for the benefit of their offspring and future generations.

f. Summary

The above arguments provide a broader outlook on the implications of imposing a duty on individuals or prospective parents to avoid epigenetic harms. Without predefining legal duty, individuals can be responsible and liable for conduct that may be beyond their control, such as those already facing structural constraints or those born with epigenetic harms attributed to their own parents' conduct. Imposing a duty will likely impinge upon individual rights to privacy and personal autonomy and raise concern over blame culture, revival of race and reproduction practices, and epigenetic discrimination. In sum, suing one's parents for their past conduct is counterproductive and does not solve the root causes of behavior attributed to structural constraints. As Rakowski wrote, allowing future children to sue their parents for compensation is unlikely to achieve justice for all:

> Criminal or civil penalties directed at parents are likely to achieve little deterrence and thus only increase the misery their children experience by depleting parental resources. Potential parents already have powerful incentives not to give birth to children with lives not worth living. . . . [P]otential parents who do not respond to existing incentives generally fail to do so because of ignorance, poverty, or both. Adding liability laws to the books is unlikely to attract their attention any more than fines scare judgment-proof defendants.[412]

III. PUBLIC HEALTH INTERVENTIONS

Part III delves into several public health initiatives and suggests that these interventions may better address the socioeconomical constraints conspicuously highlighted by epigenetics research. Instead of seeking redress through civil liability, it may be better to look into collective responsibility approaches to put disadvantaged individuals on an equal footing with everyone else. To achieve this end, epigenetic knowledge can be utilized in ways that incentivize existing public health measures or incentivize innovative measures that tackle the earlier-mentioned factors that restrict individual choice.

Environmental epigenetics is valuable to public health because it provides new insights into disease causes, including dietary, lifestyle, and environmental factors. Environmental epigenetics:

> [P]roposes new ways of thinking about the temporal dynamics of health and disease across the life course of an individual and even across generations. . . . [And] raises questions for public health in terms of how to better address unjust living conditions that might limit an individual's ability to improve their health and that of their children.[413]

412. *Id.* at 1408.

413. Müller et al., *supra* note 15, at 1678.

Emerging epigenetic knowledge can assist public health efforts through education and interventions.

This Part seeks to tie environmental epigenetics to the public health problem of non-communicable diseases (NCDs) such as obesity, diabetes, heart disease, and cancer. As discussed in the earlier Parts, these conditions may be a byproduct of factors examined in epigenetic studies, such as physical inactivity,[414] alcohol,[415] and tobacco.[416] This Part also highlights effective public health measures for mitigating NCDs and argues that new epigenetic knowledge can supplement interventions and education to improve overall health outcomes.

It will further argue that public health interventions need to be sensitive to life stages. Early interventions may benefit the populace more than delayed interventions. Costs accumulate as individuals suffering from epigenetic harms face higher risks of disease, depleting their personal resources and becoming public charges. Furthermore, while epigenetic modifications can be reversed through epigenetic drug therapy, such interventions must be sensitive to when the changes occur during one's life cycle.[417]

Finally, this Part ends with a summary of public health challenges as applied to epigenetic-based interventions. While these challenges may deter or delay policymakers from urgently addressing the identified public health concerns, it is argued that early interventions may reduce the overall economic burden of the public. Further, new epigenetic knowledge that provides robust evidence of the links between environmental exposures and disease outcomes can help facilitate greater public acceptance of these measures.

A. NON-COMMUNICABLE DISEASES AND SOCIOECONOMIC STATUS

NCDs are now a leading cause of disability and premature death.[418] Individuals of lower socioeconomic statuses are more prone to unhealthy life choices such as smoking or consuming sugary drinks.[419] In turn, these choices

414. Elisa Grazioli, Ivan Dimauro, Neri Mercatelli, Guan Wang, Yannis Pitsiladis, Luigi Di Luigi & Daniela Caporossi, *Physical Activity in the Prevention of Human Diseases: Role of Epigenetic Modifications*, 18 BMC GENOMICS 111, 112–113 (2017).

