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THE POLITICAL IMPLICATIONS OF EPIGENETICS:
NOVEL NARRATIVES OF THE SELF, THE ENVIRONMENT, AND CAUSAL RESPONSIBILITY

by
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COMMITTEE APPROVAL

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DEDICATION

This dissertation is dedicated to my two boys, Shane and Jake Robison. I hope the work and perseverance it took to finally complete this project provides a worthy example for them as they pursue their own goals to not let anything get them down or get in their way, and to aim high and keep on going no matter what.

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ABSTRACT

Epigenetics is an emerging field of research related to, but in many ways distinct from, genetics. The science of epigenetics introduces causal pathways which complicate a number of longstanding politically relevant concepts such as the conventional distinctions drawn between conservatives and liberals. These political complications of epigenetics are discussed in the context of the prevailing narratives of obesity which reflect these ideological oppositions. For example, epigenetics provides elements which at once fit both the conservative narrative of personal responsibility for obesity and the more liberal narrative of the overriding influence of the environment. How these novel narrative possibilities from epigenetics will be used in policy discussions is therefore an open question which this dissertation attempts to answer.

To begin to answer this question, the significant narrative elements of the prevailing attributions—or causal narratives—of responsibility for obesity are identified and established via a content analysis of articles on obesity from the New York Times and the Wall Street Journal as proxies for the two opposing ideologies. The emerging narrative of epigenetics are then also identified and compared against the liberal and conservative narratives. This comparison produces a number of interesting results.

First, as expected, these obesity narratives correspond to the conventional ideological distinctions discussed before. However, the narrative of epigenetics is found to share elements in common with both the liberal and conservative narratives at the same time. In other words, the unique causal mechanisms proposed by the science-

based narrative of epigenetics provide a non-ideological or trans-ideological bridge which does not adhere exclusively to either ideological orientation.

This dual nature of the emerging narrative of epigenetics is unanticipated, and quite possibly unprecedented. The potential effects on policy are interesting in their own right, but, as will be discussed, the political repercussions of this unique narrative of epigenetics extend well beyond the implications for specific policy domains. The effect from the widespread dissemination of such a non- or trans-ideological policy narrative would be to fundamentally reorient our contemporary politics away from the prevailing dichotomizations and towards a more inclusive and holistic orientation.

Prologue: Politics and the Life Sciences

Political science at its core is the study of power and influence at all levels, from whole governments down to interpersonal interactions and even individual behavior. This study of political phenomena has traditionally been conducted through conventional social science methods such as observation, commentary, surveys, content analyses, and through a focus on explicitly political phenomena such as regime changes, voting patterns, political involvement and ideology. Increasingly, though, political scientists have turned to the natural sciences, such as neuroscience, evolutionary biology, and genetics, to delve deeper into the explanations of how and why people think and act in the political ways that they do. In this way the barriers between the natural sciences and political science are becoming increasingly blurred.

There are a number of ways that political scientists are crossing these boundaries into the life sciences and that the life sciences are crossing over into the study of politics. Beyond the impacts on public policy of changes in scientific understanding, the traditionally presumed absence of normative notions of power in the supposedly objective practice of science itself is becoming increasingly problematized, which as described before is the proper purview of political scientists. Likewise, newly emerging sciences such as nanotech, biotech and synthetic biology are shattering the conventional dichotomies of living/nonliving, natural/artificial and individual/environment, with potentially dramatic implications for the exercise of human political power, which again is the proper focus of political science. This dissertation is located in this overlapping of the politics and the life sciences.

Biopolitics

An example of the growing acceptance of this blurring of disciplinary boundaries between political science and the life sciences is the emergence of “biopolitics” as a subfield within political science (Blank & Hines 2001; Masters 1989; Somit & Peterson 1998). The origin of the field of biopolitics is usually located in the paper “Towards a more Biologically Oriented Political Science,” written by Albert Somit (1968) and published in the *Midwest Journal of Political Science*, while the origin of the term *biopolitics* is traced to Thomas Thorson and his 1970 book titled *Biopolitics*.

Political Science and Biopolitics

The Association of Politics and the Life Sciences (APLS) has also emerged as an official association to promote this confluence of politics and the life sciences. The APLS was formed in 1980 as an organized section of the American Political Science Association (APSA) which then grew to become its own association, though always maintaining its original affiliation with the APSA (History of APLS 2014). Today, the APLS is officially recognized by the APSA as a Related Group (Welcome to the APLS 2015) which “exists to study the field of biopolitics as a sub-field of political science” (“Association of Politics and the Life Sciences” n.d.).

The stated purpose of the APLS is to promote recognition of “the immense social and political implications wrought by revolutionary changes in biology,” on the premise that “ongoing developments in genetics, cognitive neuroscience, and evolutionary theory will inevitably have a huge impact on government decisions” (Welcome to the APLS 2015). The APLS is therefore dedicated to “generating, disseminating, and using

evolutionary, genetic, and ecological knowledge related to political behavior, public policy and ethics” (About APLS, 2015).

To realize this mission, the APLS publishes the interdisciplinary peer-reviewed journal *Politics and the Life Sciences* (PLS), now in its 34th volume. The journal is indexed by International Political Science Abstracts (“Politics and the Life Sciences” n.d.), and publishes work by “political scientists and political behaviorists; biosecurity and international-security experts; life scientists, clinicians, health-policy scholars, and bioethicists; moral and evolutionary philosophers; environmental scientists and ecological economists; political-behavioral and environmental historians; science-policy scholars and historians of science; and legal scholars” (Welcome to PLS 2015). Recent articles published in *PLS* cover topics from the long-term political repercussions of the evolutionary biology of human morality (Robison 2014a) to federalism and bioethics (Von Hagel 2014) to the political economy of emerging infectious disease surveillance programs (Ear 2014).

Work in biopolitics has been also published in mainstream journals of political science, such as the *American Political Science Review* (Alford, Funk & Hibbing 2005), the *Journal of Politics* (Fowler & Dawes 2008; Hatemi et al. 2009), *Perspectives on Politics* (Alford, Funk & Hibbing 2008; Charney 2008), and *International Affairs* (Bell 2006). This record of publication is a good indication of the acceptance of biopolitical perspectives within mainstream of political science. Again, this confluence of politics and the life sciences is the proper location of the theme and topic of this dissertation.

A primary focus of conventional biopolitics is to identify correlations between the growing knowledge of life sciences and social sciences to expand expert knowledge in regards to such domains as policy interventions. However, this focus on increasing the effectiveness of policy through the incorporation of knowledge from the life sciences does not account for the ways emerging scientific knowledge itself affects the policy formulation and adaptation process. The elaboration of the effects of emerging scientific knowledge on political narratives is one major contribution of this dissertation.

Biopolitics, Policy Narratives and Obesity

One method of studying these processes of policy formulation and adaptation is to look at the different narratives employed by individuals and groups involved with a policy area. These narratives express different motivations for political action and provide a context in which these different forms of political action can be understood. The novel biopolitical approach developed in this dissertation is that emerging scientific knowledge not only increases our understanding of effective policy design (i.e. conventional biopolitics), but also that this emerging scientific knowledge influences the formation of these policy narratives themselves in concert with preexisting political preferences.

An example of a policy area that exemplifies both aspects of biopolitics is obesity. Obesity has become increasingly comprehended through the life sciences which provide details to policy makers about the causes of obesity, which then recommend specific policy solutions. For example, knowledge gained from neuroscience

provides insights into how people make decisions or respond to different stimuli at the level of brain chemistry or structure; this knowledge can then be used to inform policy. Notably, though, this scientific knowledge lends itself to any number of political uses, some of which can be perceived as competing or mutually exclusive orientations.

On the one hand, new scientific knowledge about the biological causes of obesity can suggest modifications of the environment to reduce the likelihood of people becoming obese, such as through the removal of trans-fats from food production. On the other hand, new scientific knowledge about the psychology of decision making can justify the limitation of individual choices, such as the prohibition of the sale of super-sized fountain drinks, as the most effective means to reduce obesity. In the former case, the external environment is identified as the location of obesity causes and solutions, and in the latter the causes of obesity are located in the individuals' ability or lack of ability to make healthy choices. Hence, scientific knowledge can play out as significantly different policy narratives, resulting in significantly different policy outcomes.

Notably, these two policy prescriptions—a focus on the environment versus focus on the individual—actually reflect the two predominant ideological orientations which guide and constrain contemporary politics. Ideological liberals tend to locate causes in the environment and therefore prefer policies which modify the environment as the most effective means to realize desired changes; ideological conservatives tend to locate causes and solutions within the individual, as the product of internal drives and dispositions. And, just as described before, both sides of this ideological contest

constitute opposing prescriptions for political solutions to the problems of obesity, and both sides have utilized science in constructing their opposing narratives.

However, what if knowledge coming out of the life sciences provides evidence that this longstanding dichotomization of the individual and the environment itself is problematic? As will be described, recent developments in the life sciences suggest that the causes and solutions of biology-based problems like obesity are not limited to either individual dispositions *or* environmental conditions, but rather that both internal individual characteristics *and* environmental circumstances are simultaneously interactive and actually not separable.

The Political Implications of Epigenetics

In particular, within the field of genetics, in what is called *epigenetics*, biological mechanisms have been identified which modify gene expression in response to the environment, some of which may be heritable. These findings present some potentially significant challenges to the conventional science of genetics which presumes a fundamental isolation of genes from their environments, which science reinforces these ideological dichotomizations of inside/outside and individual/environment mentioned before.

This dissertation explores the potential for epigenetics to dissolve the foundational dichotomies present in our conventional narratives and policies. In particular I employ Deborah Stone's (2002) causal narrative analysis to move past taking sides between the normative positions of blaming either the individual or the environment. The prevailing policy narratives of obesity which are based upon this

dichotomy of individual or environment are well suited for an empirical investigation into the political implications of the emerging science of epigenetics. As these two dichotomous positions frame the discussion of obesity as either an environmentally caused problem or an issue of individual ethical responsibility, the political discourse and narratives of obesity likewise coalesce around two seemingly incommensurable positions of blame. The opening of the discourse to allow for the possibility of both environmental and individual causes of obesity would be a remarkable innovation. As will be discussed, epigenetics does exactly this.

Again, this dissertation is located within this movement towards the blurring of disciplinary boundaries between political science and the life sciences, at the cutting edge of recent advances in biology and genetics. In particular, I discuss the political implications of the emerging science of epigenetics in part through a comparison of the emerging narratives of epigenetics with the dominant policy narratives of obesity. As a demonstration of the fit of this topic within the biopolitics subfield of political science described above, I have already presented papers on the philosophical aspects of epigenetics in politics (Robison 2014b) and the policy implications of epigenetics (Robison 2014c) at the 2014 annual conference of the APLS, and another paper on epigenetics at the annual conference of the Midwest Political Science Association (MPSA) in the Health Policy section (Robison 2015).

Obesity

Overweight and obesity have long been an issue of social commentary, much of which revolves around attributions of blame or responsibility for the conditions (Farrell

2011; Forth 2013; Fraser 2009; Levy-Navarro 2010; Rogers 2010), but only recently has obesity emerged as a primary health concern on a par with cancer. The emergence of obesity onto the public policy agenda is often fixed at around 2001, coincidental with the release of the report of the Surgeon General of the United States titled “A Call to Action to Prevent and Decrease Overweight and Obesity” which identified obesity as an epidemic of nationwide proportions (U.S. Department of Health and Human Services 2001).

