



Altering the Path Our DNA Paved

Epigenetics and OhioGuidestone's Theory of Change

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THE INSTITUTE OF
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SUMMARY

Epigenetics, which looks at heritable changes to gene function that occur “over and above” changes to the DNA sequence, is a growing field of study that healthcare providers, educators, researchers, and policymakers all should be knowledgeable of. Because of how epigenetic modifications can alter gene expression through generations, researchers are uncovering important connections to health and disease, including behavioral health and psychiatric disorders. We also are learning that these modifications sometimes may be driven by such factors as social determinants, physical environments, and stress.

As one of Ohio’s leading behavioral health providers, OhioGuidestone is taking the lead on promoting, educating, and responding to issues that may affect or be affected by epigenetics as they relate to our clients, their families, and their communities.

WHO SHOULD USE THIS PAPER

- Primary care providers
- Behavioral health providers
- Clinicians
- Policymakers
- Researchers

TAKEAWAYS & ACTION ITEMS

- Epigenetics is the study of heritable changes to gene function that don’t come from changes to the DNA sequence, but rather can be caused by environmental and social factors.
- Public health, both physical and behavioral, can be greatly impacted by epigenetics, leading to a number of implications for disease and other barriers to health and well-being.
- Epigenetics should at least be considered when reviewing patient/client family history.
- Particularly for behavioral health, the need is for interventions that are both treatment for psychiatric disorders stemming from epigenetic changes and prevention of stress and trauma that could impact epigenetics.
- Epigenetics are closely tied to some health disparities and social determinants of health, but must be understood as a mechanism for those outcomes and not the underlying root issue.
- Communities must be engaged and must be leaders in determining how to plan for and address potential public health issues, including epigenetics factors.

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OhioGuidestone

WHERE NEW PATHS BEGIN

Altering the Path Our DNA Paved

Epigenetics and OhioGuidestone's Theory of Change

Maic D'Agostino, *OhioGuidestone*

Introduction

Epigenetics is a quickly growing field of study with far-reaching impacts across the spectrum of human health. Essentially, epigenetics looks at heritable changes to gene function that don't come from changes to the DNA sequence. The prefix "epi-" means "above"; thus, epigenetic changes happen "over and above" the basic genetic attributes (Rozek et al., 2014).

In particular, research has focused on how environments — physical, social, and otherwise — may imprint epigenetic changes that affect not only communities of individuals but their offspring as well. This is profoundly important for health and public policy. By studying epigenetics, we can uncover patterns of socially driven inequities and how they affect the observable health disparities among unprivileged groups.

For healthcare providers, these physiological impacts could mean different risk factors for the patients and clients they treat. This is true for physical and behavioral health, as well as the ways they intersect. Therefore, it is imperative that providers consider how care and access are delivered to individuals and how patients' physical and mental health histories are collected and respected.

In educational settings, epigenetics research could inform a broad range of policies and strategies as they relate to stress, learning, and memory formation (McEwen, 2015). Policymakers also must consider community and generational history when responding to community needs.

Perhaps most importantly, impacted communities, groups, and individuals should be empowered to advocate for themselves using the best information available. It should be clear that public health considerations must prioritize the real-world experiences and needs of community stakeholders in shaping policy, conducting research, and drawing conclusions (see Haas Center for Public Service, 2019).

As part of OhioGuidestone, one of Ohio's largest behavioral health service providers, we care deeply about the impact we have on our clients in all facets of their lives. Epigenetics, therefore, is imperative for our organization — and likewise all healthcare providers — to study and consider. In this paper, we will discuss how we integrate our understanding of epigenetics into what we believe and how it informs what we do.

What Is Epigenetics?

As noted in the introduction, epigenetics is a field of study that investigates modifications to gene expression and function that are inherited but can't be traced or attributed to changes in the DNA sequence. These changes — whether facilitated through DNA methylation, histone modification, or some other mechanism — can alter the way gene expression manifests, affecting health, disease, and other potential outcomes.