415. C. Liu et al., *A DNA Methylation Biomarker of Alcohol Consumption*, 23 MOLECULAR PSYCHIATRY 422, 432 (2018).

416. Roby Joehanes et al., *Epigenetic Signatures of Cigarette Smoking*, 9 CIRCULATION 436, 447 (2016).

417. Khan, *supra* note 37, at 263.

418. Lawrence O. Gostin, *Non-Communicable Diseases: Healthy Living Needs Global Governance*, 511 NATURE 147, 147 (2014).

419. Rachel E. Morse, Note, *Resisting the Path of Least Resistance: Why the Texas "Pole Tax" and the New Class of Modern Sin Taxes are Bad Policy*, 29 B.C. THIRD WORLD L.J. 189, 195 (2009); *see* Hui Luan, Leia M. Minaker & Jane Law, *Do Marginalized Neighborhoods Have Less Healthy Retail Food Environments? An Analysis Using Bayesian Spatial Latent Factor and Hurdle Models*, INT'L J. HEALTH GEOGRAPHICS, Aug. 22, 2016, at 1, 9–13 (finding that "materially deprived neighborhoods" have fewer healthy food options within walkable distances); Nicole I. Larson, Mary T. Story & Melissa C. Nelson, *Neighborhood Environments: Disparities in Access to Healthy Foods in the U.S.*, 36 AM. J. PREVENTATIVE MED. 74, 77–79 (2009) (noting that unhealthy food options, such as fast food restaurants, are concentrated in lower-income and minority neighborhoods).

are tied to poorer health outcomes such as NCDs. The burdens of NCDs also disproportionately affect people of color and persons with disabilities.[420]

Studies in the U.S. have consistently found that residents of low-income, minority, and rural neighborhoods tended to lack access to supermarkets and healthful food.[421] These neighborhoods tended to have greater access to fast-food restaurants and energy-dense foods.[422] A similar study conducted in Canada found that materially deprived neighborhoods have a less healthy food retail environment.[423] Accessibility and affordability problems may explain the higher likelihood of diet-related chronic diseases, such as obesity that plague not only society but also the individual themselves.[424] They also underline the lack of nutrition education as a potential cause.

B. MEASURES TO PROMOTE AND FOSTER HEALTHFUL BEHAVIOR

As mentioned, studies have found marginalized neighborhoods have limited access to healthy foods and greater access to junk foods.[425] These may explain why poorer and vulnerable individuals have greater susceptibility to NCDs.[426] To this extent, increased prevalence of obesity and comorbidities are now major public health concerns.[427] Paired with emerging epigenetic knowledge linking certain factors to disease risk, public health interventions may be improved to resolve these problems. Potential solutions include measures to promote accessibility and affordability of healthy foods, taxes on unhealthy foods to subsidize healthy food programs, and health education.

Hui Luan et al. suggested strategic interventions to enable equitable access to healthy foods.[428] Strategies range from "providing fruits and vegetables in less healthy food outlets through intervention programs such as healthy corner

420. LAWRENCE O. GOSTIN & LINDSAY F. WILEY, PUBLIC HEALTH LAW: POWER, DUTY, RESTRAINT 437–439 (3d ed. 2016).

421. Larson et al., *supra* note 419, at 76.

422. *See id.* at 77.

423. Luan et al., *supra* note 419.

424. Sarah A. Roache, Charles Platkin, Lawrence O. Gostin & Cara Kaplan, *Big Food and Soda Versus Public Health: Industry Litigation Against Local Government Regulations to Promote Healthy Diets*, 45 FORDHAM URB. L.J. 1051, 1055–56 (2018). The authors identified treatment of chronic-related diseases as comprising of two costs: direct and indirect costs. "Direct costs result from medical treatment, both inpatient and outpatient, including surgeries, drug therapy, and laboratory and radiological testes." *Id.* at 1055. Indirect costs include "absenteeism, lack of productivity at work, increased insurance premiums, and lower wages." *Id.* at 1055–56. The former can be regarded as collective social costs and the latter as individual costs.