Obesity is associated with hundreds of billions of dollars in medical expenses, and is one of the leading causes of death in the U.S. and Western Europe (Alwan 2011; OECD 2014). Increasingly, obesity is also not just an issue for post-industrial societies, but is increasingly becoming a serious health concern in developing countries as well (Stevens et al. 2012; Tran 2014; WHO 2000). As a result, there are an increasing number of obesity-related policies and programs already in place or being considered at all levels of government around the world.

Obesity and Narratives

Different obesity policies are a function of different causal explanations—or narratives—of obesity. The credit or blame for an outcome usually comes in the form of a narrative composed of “characters, plots, colorful language, and metaphors to analyze policy narratives” (McBeth et al. 2007); the more easily accepted the accompanying assignments of credit or blame, the more persuasive the narrative. This identification of the primary causes for obesity, and the agents responsible for those causes, determines the focus of policies intended to address those causes.

These causal narratives are in turn the products of more general ideologies (e.g., conservatism and liberalism). Previous work has identified ideological differences in the promotion and acceptance of different health policy narratives and the policy solutions recommended by these different narratives, with liberals emphasizing social and environmental causes and solutions for adverse health outcomes and conservatives emphasizing the personal responsibility of the individual (Cozzarelli, Wilkinson & Tagler 2001; Kluegel & Smith 1986; Skitka, Mullen, Griffin, Hutchinson et al. 2002; Sniderman, Hagen Tetlock & Brady 1986). This ideological opposition of personal responsibility versus environmental influences also corresponds to the nature versus nurture dichotomy which has marked modern Western liberal culture for millennia, with conservatives placing more emphasis on intrinsic characteristics and liberals placing more emphasis on the extrinsic circumstances (Bellah et al. 1996; Kingdon 1999; Lipset 1991).

Narratives and Ideology

In other words, different ideological orientations produce different causal narratives which result in different policy prescriptions. The two currently dominant narratives in obesity policy are the narrative of personal responsibility, which is generally associated with a conservative ideology, and the narrative of a toxic ‘obesogenic’ environment, which is generally associated with a liberal ideology. The prevailing policy prescriptions for obesity emanating from these basic ideological orientations emphasize either changing the individual or holding the individual responsible for his or her obesity, or changing the environment and holding external

actors responsible for obesity. These policy prescriptions are usually opposed against each other—because these dichotomizations are all we currently have available to us.

Although obesity has been the focus of significant policy attention for the last decade, the rates of obesity have either increased or stabilized, but not declined. This absence of noticeable effect strongly suggests that these ideologically opposed policies have been ineffective at either properly identifying the causes of obesity, or in identifying solutions for obesity. However, what if this lack of effect from conventional obesity policies is not so much a result of the inadequacies of the policies themselves, but is instead the result of intrinsic limitations in how we understand the world?

Epigenetics, Narratives and Ideology

Recent developments in biology—in particular in the field of epigenetics—suggest new ways of perceiving and conceptualizing our place in the world which defy these conventional dichotomizations. Epigenetics is an emerging field of research related to, but in many ways distinct from, genetics. Genetics has long been the dominant biological explanation of human origins and development. While genetics is in many ways a prototypical modern science, what is often not recognized is that many of the basic assumptions of genetics reflect these ideological oppositions. In other words, while many of the results from the science of epigenetics challenge these fundamental assumptions of genetics, beyond these scientific disputes, this new biology-based mode of explaining cause and effect has significant implications for politics via the novel narratives it engenders; these new narratives in turn recommend new policies. These political implications of epigenetics are the focus of this dissertation.

As will be shown, the implications of epigenetics extend well beyond just obesity or health policy in general. Just as epigenetics complicates the conventional dichotomizations of genetics in the domain of science, epigenetics also complicates the opposition of these narratives of personal responsibility versus the overriding influence of the environment which are associated with the two basic ideological orientations, with important implications for obesity policy. At the same time, because epigenetics provides a rigorous scientific basis for the blurring or even dissolving of the boundaries erected between core elements of the predominant conservative and liberal ideologies, epigenetics thereby also complicates these ideological orientations themselves around which are organized so much of our contemporary politics. In this way, epigenetics presents a new mode of seeing the world—with the promise of novel causal narratives—which fundamentally challenge the foundations of our contemporary politics.

Chapter I

Why Epigenetics and Politics

Epigenetics is an emerging field of research related to, but in many ways distinct from, genetics. While the basic premises of genetics are widely known and accepted, what is much less well-known or accepted is that there are biological processes ‘above’ the genome called collectively the epigenome (from the Greek root *epi-*, meaning ‘above’ or ‘over’). These processes regulate the expression of genes in the genome in response to influences in the immediate environment, though without modifications of the underlying DNA sequences. What is also not well-known is that some of these epigenetic changes in genetic expression can also be passed on to multiple generations, which is a fundamental challenge to many of the most basic tenets of genetics.

The nature of these challenges of epigenetics have spurred intense debate between geneticists, epigeneticists, and other scientists working in these fields as to the validity and the utility of these results from epigenetics. Epigenetic phenomena have been recognized for decades but for most of that time, as manifest in the rates of publication of research on epigenetics, epigenetics has been almost totally ignored by the mainstream of conventional genetics. Only within the last decade or so has the study of epigenetics gained any traction, with the interest in epigenetics now growing at exponential rates.

As will be shown, the reasons for this longstanding avoidance of epigenetics transcend science and involve politics and ethics. However, these political and ethical influences are often obscured and subsumed within the detached objectivity which

characterizes modern science. Once these political and ethical influences are made clear, though, this scientific history of genetics and epigenetics becomes much more understandable.

The elaboration of these non-scientific influences not only reveals the influences of politics and ethics on the historical development of the science of genetics, but also the influence of this science of genetics on the development of the prevailing politics and ethics. Likewise, this history also suggests that because of the reciprocal influences of politics and ethics and the science of genetics with its longstanding antipathy towards epigenetics, the recent emergence of epigenetics has significant political and ethical influences which are not currently being recognized or addressed. This dissertation is thus one of the first attempts to comprehensively address these extra-scientific political and ethical implications of epigenetics.

Policy Implications

As with any new scientific advance, epigenetics presents significant considerations for public policy via the new knowledge it introduces. However, epigenetics is such a new field of study that it has not yet broken out of scientific research and academia to make a noticeable impact public policy discussions. Given the exponentially increasing attention epigenetics is receiving in the natural sciences, and the nature of the results being produced by this research, the significant impacts of epigenetics on public policy are only a matter of time. The nature of these impending effects of epigenetics on public policy will be discussed as one of the major political implications of epigenetics.

Philosophical Implications

However, epigenetics also presents even more significant issues which are not as obvious as these potential impacts on policy. The common histories of our politics, ethics and genetics suggests that the modern science of genetics is built upon many of the same fundamental assumptions as modern Western liberal politics and ethics, and vice versa. As will be shown, the recent emergence of epigenetics provides a demonstration of these fundamental interconnections between politics, ethics and science. Therefore, in challenging the assumptions of the science of genetics, epigenetics likewise challenges the political and ethical assumptions which underlie contemporary society. In this way, as will be shown, the recent emergence of epigenetics also provides political scientists, theorists and philosophers with a unique lens through which to view the unfolding of the Western intellectual and cultural history which produced our contemporary political institutions, as well as a unique perspective for discussing both the present state of our politics and ethics and their ongoing evolution.

What Epigenetics Is

There are a number of ways that 'epigenetics' has been defined, most of which involve the technical requirements of a specific biological specialization (Haig 2004). For example, in molecular biology, which is obviously focused on biological phenomena at the cellular level, epigenetics is that research which focuses on "the study of mitotically and/or meiotically heritable changes in gene function that cannot be explained by

changes in DNA sequence” (Riggs et al. 1996). However, in the research area of functional morphology the net of epigenetics is cast much wider to include not only “the entire series of interactions among cells and cell products which leads to morphogenesis and differentiation,” but also the effects on development of hormones and other growth factors, as well as the non-genetic influences on biological development from “ambient temperatures,” and even the differential effects gravity (Herring 1993). In other words, the focus of research in epigenetics can technically run the gamut from development at the cellular level to the influence of environmental conditions such as temperature and gravity.

For the purposes of this dissertation, though, ‘epigenetic’ will be defined as those biological pathways and mechanisms which regulate the expression of the gene but without changing the sequence of the genes. Further, these epigenetic influences on gene expression often—though not exclusively—occur in response to environmental influences, with the additional feature that some of these mechanisms may be passed on to subsequent generations. This definition is broad enough to allow the discussion of epigenetic phenomena at every level of analysis from the cell to the organism, but also narrow enough to focus this discussion on the identifiable physical mechanisms through which these epigenetic phenomena operate and are manifest.

Is Epigenetics Different from Genetics?

While there is a growing acceptance of epigenetics, there is still a lot of skepticism from within conventional genetics about the claims emerging from

epigenetics (Jorgensen 2011; Meloni & Testa 2014; Pickersgill et al. 2013; Weitzmann 2011; West-Eberhard 1992).

The original point of departure between genetics and contemporary epigenetics is usually identified as the pre-Darwinian theories of the French naturalist Jean-Baptiste Lamarck (1744-1829). Lamarck's epigenetics-like theories were premised upon his conception of evolution as a progressive process driven by the inheritance of acquired characteristics, or that organisms and species evolved in response to the influence of the environment, which responses propelled adaptive changes in morphology, which changes were then passed from parents to offspring. This environmental responsiveness and the use-disuse inheritance of Lamarckism were long thought to have been definitively disproven by the union of Darwinian natural selection with Mendelian genetics.

The results emerging from the research epigenetics suggest that these longstanding claims discounting gene-level adaptation to the environment and non-genetic inheritance may have been premature. Although there are substantial differences between Lamarck's actual theories of inheritance and contemporary epigenetics, to the point they only bear superficial resemblances, 'Lamarckism' or 'Lamarckian' are still often used as misdirected epithets against contemporary epigenetics.

Besides these facile comparisons with Lamarckism, two of the more assiduous critiques of the significance of epigenetics are either that the findings of epigenetics are novel but inconsequential (Pigliucci & Muller 2010), or that epigenetic mechanisms have

always been an accepted part of the conventional understanding of modern genetics and therefore do not pose any significant challenges to the mainstream (Coyne 2011, 2013). These are two related but significantly different propositions, one of which is more amenable to resolution through conventional scientific processes while the other is likely only to be resolved through more political means.

Of these two propositions, the question of whether the findings of epigenetics are consequential or not is, or at least should be, resolvable through science-based trial and error: Either the findings from epigenetics make substantive contributions to subsequent research, or they do not. In this context, as will be shown, the balance of evidence appears to be shifting in favor of epigenetics.

However, the assertion that epigenetic concepts and mechanisms have always been a part of the accepted orthodoxy of conventional genetics, and therefore could not and do not contradict the orthodoxy of genetics, raises a number of thorny ontological issues which this assertion is actually intended to avoid. On the one hand, the answer to this question should be a fairly straightforward historical and methodological exercise (i.e., what does a review of the relevant history and practices reveal?). On the other hand, that this easily resolvable dispute is still going at least a decade after the emergence of epigenetics suggests that this question transcends mere facts and methodologies, and is actually more philosophical and political than it seems at first glance. Thus, a satisfactory resolution of these scientific differences is not likely until these deeper philosophical and political aspects are acknowledged and addressed, which is facilitated through the recognition of the prevalence and salience of narrative.