In recent years, epigenetics as a field has grown exponentially, alongside quickly expanding genome and epigenome research, and its definition has shifted since it entered the scientific parlance (Felsenfeld, 2014). Because of this relative newness, epigenetics and its implications for health remain in flux as the field gathers more data and knowledge.

However, its potential significance to public health and family history make it impossible for healthcare providers to set aside. Because epigenetics research gives us clues about changes to gene expression that occur outside of the DNA sequence and yet appear to be inherited, we are starting to uncover ways in which experiences are passed on through biology.

The possibility of plasticity that arises is particularly important to public health. If

disease proliferation and health disparities can be reduced through epigenetic-informed interventions, then we want to know how to do so. Unfortunately, these questions are not fully answered yet.

What we do know is that sometimes gene functions are modified by processes such as DNA methylation, but how, where, and why exactly these modifications happen are not fully understood and may not always have clear implications for gene expression and/or function (Edwards et al., 2017). Therefore, we must continue to seek out better information and resist temptations to make sweeping assertions.

Still, the need to answer these questions and study these changes is imperative for public health. In the next section, we will briefly review some of the impacts.

Epigenetics, Disease, and Health

We all understand how environmental dangers, especially through pollution and other toxic substances, can affect public health, both short-term and long-term. Neighborhoods exposed to high levels of lead, poor air quality, or harmful pesticides suffer direct health consequences that are measurable, observable, and preventable.

But what we still don't entirely grasp is how genetics — and therefore future generations — are connected to and affected by these environmental and other experiential factors, or how those genetic effects may be detrimental to health and well-being. These sort of connections continue to be investigated, and the potential connotations for public health and epidemiology are significant (Rozek et al., 2014).

It's not just environmental risks that could induce epigenetic modifications. Social determinants, such as systemic racism and poverty, also are known to affect health. Epigenetics may be part of the mechanism that cause worse health outcomes for marginalized, disadvantaged, and disenfranchised populations, manifesting in health issues that include the immune system (Corwin et al., 2013), inflammation (McDade et al., 2017), and metabolic dis-

eases (Sales et al., 2017). To protect families from long-term adverse health conditions, we must consider the potential biological and genetic impacts from environments and experience.

Trauma likewise can impact factors that play a role in epigenetic phenomena (Ryan et al., 2016). One recent study seemed to show that mice without direct trauma exposure experienced epigenetic effects from their trauma-exposed parents (Curry, 2019). How these findings may reshape our knowledge of post-traumatic stress and its associated psychological effects is unclear, but we know some sort of connection exists.

Because of this, public health prevention strategies must incorporate antiracism and antipoverty initiatives, especially targeting trauma and toxic stress. Generational, cultural, and family history should be included wherever possible in individuals' health profile, not simply to ascertain potential risk of known genetic disorders but to consider possible epigenetic factors that could induce long-term adverse health effects. While we still have much to learn about the sources and mechanisms of epigenetic modifications, we can begin to inform, educate, and intervene.

Behavioral Health Interventions

At OhioGuidestone, considering the impact of toxic stress and trauma on the brain and development is central to our theory of change (Kearney & Lewis, 2018). We focus

our treatment directly toward interventions that disrupt cycles of stress and trauma because of the potential life-long impacts they can have.

If we consider that some of those potential impacts could be passed on to the next generation, even without those children experiencing the stress or trauma themselves, then preventative interventions become even more important. Epigenetics research has further demonstrated the significant interconnection of brain and body — the psychological, the neurological, and the biological — and epigenetic modifications can manifest in psychiatric disorders as well as physical ones (Bakulski et al., 2016). It's our duty, then, to offer treatment services that can have a positive ripple effect on communities beyond the individual client and to advocate for and help create safer, healthier environments for our clients.

Since we are an organization that serves children in their schools as well as their homes and communities, we also care deeply about potential educational impacts related to epigenetics. Decreasing the effects of and exposure to adverse experiences may aid in learning throughout the lifespan. Furthermore, we are committed

to helping train teachers, administrators, professionals, and paraprofessionals working with children in trauma- and toxic stress-informed practices and principles. As educators continue to expand their knowledge of neuropsychobiological science as it relates to childhood and development — or what schools often call “socioemotional learning” — they should recognize the importance of expanding their knowledge of epigenetics and its impacts (McEwen, 2015).