425. *See, e.g.*, Luan et al., *supra* note 419; Mayuree Rao, Ashkan Afshin, Gitanjali Singh & Dariush Mozaffarian, *Do Healthier Foods and Diet Patterns Cost More Than Less Healthy Options? A Systematic Review and Meta-Analysis*, 3 BMJ OPEN 1, 15 (2013) ("[D]ecades of policies focused on producing inexpensive, high-volume commodities have led to a complex network of farming, storage, transportation, processing, manufacturing and marketing capabilities that favor sales of highly processed food products for maximal industry profit.").

426. John M. Balbus et al., *Early-Life Prevention of Non-Communicable Diseases*, 381 LANCET 3, 3 (2013).

427. Daphne P. Guh, Wei Zhang, Nick Bansback, Zubin Amarsi, C. Laird Birmingham & Aslam H. Anis, *The Incidence of Co-Morbidities Related to Obesity and Overweight: A Systematic Review and Meta-Analysis*, 9 BMC PUB. HEALTH 88, 102 (2009).

428. Luan et al., *supra* note 419, at 11.

stores," to reducing the walkable distance to these food outlets, and the restriction of construction of less healthy food outlets around materially deprived neighborhoods.[429] These strategies have either been implemented by local governments or suggested in legal scholarship.[430]

Local governments provide successful case studies of solutions to promote accessibility and affordability of better diets.[431] For instance, epigenetics researcher Dana Dolinoy discovered maternal nutritional supplementation counteracts the deleterious effects of BPA, which is ubiquitously present in the human population, and suggested the potential for translating this discovery into reducing disease susceptibility through public health nutrition interventions.[432] Past initiatives to "promote access to nutritionally adequate diets include a Minneapolis ordinance requiring grocery stores to stock staple foods and increasing the available number of vending permits to sell fresh fruit and vegetables from food carts in underserved areas of New York City."[433] Local jurisdictions, such as Boston and Baltimore, have also incentivized the use of Supplemental Nutrition Assistance Program benefits at farmer's markets to increase consumption of fresh fruits and vegetables.[434] Accessibility can be further enhanced via public health and policy efforts "to create an infrastructure and commercial framework that facilitates production, transportation and marketing of healthier foods." [435] These initiatives can increase accessibility to nutritionally adequate diets and reduce the prices of healthful products.

Another solution is to use public health-based taxes to effectuate an environment where consumers decrease consumption of the targeted products and potentially substitute for more affordable yet healthful products.[436] These taxes utilize the fundamental economic principle that as price increases, demand generally declines. The city of Berkeley is one example, where excise taxes on sugary drinks were introduced to tackle the risks of NCDs.[437] In the first year,

429. *Id.*

430. *See, e.g.*, Roache et al., *supra* note 424, at 1059–61.

431. Under the "home rule" which delegates state power to local governments, innovative and progressive reforms have been adopted that have failed at the state and federal levels. *Id.*

432. Dolinoy et al., *supra* note 59, at 13060.

433. Roache et al., *supra* note 424, at 1059.

434. *Id.* (For instance, the authors note that the Boston Supplemental Nutrition Assistance Program provides eligible shoppers with a dollar-for-dollar match when they buy fresh fruits and vegetables).

435. Rao et al., *supra* note 425 (explaining that the solution of public health and policy efforts to promote healthier foods was made because "many decades of policies focused on producing inexpensive, high-volume commodities have led to a complex network of farming, storage, transportation, processing, manufacturing and marketing capabilities that favor sales of highly processed food products for maximal industry profit").

436. The benefits of excise taxes are not limited to the United States. *See* Adam D.M. Briggs, Oliver T. Mytton, Ariane Kehlbacher, Richard Tiffin, Mike Rayner & Peter Scarborough, *Overall and Income Specific Effect on Prevalence of Overweight and Obesity of 20% Sugar Sweetened Drink Tax in UK: Econometric and Comparative Risk Assessment Modelling Study*, 347 BMJ 1, 5–7 (2013) (finding that taxes on sugar-sweetened beverages impact younger populations more strongly and a 20% tax on sugar-sweetened beverages is predicted to reduce prevalence of obesity in the U.K. by 1.3%).