Epigenetics, Science and Ideology

One of the guiding principles of modern sciences such as genetics (and contemporary epigenetics, for that matter) is objectivity, as the idea that claims, methods and results are scientific to the extent that they are not influenced by particular perspectives, value commitments, or personal or community bias (Eberhart 2011; Reichenbach 1938).

The exemptions of the practice and methods of sciences such as genetics from subjective ethical and political considerations is a relatively recent phenomena coincident with the emergence of modern liberalism (Daston & Galison 2007). In the past, the political and ethical commitments of scientists were much more explicit and actually inextricably intertwined with the practice of science (Holton 1960; Osler 2010). These subjective influences are now assumed to be eliminated through the techniques of scientific objectivity which as much as possible remove the traces of the individual and of the subjective from the results of investigative and experimental process. However, studies in the history of science show how these subjective non-scientific influences are often not actually removed by this concept of scientific objectivity but rather sublimated as unquestionable assumptions within the methods and practices of science (Daston 2008; Feyerabend 1987; Kagan 2009; Suarez-Diaz & Munoz 2008).

As such, scientific assertions—such as the longstanding exclusion of epigenetics from genetics and many of the current doubts as to the validity of epigenetics research—can often function as unconscious proxies for underlying ideological

positions, only couched in scientific language. In other words, while it is widely accepted that laypersons may often misapply the results of scientific research in defense of their ideological positions, and that sometimes even leading scientists may interject their politics into their science (Trivers 2015), that the objective practices of modern science themselves can often mask subjective preferences is not so widely accepted. A primary assertion of this dissertation is that many of the central tenets of genetics, such as the decades-long exclusion and ongoing resistance to epigenetics, are these sublimated proxies for political and ethical positions.

The extent to which modern genetics has downplayed or ignored the interactivity suggested by epigenetics is a subjective and not an objective judgment has important consequences for not only genetics and epigenetics, but for contemporary politics as well. By the same token, the extent to which the reductionist and atomistic thrust of modern genetics is a subjective and not an objective judgment *is* politics. Both of these are indicative of the significant overlap of genetics, epigenetics and politics which is the core of this dissertation.

As demonstrated by the current vaccination/anti-vaccination and global climate change debates, ideological disagreements involving significant scientific components are not—and actually cannot be—resolved through appeals to science alone but are rather ultimately political contests. Political debates like these are not resolved by dispassionate, critical comparisons of evidence, but rather revolve around the competing narratives employed by the different sides. Science in these circumstances,

instead of being persuasive, becomes just another weapon in the arsenal to defend an ideological position (Lodge & Taber 2005; Taber & Lodge 2006).

‘Narrative’ in this context means the causal attributions which are used to characterize a political dispute. That an issue has become political means that it is disputed by at least two parties, each or all of which have different causal stories, or narratives, for what or who has caused the problem and for what or who is responsible for fixing the problem (Stone 2002). If there was no disagreement about causal narratives, either about causes or solutions, there would be no grounds for dispute. In this way, narratives are an integral component of politics and policy.

In distinction to ideal objective scientific methods, narratives have the unique property of not needing to be objectively true—usually defined as correspondence with an empirical reality (Blackburn 1994, 81; See also Dawson & Gregory 2009)—to be effective. Rather, narratives are often persuasive for very subjective reasons, such as the associations they invoke or their congruence with existing beliefs (Gilovich 1991; Schank et al. 1995; Taber & Lodge 2006). Thus, again, the extent to which politics and ethics have played formative roles in the histories of genetics and epigenetics is also the extent to which an approach which can appropriately analyze and discuss these narratives is required.

Epigenetics and Policy Narratives

One such approach is the narrative policy framework (NPF) from the ‘Portneuf School’ of policy analysis out of Idaho State University (McBeth 2014). The NPF is a unique approach to policy analysis because it combines a postpositivistic orientation

which emphasizes the salience of context, perspective, and subjective values (Fischer 1998, 2003), with the more conventional positivistic methods of measurement, generalizability and prediction. The result is “a quantitative, structuralist, and positivist approach to the study of policy narratives” (Jones & McBeth 2010). This will be the primary empirical approach utilized in this dissertation to begin to establish the unique political implications of epigenetics through its impacts on conventional narratives and ideologies.

Why Narrative

“Narrative,” as writes David Herman, “can be construed as both reflecting and supporting a cognitive predisposition to find causal links between entities, states, and events in a sequentially presented array” (Herman 2003). Through the syntactical properties of narratives, “the ongoing stream of experience” is organized into usable ‘chunks,’ without which the world would quickly become unmanageable (Herman 2013). This order-imposing function of narratives is similar to what the cognitive scientist and artificial intelligence pioneer Marvin Minsky refers to as “frames,” or the heuristics necessary to represent the unruly cacophony of realities in which cognizing entities are immersed (Minsk 1975, 1985). The neurological substrate for human narrative capacities have been identified (Frith 2007; Hawkins & Blakeslee 2005; Troiani et al. 2006), as have the significant impairments that result when this physical capacity for constructing or assimilating narratives is damaged (Hirstein 2006; Young & Saver 2001). Thus, our human penchant for constructing narratives is more than just a capricious preference for hearing stories, but rather appears to be a fundamental aspect of human

existence, down to the physical configuration of our brains. In other words, the concept of narrative as utilized in the NPF moves beyond merely a recounting of events to the establishing of an order and reasons for those events.

In this way, the process of science is fundamentally also a process of narrative formation, just conducted according to a very specific set of criteria (Fuchs 2015; Sheehan & Rode 1999; Wise 2011). Therefore, even though much of the current debate around epigenetics takes place in scientific circles and is conducted primarily in the language of science—and of genetics in particular—this debate is still as much a process of narrative formation, or an ongoing contest over how epigenetics is talked about and perceived both within and outside of its scientific contexts (Bruner 1991; Emery 1994; Jones & McBeth 2010), as it is a process of scientific discovery. And, as the NPF shows, narratives—even scientific narratives like those of genetics and epigenetics—are, like the epigenome itself, malleable and highly susceptible to internal and external influences at critical moments in their development.

Epigenetics, Politics and Narratives

According to the conventional perception of modern science, scientific (i.e., objective) methods on their own—in a vacuum, as it were—would ideally resolve the current disagreements between genetics and epigenetics by eventually determining the ultimate truth of these claims, usually understood as correspondence with empirical reality (Blackburn 1994, 81; See also Dawson & Gregory 2009). However, genetics, as with any modern science, is neither ahistorical nor insulated from the prevailing politics and ethics of its times. The intertwined histories of genetics and epigenetics reveal a

number of ways in which some of the foundational assumptions of genetics—in particular those which resulted in the decades-long exclusion of the interactivity of epigenetics—have been not only influenced by but also infused with political and ethical concerns, and vice versa. This overlapping scientific and political history is another one of the ways that epigenetics provides not only a unique lens through which to view the development of the science of genetics, but also a unique lens to view the evolution of politics during this same period. These historical and political influences on a science like genetics, though, are not perceptible through conventional positivistic scientific methods. What is required to understand the fundamental political and ethical challenges posed by epigenetics is an approach which is capable of explicitly incorporating these extra-scientific influences.

Epigenetics: Politics and Science

In this context, ideologies can also be considered a form of narrative. An ideology is “the shared framework of mental models that groups of individuals possess that provide both an interpretation of the environment and a prescription as to how that environment should be structured” (Denzau & North 1994/2000), or, more specifically, as the “set of beliefs about the proper order of society and how it can be achieved” (Erikson & Tedin 2003). The history of epigenetics presents a unique if unexpected example of the fundamental interconnections between science and ideology as narratives. In this way, epigenetics also suggests a unique model for analyzing politics and for predicting political change which will be laid out in more detail later, and which is the core of the analyses conducted in this dissertation.

For example, as will be discussed in more detail in a subsequent chapter, even though the science of genetics and epigenetics now seem to many to be so obviously and inevitably and inextricably linked, during the 1930s and 1940s and through the Cold War the prevailing sciences and narratives of epigenetics and genetics were often diametrically juxtaposed as key components of the two dominant competing political ideologies of the era (Adams 1991; DeJong-Lambert 2007; Gaissinovitch 1980; Graham 2004; Sapp 1994; Wrinch 1951). In the Soviet Union, epigenetics was sanctioned by the state as the only legitimate explanation of evolution and biological development; references to genetics were removed from textbooks and curricula, and over 3000 biologists are estimated to have been imprisoned and even executed for not renouncing the principles of genetics (Gratzer 2000; Joravsky 1970; Soifer 1994, 2001). In the United States, epigenetics was derided as ‘Soviet science’—similar to the ways in which Einsteinian relativity was discounted as ‘Jewish science’ by the Nazi scientific establishment (Gimbel 2012)—and scientists studying epigenetic phenomena were often ostracized with extreme vitriol and even blacklisted (Dejong-Lambert 2012; Gershenowitz 1984; Sax 1944; Spitzer 1949; Strand 1949; Zirkle 1959). To suggest that these decades of often bitter politically motivated antagonism had no effect on the development of the sciences of both genetics and epigenetics, and that genetics and epigenetics had no influence on these politics, strains credulity.

To wit, the effects of this ideology-based antagonism towards epigenetics still reverberate today in a number of ways. First, as will be discussed in more detail, in the almost complete lack of publication of research on epigenetics in the West during this

period; and, second, in the conceptual and empirical challenges presented to the orthodoxy of conventional genetics by contemporary epigenetics. If epigenetics had been incorporated into the Modern Synthesis of genetics as it was developing in the early 20th century—as it just as easily could have been—then the conceptual and empirical discrepancies introduced by epigenetics that are now so problematic would likely have been resolved long ago. Instead, conventional genetics developed along the particular trajectory that it did, with the exclusion or disqualification of substantial aspects of epigenetics, which is why the introduction of epigenetics now presents its not only its scientific challenges, but also its political and ethical challenges.

An important point—perhaps the central point of this dissertation—is that this exclusion from genetics of the interactivity suggested by epigenetics was no accident, but rather the result of the fundamental interconnection of biology, politics and ethics.

The antagonistic roles of the sciences of genetics and epigenetics in the defining ideological struggle of 20th century geo-politics as an indication of the fundamental interconnection of biology and politics is further buttressed by the fact that these ideological oppositions of genetics versus epigenetics in the 20th century actually have their roots in the social reform movements of the 19th century (Desmond 1985; Desmond & Moore 1994; Lenoir & Ross 1996). I further contend that these ideological juxtapositions of genetics-like theories and epigenetics-like theories—or the connection between biological science and politics and ethics—go all the way back to the origins of modern Western thought.

That the contemporary science of genetics is contingent on these historical and philosophical precedents likely seems trivial to laypersons and nonsensical to geneticists. Genetics, as a product of modern science, exhibits the patina of scientific objectivity which appears to negate these historical and cultural influences. However, one of the unanticipated benefits of this recent (re)emergence of epigenetics is how it exposes these hidden ethical assumptions of genetics—which are themselves reflections of the prevailing ethics of our time—against which epigenetics (potentially) proposes its own unique ethics and politics.