While we can't yet pinpoint all the ways epigenetic modifications affect behavioral health and development, there's no question that they do. Potential health benefits beyond psychological treatment may be gained from careful practices that address this reality. Interventions that target stress, for instance, may counteract adverse epigenetic effects on health for people from marginalized populations (Corwin et al., 2013). More research will be needed to determine the specific mechanisms, but in the meantime we can intensify our efforts to address these issues.



Understanding Epigenetics as a Mechanism — Not a Cause — of Health Disparities

Due to our context, OhioGuidestone serves a broad and diverse cross-section of Ohioans. However, our community-based therapists and mental health specialists work mainly with Medicaid recipients in urban environments, many of whom experience intersecting disadvantages. Particularly in Cleveland, where we are headquartered, Black residents and neighborhoods have suffered decades of economic, environmental, and systemic inequity and racism (Tarter Jr., 2020).

Racism, poverty, and inequality have the potential to be profoundly stressful, as we've previously noted while discussing our clients' therapeutic needs (D'Agostino et al., 2020). Since we know stress can be detrimental to health, we must be cognizant of how this may be due, in part, to epigenetic influences.

While epigenetics may be one of the ways racial disparities manifest and thus affect different racial groups, it is extremely important to always affirm that race is not genetically based and therefore racial disparities are not due to race but to racism.

In other words, observable epigenetic effects may be branches of health disparities or mechanisms that mediate them, but the root causes are socially driven.

This has been well-established in recent years, despite certain popular opinions (and even some doctors and scientists) still attributing differences between races to genetics and biology (Goodman, 2020).

The history of science and scientific research is marred by tragic misuse and misunderstanding of knowledge to enforce social power structures, especially through racist and ableist concepts (Nelson, 2019). Because of this, epigenetics researchers — like all researchers — must be culturally

humble and sensitive when designing studies and analyzing results (Saulnier & Dupras, 2017).

This also is significant for the way researchers and educators interact with communities. As noted by urban education and Indigenous studies scholar Eve Tuck (2009), "The trouble comes from the historical exploitation and mistreatment of

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Eve Tuck
Suspending Damage: A Letter to Communities
2009

people and material. It also comes from feelings of being overresearched yet, ironically, made invisible” (pp. 411–412). Tuck calls for researchers and scholars to move from a “damage-centered” framework toward a “desire-based” one.

To that end, researchers and providers — like us at OhioGuidestone — must be committed to learning the desires of the communities we serve.

Conclusion

Epigenetics has given us a new entry point into understanding the interconnected genetic impact of disease, environments, social determinants, and family history. Because stress and trauma play such an important role in many of these overlapping concerns, behavioral health interventions are key to both treat and prevent disorders and negative health outcomes.

Public policy must consider epigenetics within the potential long-term concerns of public health and education. Primary care physicians should at least be aware of possible epigenetic risk factors, including potential disease outcomes, both in gaining insight from past family history and helping build prevention and protective factors against potential future negative outcomes. Education experts also must consider possible epigenetic effects, as they may disrupt student learning and engagement. Targeted, individualized planning and care will be paramount to addressing unseen and un-

If we strive to educate, treat, or study people, they must of course consent to and directly benefit from it. This is vital to addressing the underlying issues behind health disparities and adverse epigenetic modifications.

If the path that DNA paved has been altered, the people who are affected must determine the direction it ultimately should take.

derlying barriers to health and education.

Stress and trauma must be addressed through primary care, education service, and behavioral health as they are key to whole health. These effects can be counteracted, and our increasing understanding of the plasticity of epigenetics — like our expanding knowledge of neurobiology — allows us to intervene, adapt, and align treatment and prevention strategies.

Above all, communities must be informed, engaged, consulted, and ultimately empowered to make their own decisions. Families likewise should understand the potential impacts of epigenetics and be given the tools and support to address any issues or concerns. It is imperative that we understand what causes epigenetic changes. We must target and either reduce or eliminate social and environmental conditions that perpetuate harm — past, present, and future.

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