437. Jennifer Falbe, Hannah R. Thompson, Christina M. Becker, Nadia Rojas, Charles E. McCulloch &

consumption of sugar-sweetened beverages decreased by 21 percent compared to an increase by 4 percent in comparable cities.[438] Water consumption as a substitute increased by 63 percent in Berkeley compared to a 19 percent increase in comparable cities.[439]

Tax programs have several benefits, including discouraging consumption, raising revenue to offset high healthcare costs, implementing prevention programs, implementing subsidy programs for healthier substitutes, improving nutritional education, and encouraging manufacturers to reduce the harmful content in their products.[440] For instance, steep taxes on cigarettes have been a successful measure to reduce smoking, especially among younger people who are more sensitive to prices than adults.[441] Similar initiatives may be implemented to tax food products linked to epigenetic changes that increase risks of NCDs.

Healthful eating is, contrary to conventional wisdom, not expensive. A systematic review and meta-analysis study conducted by Mayuree Rao et al. found that healthier foods and dietary patterns cost an additional $1.50 per day.[442] This finding is far-reaching and can mitigate concerns of exorbitant costs associated with healthy diets and promote conscious awareness of healthful lifestyles. Yet, the study suggested the additional cost, while negligible for many, may be an impediment to healthier eating for socioeconomically disadvantaged populations.[443] These populations are at greatest risk of poor health outcomes and disease risk because of inequitable access to healthy foods and lower socioeconomic statuses. The added expense may be resolved with some of the earlier-mentioned interventions, such as diverting tax revenue from unhealthy foods to healthy foods, subsidizing the production of healthy foods, or structural measures enabling greater accessibility.

Finally, health education in schools may prove useful in improving health knowledge, attitudes, behaviors, and skills. New knowledge derived from environmental epigenetics studies may supplement educators or school-employed health professionals in educating generations on obesity, physical activity, nutrition, tobacco, alcohol and drug use, mental health, violence, bullying, and more.

These are potential public health-based measures that can be improved with epigenetic knowledge. Epigenetics is not presented as a new science because it supplements genetics with an additional layer of information for phenotypes

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Kristine A. Madsen, *Impact of the Berkeley Excise Tax on Sugar-Sweetened Beverage Consumption*, 106 AM. J. PUB. HEALTH 1865, 1865 (2016).

438. *Id.*

439. *Id.* at 1867.

440. GOSTIN & WILEY, *supra* note 420, at 271–97.

441. Frank B. Hu, *Resolved: There is Sufficient Scientific Evidence that Decreasing Sugar-Sweetened Beverage Consumption Will Reduce the Prevalence of Obesity and Obesity-Related Diseases*, 14 OBESITY REVS. 606, 611 (2013).

442. Rao et al., *supra* note 425 (using data from MEDLINE between 2000 and 2011).

443. *Id.*

previously unexplained by genetics alone. This layer of information helps paint a clearer picture of human biology by explaining how and why individuals affected with epigenetic changes in certain genes are more or less likely to develop particular health conditions in later life. Epigenetic knowledge can be utilized to shape and improve existing and novel interventions to ameliorate the very problems of inequalities that epigenetics research highlights.

C. EPIGENETIC THERAPY

Epigenetic therapy, in the form of drugs that treat diseases with epigenetic origins or reverse epigenetic changes on genes causing certain diseases, can be a useful public health intervention.[444] As epigenetics reveal distinctive patterns of changes in DNA methylation and other epigenetic changes, they "may be useful as biomarkers of exposure and disease and as targets for modification through preventive and therapeutic interventions."[445] Epigenetic epidemiology studies can identify at risk populations and implement measures to reverse or preempt the development of certain diseases.[446]