In other words, in posing the significant challenges to the science of genetics that it does, epigenetics also poses equally significant ethical and political challenges. An important difference, though, is that while these scientific challenges are readily apparent, these ethical and political dimensions are not—primarily because these ethical and political implications are often masked by the more obvious scientific differences between genetics and epigenetics.

There are a couple of important implications. On the one hand, the enduring longevity of these ideological oppositions throughout the formative periods of modern genetics calls into question the purity or ideological neutrality of the science which had kept the interactivity revealed by epigenetics so distinct from the atomism of genetics for so long. On the other hand, the recent emergence of epigenetics in the context of this history also suggests that perhaps these fundamental political and ethical oppositions which have held epigenetics so distinct from genetics for so long, and which now seem to be so quickly evaporating, are perhaps changing as well to become more

compatible with the narratives of the emerging science of epigenetics. To the extent that this is true, the recent emergence of epigenetics could signal a fundamental change in prevailing politics and ethics of contemporary society.

Likewise, this combined political and scientific history suggests that one of the reasons for the smooth acceptance of the science of modern genetics within contemporary society compared to the jagged history of epigenetics is that genetics-like theories have been somehow more compatible with the fundamental assumptions of the politics and ethics of modern liberalism, while the fundamental assumptions of epigenetics-like theories have been somehow incompatible with modern Western liberalism. One of the main goals of this dissertation is to illuminate some of these ‘hidden’ political and ethical aspects of both genetics and epigenetics as a means to illuminate the profound political implications of the recent emergence of epigenetics.

The Epi-politics Model

This suggestion of the role of biological science as a co-equal factor in the determination of historical and contemporary politics and ethics—not as a peripheral point of interest or a footnote, but as a full-fledged, fully vested partner—is unexpected.

To our contemporary eyes, science seems to be necessarily distinct from politics and ethics. However, this presumed separation of science from politics and ethics is a relatively recent phenomena. For most of modern Western cultural and intellectual history—meaning the history which has resulted in our contemporary modern Western liberal worldview—the study of what we now call science and the study of politics and ethics were inextricably intertwined. In fact, even Isaac Newton, who is generally

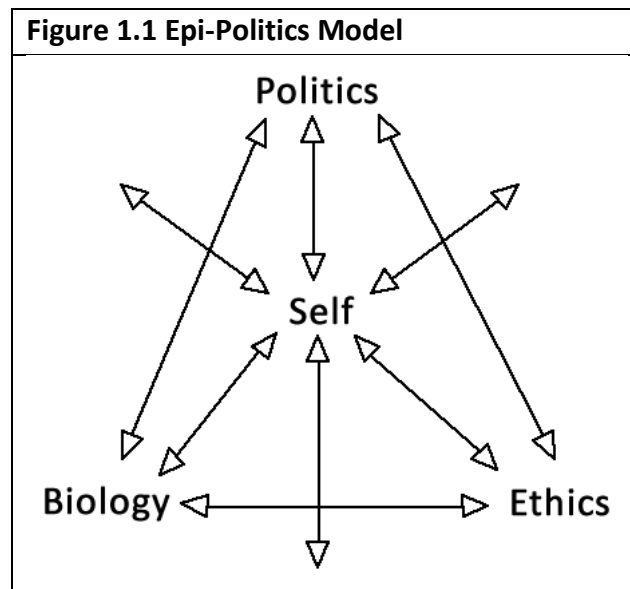
considered one of the fathers of objective modern science (Feingold 2004; Schliesser 2011, 2013), openly proclaimed the purpose of his scientific work was to provide irrefutable proof of God so that humanity might believe and behave according to God's will (Holton 1960, 59; Osler 2010, 162-163). However, even though modern science as a practice is now presumptively distinct from modern politics and ethics, because of this shared history they all share many of the same basic assumptions only now these assumptions are expressed in different idioms, applied to distinct domains and sublimated through the objectivity which makes science appear to be mutually exclusive from politics and ethics.

Contemporary genetics is a prototypically modern science. This identification has a couple of important implications: First, this identification indicates that genetics is conducted according to the objective methods which characterize conventional modern science; second, this identification also means that genetics shares these basic underlying assumptions in common with the prevailing modern Western liberal politics and ethics. From this common scientific and political history just mentioned, I suggest that because epigenetics presents explanations which do not fit into the reductionist and atomistic paradigm of genetics, many of the assumptions of epigenetics also do not fit into the similarly atomistic paradigm of the prevailing modern Western liberal politics and ethics, which is why epigenetics has been so ignored and even maligned for so long.

Epigenetics—or at least epigenetics-like explanations of biological origins and development—have been around even before the emergence of the modern theory of genetics, but are only just now emerging as valid descriptions of biology and

inheritance, and even still there is significant resistance to epigenetics. One of the main assumptions of this dissertation is that this resistance to epigenetics, while couched primarily in the language of science, is actually a mask for the political and ethical challenges which epigenetics presents due to many of its basic assumptions which do not coincide with the prevailing politics and ethics.

This multiplex of politics, ethics and biology as revealed by the history of epigenetics is the basis for the discussion of the political implications of epigenetics. These relationship are illustrated in the model displayed below in Figure 1.1 and elaborated in more detail in a subsequent chapter:



I call this model the “epi-politics model” because just as *epi*-genetics denotes important regulatory influences on the expression of genes from processes ‘above’ or ‘before’ or ‘in addition to’ genetics, *epi*-politics denotes important regulatory influences on the expression of politics from processes ‘above’ or ‘before’ or ‘in addition to’ politics—specifically, that our understanding of our biology interacts with our prevailing

ethics and our politics, all of which produce the prevailing concept of self at the center of the model as at the center of a society. In drawing these parallels between epigenetics and the epi-politics model, though, the proposed components and mechanisms of the epi-politics model should be considered as only conceptually isomorphic with epigenetic mechanisms, and not a strict correspondence (i.e., while the concept of self at the center of the epi-politics model is conceptually similar to genes in an epigenetic model, I make no claims as to how far this metaphor can be stretched until it breaks).

In particular, this model explicitly introduces the often overlooked linkages between our politics our ethics and our biology (to be understood as the prevailing descriptions of the physical composition of humans and of our physical relationships with each other and with our environments). How we describe our physical origins and physical development necessarily informs our metaphysical concepts of our self, which necessarily informs our ethics, which ethics are then translated into and manifest through our politics. However, as shown by the bi-directional arrows in Figure 1.1, a change in any one of these factors unavoidably influences all the other elements in this model in a homeodynamic network (Lloyd, Aon & Cortassa 2001).

The self as an atomistic and autonomous individual is the organizing principle of contemporary modern liberal society, as the locus of action and accountability in politics, in economics, in law, etc. (Geertz 1975; Jenkins 2014; Lambek 2013; Mauss 1985; Szokolczai 2013). As described by Larry Siedentop in his 2014 book *Inventing the Individual: The Origins of Western Liberalism*, even though this concept of the self seems

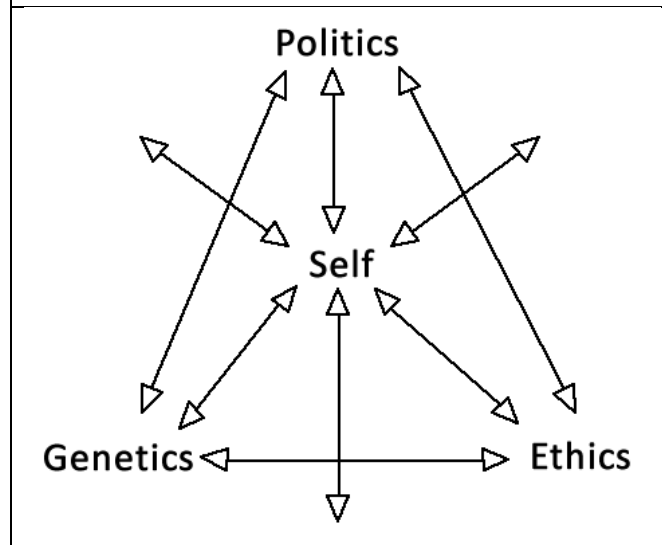
self-evident and natural to us today, it is actually the contingent product of centuries of history, as are our science, ethics and politics.

Per the epi-politics model in Figure 1.1, this uniquely Western concept of self developed apace with commensurate developments in biology, ethics and politics. This concept of self as the physical and metaphysical locus of responsibility for right and wrong action is therefore centrally located in this model, between the prevailing understanding of biology, the prevailing ethics and the prevailing politics.

The necessity for this basic congruence between biology, politics and ethics is practically semantic: To the degree that any one of these elements changes and begins to diverge too far from any of the other elements, adjustments must be made to either the diverging element or to the other elements for each of these elements to maintain their commonly understood meanings. These adjustments can take many forms, such as scientific 'saving' moves (Bogen and Woodward 1988; Basu 2003; Massimi 2007) which re-align the biology with the prevailing politics and ethics, or political and ethical innovations like those detailed by Siedentop (2014) which more properly reflect the underlying changes in the prevailing concept of self.

Therefore, to truly understand the history and the underlying assumptions of contemporary politics, for example, requires the incorporation of the history and the underlying assumptions of the contemporary science of genetics, as the predominant contemporary biological explanation of human origins and development, and vice versa, as shown in Figure 1.2 below:

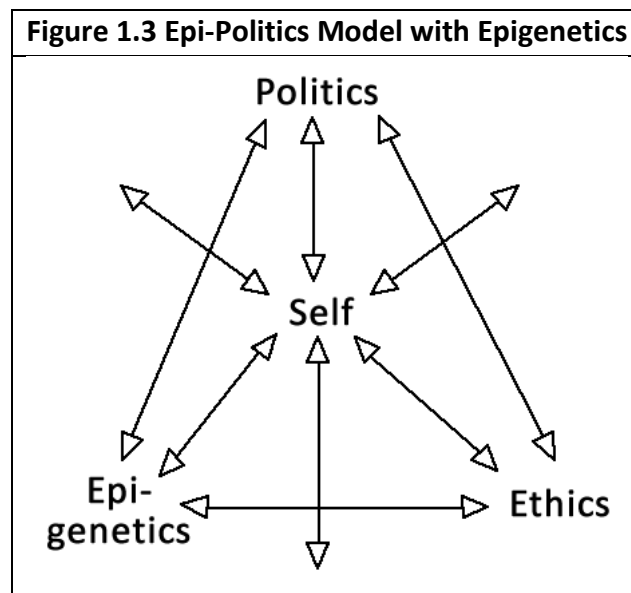
Figure 1.2 Epi-Politics Model with Genetics



For example, it is as difficult to imagine the long-term maintenance of a politics that is fundamentally at odds with the prevailing ethics of the time (e.g., a hereditary monarchy coupled with an ethos of the self as an autonomous individual), as it is to imagine a biology which assumes that nature is organized into rigorous biological hierarchies coupled with that same ethos of the self as an autonomous individual and a radically democratic politics. In these scenarios, all the elements must eventually move towards congruence so that these elements are at least compatible (for example, the hereditary monarchy changing into a representative democracy).

According to Figure 1.2, adjustments to the introduction of genetics by the other elements identified in this model must and will take place. To suggest that the prevailing concept of biology would be allowed to remain indefinitely at odds with the prevailing ethics and politics, or that a politics and ethics would remain indefinitely at odds with the biology, would rob each of these concepts of their meaning.

That the biological and ethical and political are all knit from the same cloth suggests a couple of things: First that the longstanding and almost universal acceptance of genetics in modern society is a demonstration that the scientific assumptions of genetics dovetail with the basic assumptions of our prevailing ethics and politics. Second that much of the scientific resistance against epigenetics stems from the “ethical exceptionalism” of epigenetics (Rothstein 2013), and not necessarily the scientific invalidity of the proposition of epigenetic mechanisms. Thus, per the epi-politics model as shown in Figure 1.3, the extent to which epigenetics does introduce fundamental changes to the conventional understanding of genetics is the same extent to which epigenetics should cause modifications of the prevailing politics, ethics and the prevailing concept of self.



As such, an important component in the analysis of the science and the politics of epigenetics is to begin to untangle the scientific from the ethical and political, so that

as much as possible the scientific issues around epigenetics can be treated scientifically, and the political and ethical components of this emerging narrative of epigenetics can be dealt with as political and ethical issues.

Another interesting area of consideration suggested by this epi-politics model, is that a science of genetics which from the start incorporated the interactivity of epigenetics and its now unique causal mechanisms (e.g., the responsiveness of gene-level expression to environmental influences, transgenerational non-genetic inheritance, etc.) would also have influenced the coterminous development of the politics and the ethics over the course of the 20th century to reflect these epigenetic mechanisms.

What these epigenetics-informed politics and ethics would have been is an interesting subject to consider. One tantalizing suggestion is that epigenetics-type explanations were sanctioned by the Soviet state under Josef Stalin as the only valid biology; likewise, Karl Marx and Friedrich Engels who originally conceived of the value theory of labor and of Communism were similarly proponents of Lamarckism as providing the scientific support for the thesis that it was the inheritance of characteristics acquired through labor which eventually transformed apes into humans (Engels [1876] 2001; Foster 200). The model in Figure 1.3 illustrating the necessary connections between a biology (epigenetics, in this case), a politics and an ethics therefore suggests that the assumptions of epigenetics, or at least of epigenetics-like theories, therefore lend themselves to anti-capitalist, collectivist and socialist—possibly even totalitarian—politics and ethics.

However, by the same token, the world renowned 19th century biologist and philosopher Herbert Spencer, who actually coined the phrase ‘survival of the fittest’, and who is associated most prominently with the misnamed concept of Social Darwinism (Leonard 2009), advocated for a highly individualistic politics and ethics based primarily on Lamarckian theories of biology and evolution. Contrary to Marx, Engels and Stalin, Spencer was no collectivist or statist—for example, one of his most well-known books is titled *The Man versus the State* (1884), and he is often identified as a forerunner of American libertarianism and a “radical for capitalism” (Doherty 2009). For Spencer, Lamarckism was the best explanation for evolution because it coincided with his deeply held belief that “in the struggle for existence, self-improvement came from conscious, planned exertion, not from the chance variation and natural selection that are the heart of Darwinism” (Leonard 2009).

In other words, diametrically opposed recommendations for politics and ethics came out of the same basic biology. This duality might seem to contradict the analytical power of the epi-politics model, but it actually raises a couple of important points: First, the model only says that the prevailing biology, politics and ethics will be brought into congruence with each other, not that the biology determines the politics and ethics, or vice versa. This highlights again the importance of narratives for the analysis of science and politics. As discussed before, the force of narratives is not a function of their correspondence with some empirical reality but rather of their persuasiveness and their effectiveness in motivating action. In this way, there is no contradiction if ideologically opposed politics and ethics arise from the same biology; what the model suggest from

this opposition, though, is that the differences will likely be in the composition of the narratives and/or in the concept of the self at the center of the model (which differences would also be a function of differences in the prevailing politics and ethics).

Second, neither the ideas of Spencer or Marx and Engels were ever implemented in the world as theorized. Thus, it is difficult to say with any certainty that their proposed configurations of politics and ethics and biology were actually compatible as theorized. Instead, all we do know is that neither the politics of the Soviet Union nor its state-sanctioned support of epigenetics-like biologies lasted, and that the combination of the atomistic science of genetics and the equally atomistic ethics and the politics of modern liberalism have lasted so far (Fukuyama 1992). By the same token, though, just as the eventual renunciation of epigenetics-like theories in the Soviet Union preceded its fundamental change in politics, the recent emergence of epigenetics does suggest that significant ethical and political changes are also on the way in contemporary modern liberal societies. This dissertation is therefore a first step in the verification of the epi-politics model through the linking of changes in biology (i.e., the introduction of epigenetics) with potential changes in politics and ethics, as well as a first step towards the possible identification of these commensurate changes in politics from this emerging change in biology.

Obesity, Narrative, Ideology and Epigenetics

To begin to see if—per the epi-politics model—epigenetics is introducing novel political and/or ethical modifications, I analyze the emerging narratives of epigenetics relative to the narratives of obesity. I do this in Chapters VI and VII through empirical

analyses of both the existing narratives of obesity and the emerging narratives of epigenetics as reported in major media sources (the New York Times and the Wall Street Journal).

To my knowledge, this dissertation is a first effort to establish empirically what the narrative of epigenetics looks like. My ultimate intention in this narrative analysis is to compare the emerging narratives of epigenetics with the current narratives of obesity, to see if the narratives of epigenetics are similar to or different from the narratives of obesity.

Although this narrative analysis is focused on obesity in particular, the results can be extrapolated to other policy domains as well if only by providing a baseline of comparison. Also, this narrative analysis of epigenetics also provides a test of the epi-politics model. If epigenetics is fundamentally different from genetics, which is already congruent with the prevailing politics and ethics, the model predicts that the narratives of epigenetics will also be different from the narratives of the prevailing politics and ethics. However, if epigenetics is ultimately nothing new, then the epi-politics model predicts that the narratives of epigenetics will likewise not introduce anything new to politics or ethics.

Chapter II

The Epi-politics Model

As discussed in the previous chapter, I assert that the findings now emerging from epigenetics not only challenge many of the basic assumptions of the science of genetics, but also challenge the basic assumptions of our contemporary politics and ethics. As I will show, these dual challenges of epigenetics to both the science of genetics and our politics and ethics are a function of the long common history of science and politics and ethics. However, an important point is that the focus is on the narratives of genetics and epigenetics, which may be only loosely related to the science of genetics and epigenetics; as such, the science of genetics and epigenetics may be ultimately reconcilable, while the narratives of both can still exhibit substantial differences.

To our contemporary eyes, science seems to be necessarily distinct from politics and ethics. However, this presumed separation of science from politics and ethics is a relatively recent phenomena; for most of modern Western cultural and intellectual history—meaning the history which has resulted in our contemporary modern Western liberal world—the study of what we now call science and the study of politics and ethics were inextricably intertwined (Dear 2005; Grant 2007; Harrison 1998, 2001; Lindberg 1992). Even though science as a practice is now presumptively distinct from politics and ethics, because of this shared history they all share many of the same basic assumptions, only now these assumptions are expressed in different idioms which make them seem mutually exclusive.

Contemporary genetics is a prototypically modern science. By this I mean that not only is the study of genetics practiced according to the conventional modern epistemologies and ontologies which would be recognized by most as ‘scientific,’ but also that it shares these basic underlying assumptions in common with the prevailing modern Western liberal politics and ethics.

Contemporary epigenetics, as a proper subset of genetics, is likewise a prototypical modern science in practice; what I assert is different about epigenetics is that because epigenetics did not develop apace with genetics and modern Western liberal politics and ethics—because of the unique scientific and historical contingencies of its development—the assumptions of epigenetics present explanations which do not fit this common paradigm. Epigenetics, or at least epigenetics-like explanations of biological origins and development, have been around even before the emergence of the modern theory of genetics, but are only just now emerging as a valid description of biology and inheritance, and even still there is significant resistance. One of the main assumptions of this dissertation is that this resistance to epigenetics, while couched primarily in the language of science, is actually a mask for the political and ethical challenges which epigenetics presents.

As discussed in the previous chapter, the assimilation of genetics into modern liberal society was remarkably rapid and smooth, especially compared with the long strange history of epigenetics. One of the main reasons genetics was accepted as easily as it was is because its basic assumptions reflect the basic modern liberal assumptions upon which our contemporary politics and ethics are based. In contrast, the resistance

to epigenetics goes beyond a mere science-based disagreement about methods and is rather at heart a political and ethical disagreement. This disagreement arises because our contemporary politics and ethics as currently constituted are in many ways incapable of assimilating the causal mechanisms and explanations such as transgenerational inheritance which are introduced by epigenetics.

In essence, I am proposing a model of political change based on the new knowledge of human biology introduced by epigenetics. A linear depiction of my model in this case would look like:

$$\text{Epigenetics} \rightarrow \Delta(\text{Genetics}) \rightarrow \Delta(\text{the Self}) \rightarrow \Delta(\text{Ethics}) = \Delta(\text{Politics})$$

or that as epigenetics modifies our understanding of genetics so is modified the concept of self of which our contemporary understanding of genetics is such a significant component, which in turn modifies the ethics derived from this concept of self, which then will manifest as changes in the politics—to be understood more as systemic change in philosophical and ideological justification rather than merely as changes in regimes (i.e., this model is likely not applicable to predicting mid-term election swings—although it could help to explain the overarching political or ideological positions at play in a mid-term election).

This formula is the essence of what I propose regarding the implications for contemporary politics from the introduction of epigenetics. However, a significant caveat is that political and historical reality are not as linear and straightforward as suggested by the above formula. In particular, instead of a unidirectional causal path, each of the elements in this formula influence and are influenced by not only all of the

other elements specified in this model but by other influences which not specified in the model.

The General Model

As will be shown, the formula above is only one possible iteration of a more general model for explaining political change as connected to changes in biological concepts. Thus, the unidirectional path shown above—while perhaps a fitting heuristic of my model of the (potential) political impact of epigenetics on contemporary politics—is only one such iteration of a more general model.

This more general model is diagrammed in Figure 1.1 from the previous chapter, in which every element influences and is influenced by every other element (as are the unspecified elements) such that the causal arrows are bi-directional.

An important feature of the epi-politics model, as indicated by the bi-directional arrows in Figure 1.1, is that all of these elements are capable of influencing and being influenced by each other, such that there is no one single linear chain of cause and effect. As all elements are potentially influenced by each other, there are any number of possible mappings of changes in politics or changes in ethics or even changes in biology, and thus no one single exclusively valid mapping of political change or of change in any of the components of this model. Changes in ethics can effect changes in biology, just as changes in politics can effect changes in ethics, and so on. However, this dissertation focuses on the influence of the vertex of biology on the other vertices and on the concept of the self at the center. However, there are a couple of points that need clarification.

Biology and the Self

In particular, this model explicitly introduces the often overlooked linkages between our politics our ethics and our biology. Biology in this context is to be understood as the identification of the physical composition of humans and the description of our physical relationships with each other and with our environments. This model suggests, then, that how we understand our biology is therefore inextricably linked to how we perceive ourselves—and more literally our *selves*. These biological and metaphysical conceptions of how we understand ourselves inevitably constitute core aspects of our ethics, or our concepts of what is right and wrong behavior, which are then translated into and manifest as our politics.