For epigenetic therapy to be successful as a public health intervention, more research is needed to produce efficiency against diseases. Currently, epigenetic drugs face challenges in clinical use, such as the translation of small dosages to well-tolerated and efficient concentrations used in clinical studies and ensuring the specificity of epigenetic drugs to target particular genes without generating unwanted epigenetic modifications (*i.e.*, prevent side effects from occurring).[447] Therapeutic interventions for diseases such as obesity depend on ascertaining the effects of changes to obesity risk variables, such as "food, physical activity, sleeping patterns, alcohol consumption, and other environmental factors."[448] Risk variables may also be transgenerational in nature, meaning that parental and ancestral exposures may "modify the germline epigenome and induce a transgenerational phenotype in future generations in the absence of continued exposure."[449] Once these variables can be controlled for, "an individual's obesity risk at an early stage [may be anticipated], opening the door to implementing customized obesity prevention treatments."[450]

Furthermore, as professor Fazal Khan explained, not all epigenetic modifications and their effects can be reversed. Reversibility depends greatly on

444. Tiffon, *supra* note 228, at 12.

445. Rozek et al., *supra* note 92, at 106.

446. *Id*. at 107–08.

447. Yuanjun Lu, Yau-Tuen Chan, Hor-Yue Tan, Sha Li, Ning Wang & Yibin Feng, *Epigenetic Regulation in Human Cancer: The Potential Role of Epi-Drug in Cancer Therapy*, MOLECULAR CANCER, Apr. 2020, at 1, 11.

448. Abeer M. Mahmoud, *An Overview of Epigenetics in Obesity: The Role of Lifestyle and Therapeutic Interventions*, INT'L J. MOLECULAR SCIS., Jan. 2022, at 1, 13.

449. Stephanie E. King & Michael K. Skinner, *Epigenetic Transgenerational Inheritance of Obesity Susceptibility*, 31 TRENDS ENDOCRINOLOGY & METABOLISM 478, 486 (2020).

450. Mahmoud, *supra* note 448.

"when they occur during an individual's life-cycle."[451] An epigenetic mark that "affects early childhood physical or mental development" cannot be undone if that mark is reversed later in adult life because the developmental changes have already occurred.[452] But if an epigenetic mark increases the risk of late-onset disease, "reversing that mark in early adulthood could dramatically alter that individual's disease risk."[453]

However, delayed interventions may result in an overall increase in public economic burden. For instance, epigenetic studies have linked child abuse to the development of mental and physical health diseases.[454] In 2015 alone, it is estimated that "$8 billion [USD] was distributed to U.S. state and territory child welfare agencies to be used for child welfare services and foster care."[455] This does not include treatment costs for mental and physical diseases consequential to the child's maltreatment. Another example is the debilitating costs of NCD treatments as described below. By acting early, unbearable public economic burden may be avoided.

D. PUBLIC HEALTH CHALLENGES

The earlier Parts identified some advantages and challenges of implementing epigenetic knowledge in public health, namely in the preconception torts context. However, other challenges include: the costs of implementing public health measures, industry pushback, litigation, First Amendment protections over commercial speech, and taxation to fund public health-based programs.

Cost is one major factor. Based on a 2018 article, the cost of diabetes treatment in the U.S. in 2013 alone was around $93.3 billion.[456] The cost of cardiovascular disease treatment was around $212.6 billion.[457] The total cost of all NCDs treatment in 2013 was around $1.353 trillion.[458] A more recent article reported the aggregate medical cost for obesity in 2016 was around $260.6 billion.[459] These health problems are not new, nor are their mounting costs, impact on personal finances, and burden on national economic growth.[460]

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451. Khan, *supra* note 37, at 263 n.5.

452. *Id.*

453. *Id.*

454. *See supra* notes 254–262 and accompanying text.

455. Todd I. Herrenkohl, Rebecca T. Leeb & Daryl Higgins, *The Public Health Model of Child Maltreatment Prevention*, 17 TRAUMA, VIOLENCE & ABUSE 363, 363 (2016).

456. Simiao Chen, Michael Kuhn, Klaus Prettner & David E. Bloom, *The Macroeconomic Burden of Noncommunicable Diseases in the United States: Estimates and Projections*, 13 PLOS ONE, Nov. 2018, at 1, 6.