This connection with the concept of self at the center of the model is why I limit the epi-politics model to biological science and not science in general. Other modern sciences such as physics and astronomy have had indelible impacts on politics and ethics in fundamental ways, but these sciences—at least in their modern incarnations—do not deal fundamentally with the ontological distinctions that are the focus of biology.

While a good case can be made that the sciences likewise influence each other in a similarly homeodynamic network, such that changes in the understanding of physics precipitate changes in the understanding of biology and so on, the link between those changes in physics to subsequent changes in the concept of self at the center of our politics and ethics would likely have to go through biology anyways. Thus, the science of

relevance in the epi-politics model is biology because of its direct connections with the concept of self as the organizing principle of our politics and our ethics (Siedentop 2014).

Biology, Ethics and Causal Reasoning

Another point of clarification is in regards to “Ethics” in the lower right vertex in Figure 1.1. By *ethics* is meant the conventional understanding as the definition and discussion of the proper course of conduct. In the epi-politics model this means that as the understanding of biology changes, and/or the concept of self changes, and/or the prevailing politics change, so also necessarily changes the understanding of what is right and wrong behavior.

However, as the focus of this dissertation is on the novel policy implications of epigenetics and not the implications of epigenetics for ethics, I do not have the time or the space for an in-depth analysis of ethics *per se*. Even so, the concept of causal reasoning as utilized by Deborah Stone in her seminal book *Policy Paradox* provides a strong conceptual link between policy narratives and this conventional understanding of ethics.

In Chapter 8 of *Policy Paradox*, titled “Causes,” Stone compares the scientific identification of the causes of problems with the political identification of causes of problems. In the former case, true or truer causes for a problem are sought, the identification of which allows for the resolution of the problem. In the latter case, the identification of causes is also used to assign responsibility for the problem. “In policy

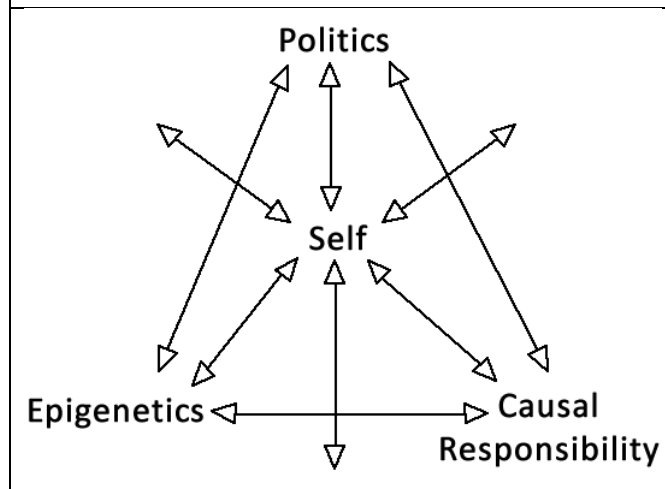
and politics,” Stone writes, “the distinction between actions that have purpose, will, or motivation and those that do not is crucial” (190).

In other words, political causal stories are unique for their focus on ascribing intention. While scientific attributions of cause are assumed to be neutral and objective, the causal narratives of politics, Stone writes, are “strategically crafted,” often with “symbols and numbers,” and then “asserted by political actors who try to make their versions the basis of policy choices” (189). In contrast to the scientific identification of causes, to identify a cause in politics, Stone writes, “is to place burdens on one set of people instead of another” (189).

The connection of these political causal stories with the conventional understanding of ethics in the lower right vertex of Figure 1.1 is that in establishing causal responsibility—either as credit or blame—these narratives also thereby “legitimize and empower particular actors as ‘fixers’ of the problem” (204). This identification of both the cause of and therefore the solution to a problem sets up a basic ethical scenario: If the cause of the problem is identified along with the party capable of and responsible for resolving that problem, then by almost any meaningful conception of ethics that party is therefore justifiably expected to resolve that problem to the best of their ability; the failure to follow through in such a scenario is by definition an ethical failure.

Thus, the conventional understanding of ethics in the epi-politics models is isomorphic, if not identical, with these political causal narratives. The incorporation of these causal narratives into the epi-politics model would look like this:

Figure 2.1 Causal Vectors for the Influence of Epigenetics in the Epi-Politics Model



Or that as the new knowledge introduced by epigenetics changes the prevailing concept of self, so also change the ascriptions of causal responsibility (i.e., who is responsible for what), which in turn also changes the resulting politics. Thus, in the context of this dissertation and its focus on policy narratives, “Ethics” in the epi-politics model should be interpreted as attributions of causal responsibility. The intent and the outcome is the same.

However, an important consideration to mention at this point is that in contrast to the scientific identification of causes, “in politics, causal theories are neither right nor wrong, nor are they mutually exclusive” (197). This ambiguity sets up an interesting juxtaposition of science-based narratives and political causal narratives. As Stone explains, “finding the true or ultimate cause of harms in these policy areas is not what it at issue. Rather, the fight is about locating moral responsibility and real economic costs

on a chain of possible causes. The location is dictated more by the political strength of different groups...than by any statistical proof or causal logic” (207).

Thus, even in such prototypically modern scientific domains such as contemporary epigenetics and genetics, the political use of that science in the resulting causal narratives may or may not accurately reflect the underlying science. In fact, as will be discussed in more detail in a subsequent chapter, a primary assumption about the emerging narratives of epigenetics is that they will reflect the ideological biases of their sources, and thus be neither right or wrong in a scientific sense, or both ‘right’ and ‘wrong’ at the same time. Regardless, according to the epi-politics model depicted in Figure 2.1, even if epigenetics ultimately does not introduce anything novel from genetics in a scientific sense, the causal narratives it produces can still have sweeping effects on the prevailing concept of self, and the attributions of ethics *qua* causal responsibility, and therefore the prevailing politics.

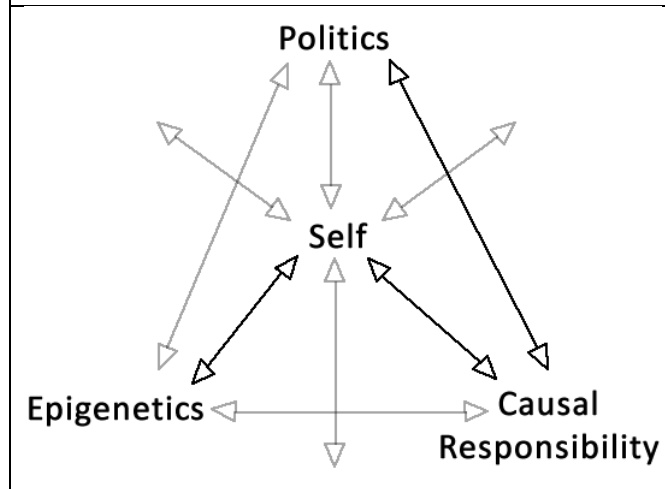
Biology, Politics and Ethics in History

The political and intellectual history of the West is marked by many such fluxions, in which the prevailing politics and ethics have been influenced by changes in the understanding of our biology, just as our understanding of our biology has been influenced by changes in politics and ethics *qua* causal responsibility. The balance of this chapter and the next will employ this model in mapping this often overlooked intersection of biology, morality and politics, in the context of contextualizing the (potential?) political and ethical effects from the recent emergence of epigenetics.

In particular, as discussed in the previous chapter, I approach the impact of epigenetics for politics via the challenges epigenetics presents to the popular or prevalent understanding of genetics. I do so by tracing the common intellectual history between how genetics conceptualizes our genes and the prevailing concept of self as the basic unit of action and accountability in contemporary society. Because of this common history between the knowledge that constitutes the science of biology and the philosophical and metaphysical descriptions that inform our politics and ethics as posited in this model, the scientific challenges of epigenetics to the assumptions of conventional genetics mirror the philosophical challenges of epigenetics to this prevailing concept of self upon which are built our contemporary politics and ethics.

As such, while Figure 1.1 is the general model for mapping this often overlooked intersection of biology, morality and politics, the more specific model for the proposed political and ethical implications of epigenetics is Figure 2.1 in which “Epigenetics” is substituted for “Biology” in the lower left vertex of Figure 1.1 as the element which both influences and is influenced by both ethics and by politics. However, the specific vector of causation I focus on is diagrammed below in Figure 2.2 in which the causal arrows are uni-directional and in bold to reflect the vector of the specific relationships I propose regarding the political effects of contemporary epigenetics compared to the other possible vectors of causation.

**Figure 2.2 Causal Responsibility
in the Epi-Politics Model**



Establishing and testing the links between epigenetics and genetics and conventional politics and ethics *qua* causal responsibility as posited in the epi-politics model are a primary project of this dissertation. This presentation will be accomplished through brief descriptions of critical historical moments and of important figures in the development of the contemporary science of genetics, through literature reviews, and through empirical analyses. These brief histories are particularly important for showing not only how the modern science of genetics has developed coeval with our contemporary politics and ethics *qua* causal responsibility, but also how epigenetics has also been inextricably intertwined throughout this political development often in unexpected or unrecognized ways. These historical vignettes will also show different ways the politics or ethics of a particular time have influenced the biological science of that time, and vice versa. These historical examples are also necessary to demonstrate how strong the links are between the different elements in this model.

To reiterate, through the epi-politics model I am not just asserting a transitory or peripheral or epiphenomenal connection between biology, ethics and politics. I maintain that the causal connections between these three elements and the central concept of self are deep and necessary—to the point of being tautological and semantic (i.e., the concepts of ‘politics’ and ‘ethics’ and ‘biology’ would lose their conventional meanings if they are held to be independent of each other). For most people, and life scientists in particular, I imagine the proposition that politics and ethics have had and will likely continue to have such a strong influence on biology is going to sound absurd if not ludicrous; likewise, for many political scientists the proposition that biology has had such profound effects on our politics and ethics is going to sound equally absurd. The examples presented in this chapter and the next few chapters will demonstrate just how much interaction there has been between science, ethics qua causal responsibility and politics throughout the history of the West, and how incomplete are accounts of changes in science, ethics or politics without reference to the others.

Before all of these historical and empirical examples, though, the almost tautological connections between biology, ethics qua causal responsibility and politics will be established. Without this necessary interconnectedness of biology and ethics qua causal responsibility and politics, the introduction of epigenetics would be of little actual consequence to politics other than as informing policy; with this interconnectedness, though, epigenetics as a new source of knowledge about human biology has significant political and ethical implications that are as yet unexplored. This necessary consistency

between the biological the ethical and the political will be first illustrated via a simple thought experiment in the next section.

Thought Experiment: Biology, Ethics and Politics in a Perfect World

Consider, for example, a hypothetical society with a perfectly democratic (i.e., representative) political system. This society also has one overriding ethical imperative: To not intentionally harm oneself. However this ethical imperative originated and was promulgated, it is now felt as obviously and self-evidently true by the overwhelming majority of people in this society. Now consider that the biologists of this society have also established as scientific fact that all living things are inextricably connected with each other at a biological level such that harm to other living things equals harm to one's self. Altogether, what harms or benefits other living things likewise harms or benefits me; therefore, to not harm myself per the ethical imperative involves not harming those other living things, such that those other things 'out there' are integral parts of me as well. Therefore, the prevailing concept of self which results from this ethics and biology is of an expansive and embedded self which extends beyond the boundaries of human skin (Bentley 1941).

Now consider that the politics of this society—as the processes through which laws are legislated and enforced by the political organs of this society—are premised upon a concept of people (i.e., selves) as equally created, independent, and autonomous individuals. By this is meant that, in terms of the politics, people are treated as if they born with the same basic physical and mental capacities, that their preferences and choices emanate from within themselves and are not contingent on

external influences, and that people are capable of and responsible for their own decisions. Because there is no fundamental interconnection between other people and other things, and because people are assumed to be equal but ultimately responsible to look out for themselves, this concept of independent and autonomous selfhood allows—if not encourages—people to pursue policies which may cause harm to other people or things. In other words, the politics of this hypothetical perfectly democratic society allow behavior that violates this sole ethical imperative as interpreted according to the prevailing biological science.

In such a circumstance, there are two ways to interpret this seeming incongruity between the politics and the ethics and the biology:

1. Politics, ethics and biology are distinct and independent domains, so there is no necessity for consistency between them, and therefore there are no contradictions or inconsistencies to be resolved.

Or

2. Something is fundamentally wrong with the politics which has resulted in this contradiction between the politics and the ethics and the biology of this society.

The first option is valid only to the extent that the findings of biology actually have no bearing upon ethics, which likewise have no bearing on politics, and vice versa (i.e., that these are independent domains). Just in terms of basic language this seems an obviously untenable proposition, particularly in terms of ethics and politics. After all, one of the foundational definitions of politics is as “the authoritative allocation of values” (Deutsch 1963; Easton 1965), so of what force or importance are ethics if they are excluded from consideration in politics? At a purely semantic level this separation of

politics from ethics would rob both terms of their usual meanings. The less obvious contradiction comes from the connection between ethics, politics and biology, but I assert that the semantic and logical connection is no less direct.

To wit, politics are the collective expression of an ethics as proscriptions for right and wrong and behavior. Ethics qua causal responsibility therefore necessarily involve definitions of what constitutes an ethical agent, which includes the definition of what constitutes an agent (i.e., what acts) and what does not (i.e., what is acted upon), and of how these ethical agents are able to act as the loci of action and responsibility. These definitions must come from somewhere, which is how biology enters the picture as an irreducible factor in the functioning of politics. Of what force or importance is a biology which does not inform these conceptions of self, or pertain to the ethics qua causal responsibility which result from this concept of self? What would be the use of a biology, the conclusions of which are not actionable knowledge? Would such a biology even be called a science, given the conventional use of the term, or would it be considered a pseudo-science like astrology which is often conducted in a very precise scientific method, but which is considered as a guide for behavior only by the gullible and uneducated?

The second option, though, that there is something fundamentally wrong or at odds in this scenario, maintains the common understanding of politics and ethics and biology. There are any number of plausible scenarios that can account for this disconnect between the ethics qua causal responsibility of this society and its politics, but what is revealing about this hypothetical example is the almost inherent need for

some kind of reasonable explanation of this inconsistency as a result of the usual understanding of politics and ethics and biology.

Biology, Ethics and Political Legitimacy

Ultimately, as revealed by this thought experiment, one critical factor linking the different elements of the guiding model of this dissertation is the legitimacy of a politics. Political legitimacy is defined as the generalized perception that the actions of a government are “desirable, proper, appropriate within some socially constructed system of norms, values, beliefs, and definitions” (Suchman 1995), or more colloquially that a government’s policies are perceived as “the right thing to do” (Dingwerth et al. 2014; Hardy 2014). In other words, the legitimacy of a political system depends upon the degree it reflects the ethical standards upon which that system is justified. In this way, as described by Figure 2.2, to the degree that epigenetics influences the prevailing ethics qua causal responsibility or the concept of self is also the degree to which the politics will also change in order to maintain congruence with these ethics and this modified concept of self.

Ethics and Political Legitimacy

Of the three edges of the epi-politics model, the least controversial connection is that between ethics qua causal responsibility and a politics. For all practical purposes, there is a tautological relationship between ethics and politics. In order to make sense of the lack of congruence posited in this hypothetical example the only reasonable explanation is that the political system has broken down; any other explanation is a semantic—if not a logical—contradiction.

In the actual world, as Judith Shklar (1979) observes, history shows that in the long run a government maintains its legitimacy primarily “by reinforcing the ideological values upon which it is based” and that “no one can hope to govern without reference to these values [because] it is neither psychologically feasible nor politically possible to evade them.” This legitimacy presupposes a particular set of values—what John Rohr (1988) called “regime values”—which inform the acceptable ethical norms within a polity and which are discoverable in the public laws passed by that regime. These are the ultimate values against which are judged the actions of citizens, the government, and government agents. If a conflict develops between the actions of a government and these values, either the actions of the government must be brought into alignment with these values (or made to seem as if they are in alignment), or the values must somehow be changed (which changes are made more difficult if the regime values are codified in a written Constitution), or questions about this disconnect between values and actions are suppressed through the threat and ultimate exercise of ever greater levels of coercive force (which can be quite expensive).

Beyond contradictions with these regime values causing crises of legitimacy, though, are possible contradictions of government actions with different sets of values held by people outside of and within government. For example, according to the non-violent revolutionary tactics of Gene Sharp, who because of the effectiveness of his tactics around the world has been called the “Machiavelli of nonviolence” and the “Clausewitz of nonviolent warfare” (Weber 2004), one successful revolutionary tactic is demonstrating the incongruence between the values espoused by the regime in power

and the values held by the majority of people through the contrast of violent government action with nonviolent resistance. This “political *jiu-jitsu*” has been a powerful tool in too many real world changes of regime to list (Sharp 1973).

In the hypothetical example described above, the inconsistency between politics and ethics could result from a small cadre in this hypothetical society who for whatever reason are neither internally nor externally compelled to adhere to his sole ethical imperative, and have been able to commandeer the political process and shape its assumptions to match their own (although how this political takeover can have occurred in the first place in this perfectly democratic society requires an explanation of its own). However, because of the conflict of their politics with the prevailing ethics qua causal responsibility, in a perfectly democratic society these offending politicians will be removed from office at the next possible opportunity.

The only peaceful ways for the cadre to avoid such a fate are through modifying the politics (to not be democratically representative) or the ethics (to allow for the harming of others as not constituting harm to one’s self) or the biology (from the biological interconnectedness of all living things to the biological independence and autonomy of individuals). Any one of these would be sufficient to mitigate the crisis of legitimacy which inevitably arises from the inconsistency described in the example. The important point, though, is how even in the discussion of the connection between ethics and politics, biology still has an important role to play.

This thought experiment also highlights the role of biology in either enhancing or undermining the legitimacy of a specific politics via its interaction with the ethics as

portrayed in the model in Figure 1.1. In other words, the more congruency between a politics and a prevailing ethics qua causal responsibility and a biology, the more support for those politics; to the extent that the politics do not match an ethics or that this ethics qua causal responsibility is contradicted by the biology is also the extent to which those politics are considered illegitimate. This enhancing or undermining role of biology in regards to ethics and politics is the source of my project regarding epigenetics, as illustrated in Figure 2.1.

Biology to Ethics to Politics

The longstanding definition of politics as the ‘authoritative allocation of values’ connects politics with ethics, but does not of itself make clear the connection of biological sciences such as epigenetics with either politics or ethics qua causal responsibility. However, there is a profound and necessary connection between politics, ethics and biology.

One often unrecognized connection of biology with politics, as writes Eugene Meehan, is that science is actually one of the prerequisites to morality because “where there is no knowledge there can be no choice,” and that “science (which is essentially capacity to act) actually *requires* mankind to be moral by forcing choice” (Meehan 1982).

This idealized example also illustrates the connection of science with the prevailing ethics and politics by demonstrating the necessary dialogue between the findings of biology and the composition of an ethics. In this hypothetical example, the biological fact established beyond a reasonable doubt (i.e., what is) is then combined

with the sole ethical imperative of this society to not intentionally harm oneself (what ought to be) to produce the expectation that legitimate politics reflects the protection of all living things as the extension of oneself. This biological fact does not of itself provide either the ethical imperative or the political expectation. In other words, there is no fallacious *appeal to nature* here—no ‘ought from an is’ per David Hume’s famous dictum (Hume 1888); rather, the biology provides an epistemic context for the application of the ethic, which is then translated into political expectations. This is the role I propose for epigenetics.

One way that biology fulfills this role in moral decisionmaking, as in the hypothetical example, is through establishing the necessary materials for ethical action. Although changes in biological sciences as exemplified by epigenetics may not provide the ethic they can provide the context for the application of the ethic, which is then manifest through the politics. For example:

Epistemic knowledge that smoking causes cancer [i.e., biology], in itself, does not have any clear policy implications. It has to be combined with phronetic arguments as to why the causes of cancer should be addressed [ethics], and practical-technical arguments about whether desired reductions in smoking are practically feasible [politics]. Phronetic claims that harm should be avoided are substantially strengthened if there is epistemic evidence that pinpoints the causes of harm, and that such causes can be manipulated by policymakers. None of these types of arguments, by themselves, would amount to a comprehensive case for restricting smoking in public places, or for raising taxes on tobacco. It is the combination of all three that builds a coherent policy argument (Tenbernsel 2006).

In other words, one way that a science such as biology impacts politics and connects with ethics is by providing the physical context for the actions of government—for example, by establishing and delineating the causal mechanisms of

harms from activities such as smoking—which actions must then reconcile with the prevailing accounts of ethics qua causal responsibility in some way in order to maintain political legitimacy.

In the preceding example, there was no fundamental change in biology just an increased awareness of what smoking does and how smoking does it; and the epi-politics model suggests that there will be a corresponding adjustment in the politics and ethics. What this also suggests, though, is that to the degree the understanding of biology does change—as with the introduction of epigenetics—so also should change the ethics and the politics. In this context, if the new knowledge introduced by the science of epigenetics does in fact introduce all new assumptions, then the epi-politics model predicts a commensurate response in the politics and ethics and concept of self. However, there are some important nuances which must be recognized before the model is applied.

To illustrate, assume that the sole ethical imperative of the hypothetical society from before is still the same, but that there has been a revolution in biology and the biologists of this society now assert that there is a heretofore undiscovered but no less fundamental biological separation between humans, other humans and non-humans. Instead, very specific biological mechanisms have been identified through which all humans are born with the same basic endowments, and through which the biological cores of humans are insulated from their environments (i.e., we are all created equal and independent), such that harm to another living thing is no longer akin to harming oneself. Given the magnitude of the change in biology, the prediction of the epi-politics

model would seem to be that there must be equally revolutionary changes in the politics and ethics.

These changes may be obvious, such as a switch from a hereditary monarchy to a representative democracy, but then again the changes may not be so obvious but no less fundamental. For example, in this new hypothetical circumstance, there is now no conflict between the prevailing ethical imperative and the politics of the previously unethical minority from before. Ergo, the politics of this minority are now perfectly legitimate without a change in the politics (i.e., the politics are still perfectly representative). This is a significant and substantive change resulting from this revolutionary change in biology, although the politics themselves did not change.