457. *Id.*

458. *Id.*

459. John Cawley, Adam Biener, Chad Meyerhoefer, Yuchen Ding, Tracy Zvenyach, B. Gabriel Smolarz & Abhilasha Ramasamy, *Direct Medical Costs of Obesity in the United States and the Most Populous States*, 27 J. MANAGED CARE & SPECIALTY PHARMACY 354, 354 (2021).

460. *Noncommunicable Diseases,* WORLD HEALTH ORG. (Sept. 16, 2023), https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases; *Economics of NCDs*, PAN AM. HEALTH ORG., https://www.paho.org/en/topics/economics-ncds (last visited Feb. 23, 2025).

Epigenetics does not change these. If epigenetics research has advanced enough to prove a causal link between an environmental factor and disease outcome, it will provide conclusive evidence and support for modifying existing public health interventions toward ameliorating disease causes. But it will not change the need to address these long-standing conditions that continue to be a societal challenge.

The additional costs of mitigating NCDs may deter or delay policymakers or lawmakers from diverting resources to proven interventions. However, rather than letting problems worsen and costs grow, it may be better to address those problems directly with effective and efficient interventions. Both the direct economic burden of obesity on health systems, households, and society and the indirect economic burden "through significant productivity losses via premature mortality, early labor force exits, absenteeism, and work at lowered capacity"[461] suggests that "effective interventions to prevent and reduce obesity may be more cost-effective."[462] Delaying the resolution of major public health problems may increase the burden on the public as individuals who have depleted personal resources become a public charge.

Other public health challenges include difficulties implementing interventions due to industry pushback, litigation, and First Amendment protections on commercial speech.[463] These barriers occur when public health interventions come into tension with the industry's "potential for sales and profitability."[464] For instance, the food and beverages industry strategies comprise "lobbying, funding scientific research [in their favor], public messaging, and litigation."[465] First Amendment protections for manufacturers pose an impediment to progress in public health because it protects industry companies' rights to promote their products and limits how much governments can control the information environment, such as tobacco warnings and advertising restrictions.[466]

Similarly, excise taxes as a public health-based measure to reduce consumption of unhealthy foods face challenges.[467] First, tax avoidance is effected through Internet purchases or retail outlets on Native American reservations that are not subject to taxes.[468] Second, excise-tax revenue either remains constant or declines over time.[469] In cigarette taxation, for example, revenue is collected through per-pack purchases, rather than a percentage of the sales price.[470] This means that revenue can be increased only if the per-pack rate

461. *Economics of NCDs*, *supra* note 460.
462. Cawley et al., *supra* note 459, at 365.
463. GOSTIN & WILEY, *supra* note 420, at 445–76; Roache et al., *supra* note 424, at 1061–83.
464. Roache et al., *supra* note 424, at 1083.
465. *Id.*
466. GOSTIN & WILEY, *supra* note 420, at 445–60.
467. *Id.* at 278.
468. *Id.*
469. *Id.*
470. *Id.*

is increased through legislative action or if consumption increases. However, revenue has declined because of lower overall consumption due to the tax itself.[471] This is a risk for health programs funded solely by excise taxes, and declining revenue may incentivize other forms of income, such as direct government funding, that could face public disapproval.

Moreover, opponents argue sin taxes are paternalistic and bad social policy. They affect political and socioeconomic minorities the most because the excise tax percentage takes up a larger share of their income, and because they smoke and consume sugary drinks at a higher rate.[472] Minority populations have no luxury to advocate for better tax treatment,[473] and because excise taxes apply equally to every consumer, they may be viewed as discriminatory—despite an indiscriminate purpose—against these populations. Similar problems may be encountered when implementing taxes targeting other unhealthy products. Additionally, support for sin taxes may decline if portrayed ineffectively within the political sphere. For example, industry campaigns may emphasize their impact on lower-income communities and minorities to garner sufficient political opposition.[474]

These challenges, when viewed broadly, are arguably trivial when compared to the "lifetime personal and societal financial burdens of diet-related chronic diseases."[475] Furthermore, because healthy behaviors and living conditions are the most important determinants of health,[476] it is vital for public health policies and legislation to promote behaviors through incentives that lessen the overall burdens on society. As law professor Lawrence Gostin wrote, "[d]enormalization of unhealthy products and portions and renormalization of healthier alternatives are particularly promising avenues,"[477] but they require a collective effort to realize the goals of legislatures and government agencies. Perhaps epigenetics knowledge can bolster greater acceptance of this effort.

CONCLUSION

Epigenetics offers potential explanations for disease causes previously unexplained by genetics alone. It seeks to link how our environmental

471. *Id.*

472. *See* Morse, *supra* note 419, at 208; Luan et al., *supra* note 419.

473. Randy Dotinga, *Love the Sinner, Hate the Sin Tax*, WIRED (Aug. 8, 2005, 2:00 AM), https://www.wired.com/2005/08/love-the-sinner-hate-the-sin-tax.

474. Daniel Zingale, *Gulp! The High Cost of Big Soda's Victory*, L.A. TIMES (Dec. 9, 2012, 12:00 AM PT), https://www.latimes.com/opinion/la-xpm-2012-dec-09-la-oe-zingale-soda-tax-campaign-funding-20121209-story.html.

475. Rao et al., *supra* note 425 (citing Am. Diabetes Ass'n, *Economic Costs of Diabetes in the U.S. in 2007*, 31 DIABETES CARE 596 (2008)); Timothy M. Dall, Yiduo Zhang, Yaozhu J. Chen, William W. Quick, Wenya G. Yang & Jeanene Fogli, *The Economic Burden of Diabetes*, 29 HEALTH AFFS. 297, 297 (2010). More recent data is available at Am. Diabetes Ass'n, *Economic Costs of Diabetes in the U.S. in 2017*, 41 DIABETES CARE 917 (2018).

476. GOSTIN & WILEY, *supra* note 420, at 287–88.

477. *Id.* at 476.

exposures, including the potential inheritance of epigenetic marks from our parents and ancestors, put us at greater or lesser risks for particular health conditions. In essence, epigenetics helps paint a more complete picture of human biology. It may even offer innovative solutions to health outcomes and disease risk assessments. Epigenetics underscores how societal, political, environmental, and financial structures constrain individual choices and how the associated behavioral decisions may negatively impact the health of the individual and their progeny.

Unfortunately, rather than celebrating the potential contributions of epigenetics to understanding human biology, the popular press has capitalized on epigenetic studies that focus on maternal bodies to prescribe and proscribe ingrained societal notions of what parents should and should not do. The perhaps unintended consequences risk entrenching parental blame in an already existing blame culture within society, while targeting the most marginalized individuals in society, such as racial and ethnic minorities and women.

If this attitude crosses over into law, the legal implications may be staggering. Individuals and prospective parents may effectively be liable and responsible for their future children's well-being. This Article has argued that individuals owe no such duty to avoid epigenetic harms to their progeny because there is no foreseeable victim nor harm thereof. Further, imposing a legal duty would risk contravening personal rights to privacy and autonomy, including broader implications of blame culture, reviving past reproductive injustices, perpetual liability, and epigenetic discrimination.

Suing one's parents for civil or criminal penalties would not do justice to the child's situation. It would "achieve little deterrence and . . . only increase the misery their children experience by depleting parental resources."[478] In effect, resorting to individual liability avoids problems that afflict society and prevents the less fortunate from ever creating a better environment for their future children.

This Article contends that public health interventions, informed by epigenetic knowledge, may represent the optimal approach for utilizing epigenetics to improve the health of future generations. Rather than instructing individuals to eat better solely for the sake of their future children's epigenetic health, a more effective solution might involve interventions that enhance the accessibility and affordability of healthy eating. Instead of attributing a child's ill health solely to an indigent individual or marginalized population, it may be more beneficial to step back and consider factors like the influence of fast-food restaurants' advertisements in neighborhoods, the downsizing of physical education in schools, or the prevailing diet culture in Western countries. Paired with epigenetic knowledge, innovative and novel public health interventions can be implemented to address these root causes and resultant health issues. In

478. Rakowski, *supra* note 401, at 1408.

summary, the potential of epigenetics in public health is beneficent compared to tort liability, which may serve as a deterrent or punishment.