Likewise, the sole ethical imperative to not harm oneself can also remain as is while there can still be significant and substantive changes in the realm of ethics from this revolutionary change in biology. Because of the revolution in biology, this ethic is now being applied in the context of independent and autonomous individuals, not dependent and interconnected parts of a greater whole, so now the ethic of not harming oneself applies just to the person of the individual agent. This narrowing of ethical focus allows actions that would have previously been considered unethical to now be accepted as ethical. These changes in the acceptance of what was previously unethical behavior are revolutionary in any sense of the word, even though there has been no actual change in the ethos itself, but only a change in the biology which informs the ethos.

In other words, there can be revolutionary changes in politics and the ethics from a revolution in biology while the politics and the ethics remain essentially the same. In terms of the politics, the primary observable difference from before the change in biology to after would be in the actual policies which result, and in the narratives which are used to justify those policies. This nuance is something to keep an eye on in subsequent applications of the epi-politics model to epigenetics: Epigenetics could still present the fundamental ethical and political challenges I suggest, and have the significant effects on politics and ethics that the epi-politics model predicts, without an apparent change in either the prevailing politics or the prevailing accounts of ethics qua causal responsibility themselves. The resulting modifications of politics or ethics may be patently noticeable, such as a change in the type of political regime or an obvious change in ethics, or they may be more subtle but no less significant.

A review of the political history of genetics and epigenetics will demonstrate different ways the dynamics illustrated by the epi-politics model in Figure 1.1 have played out in the past to suggest how these dynamics may play out in the present context. The next chapter will discuss the science of epigenetics, and the political relevance of this science, which will lay the groundwork for understanding how and why the narratives of epigenetics are as different as they are from conventional genetics. The next couple of chapters after that will detail different moments in the histories of epigenetics and genetics in which the politics and ethics of the time infiltrated the science, forming the seemingly objective science to these subjective non-scientific expectations. The establishment of these political and ethical influences on the

development of the relevant sciences is an important step in establishing the importance of narratives for first understanding the deep—though however obscured—connection of contemporary genetics with our contemporary politics and ethics, and therefore how and why epigenetics constitutes the deep political and ethical challenges that it does.

Chapter III

Introduction to Epigenetics

According to the guiding model of this dissertation mentioned in the introductory chapter (Figure 1.1) and described in detail in the previous chapter, the widespread acceptance of genetics as the prevailing contemporary biological explanation of human origins and development is indicative of a necessary congruence of the assumptions of genetics with the prevailing political and ethical conventions of our time. Therefore, the extent to which the interactivity revealed by epigenetics challenges the assumptions of the science of genetics is also the extent to which epigenetics challenges these conventional politics and ethics.

However, just as the political and ethical implications of genetics are hardly ever recognized as such because of their obfuscation by the science of genetics, a reasonable assumption is that the political and ethical implications of epigenetics will also often be obscured by the same science. Again, in a strictly technical sense, epigenetics is as much a modern science as genetics, and is most appropriately considered a sub-field of genetics. However, because of the histories which will be detailed in subsequent chapters, epigenetics does invoke some fundamentally distinct ontologies than genetics and, by extension, epigenetics therefore also expresses ontological commitments which are distinct from the commitments of our conventional politics and ethics.

At the level of the science, though, these differences in ontologies are not themselves “ontologically objective,” by which is meant they are not the result of objective differences in genetic and epigenetic phenomena ‘out there’ in the real world

which enforce these differences (Searle 1995, 7-9); instead, they are at best “epistemically objective” in the sense that while these ontological differences are premised upon things that are objectively ‘out there,’ the distinctions themselves are a function of agreed upon meanings (Searle 1995, 7-9).

Instead of being the product of an objective reality, these epistemic differences between genetics and epigenetics are a product of the twists and turns of scientific and political history. Again, if epigenetics had been included in the mix when Mendelian genetics was synthesized with Darwinian evolution in the early 1900s to produce the Modern Synthesis of evolutionary thought, epigenetics would not present the fundamental ontological challenges it does today. But, for reasons that go far beyond scientific objectivity, and which stem from the prevailing politics and ethics of the time, the interactivity revealed by epigenetics was largely excluded from the construction of the edifice of modern genetics. The result is that today, epigenetics now presents substantial challenges not only to conventional genetics, but perhaps even more so to these prevailing political and ethical assumptions.

This dissertation is therefore an effort to make these political and ethical implications of both genetics and epigenetics more clear. This chapter presents the basics of the science of contemporary epigenetics, which is necessary to understand the potential differences in narratives between genetics and epigenetics. Subsequent chapters will present the history which has produced the contemporary state of affairs in which epigenetics is just now emerging as a scientific and political challenge. The concluding chapters will then present empirical analyses of the emerging narratives of

epigenetics as a demonstration of how the science of epigenetics is being presented and utilized.

Epigenetics: The ‘New’ Kid in Town

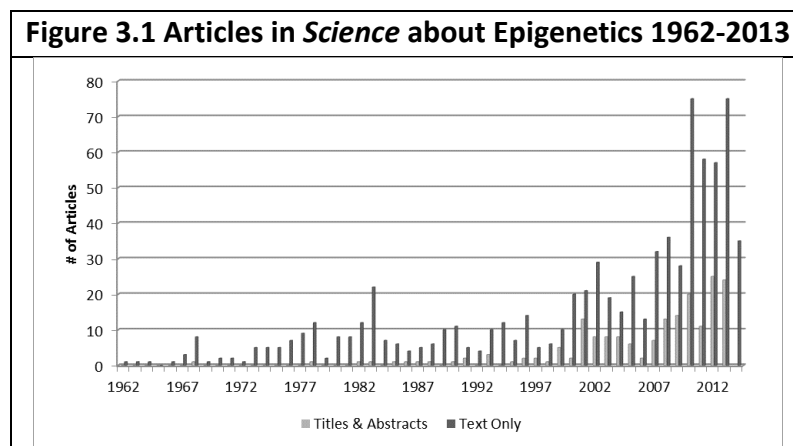
Given the history of the modern science of genetics, that epigenetics is being discussed at all, not to mention being pursued in so many different areas of the life sciences, is a highly improbable if not outright unimaginable outcome. For decades, epigenetics has been either dismissed as a trivial subset of genetics or rejected outright from the mainstream of genetics as a pseudo-science or even as a dangerous ideology. The sudden (re)emergence of epigenetics thus marks a notable reversal of fortune. Why there has been this remarkable reversal, and what are the political and ethical implications of this sudden rise of epigenetics, are the main questions being addressed by this dissertation.

Epigenetics is little known outside genetics and the life sciences, but within these fields attention to epigenetics is reaching “epidemic” proportions (Haig 2012). A content analysis conducted by David Haig (2012) using the database ISI Web of Knowledge found that while there were never more than a hundred articles with “epigenetics” in the title published in any year before 2000, by 2010 there were 1300 such articles. Haig also observes that when an index is constructed to account for changes in the composition of the database, with epigenetics-themed articles being divided by the total number of genetics-themed articles, there is little change in relative frequency from the 1950s through the 1990s but a ten-fold increase in the relative frequency of epigenetics-themed articles in the ten years from 1999 to 2009.

Likewise, according to a more comprehensive survey using the electronic archive established by the Human Genome Epidemiology Network (Wulf et al. 2008), since 1997 there has been a ten-fold increase in epigenetics-themed publications in academic journals, reaching nearly 10,000 articles by 2010 (Ebrahim 2012). This exponentially increasing rate of publications is evidence in favor of the characterization of one of the top researchers in the field that as of 2010 “it is safe to say 50 percent of biologists work on subjects related to epigenetics in one way or another” (He 2010).

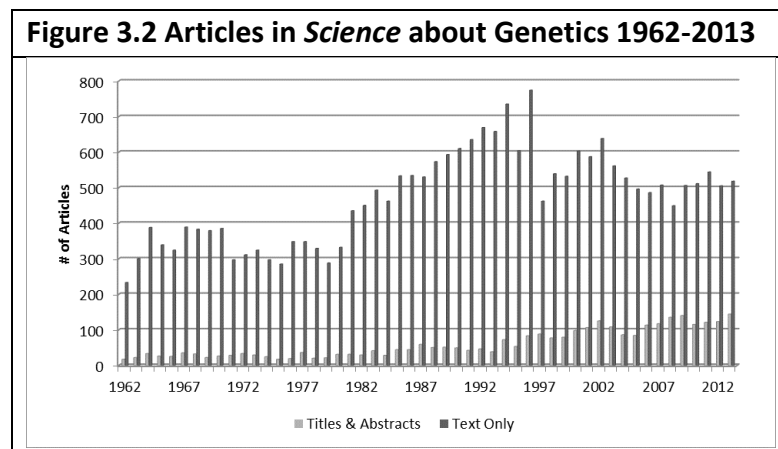
Epigenetics in *Science*

One indicator of the sudden increase of interest in epigenetics, at least among the science-informed public, is the number of articles referring to epigenetics published by *Science*, “the world’s leading journal of original scientific research, global news, and comment” (Science 2015). *Science* provides a unique perspective from which to view the historical and contemporary reception of epigenetics as its target audience is scientists and the science-literate public; therefore, publication in *Science* is a good indication of the acceptance of a topic within science in general, as well as of the penetration of that topic within the non-scientist laity:



As shown in the Figure 3.1, for almost forty years, the number of articles on epigenetics hardly ever exceeded 10 articles a year. Beginning in the 2000s this number doubles and then doubles again by 2010. That the publication of epigenetics articles in *Science* is increasing at an increasing rate is a good indicator of the increasing attention being given to epigenetics by both scientists and the science-literate public.

By way of comparison, compare this to the rate of the number of articles on genetics published by *Science* over the past fifty years:



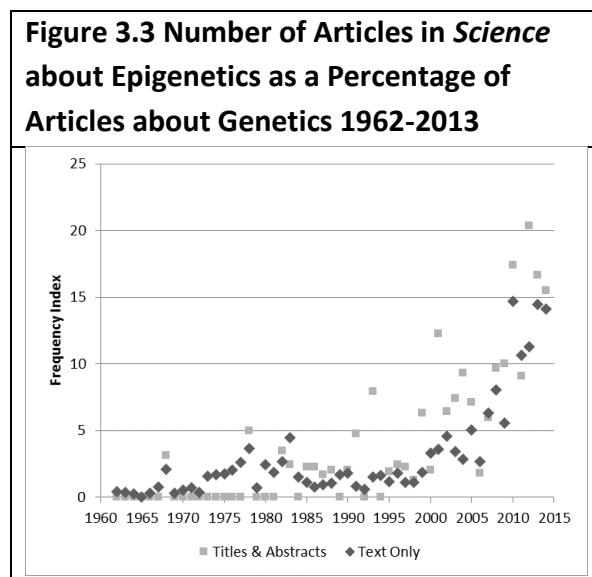
As shown, the number of articles per year was relatively steady through the 1960s and 1970s, climbed steadily through the 1980s, and appears to have peaked in the mid '90s.

However, as also shown by these two graphs, in raw numbers there are six to seven times as many genetics articles as epigenetics articles. Thus, even though the number of epigenetics articles published per year in *Science* is increasing at significantly

higher rates than articles on genetics, in terms of sheer numbers the attention given to epigenetics is only a small proportion of that given to genetics.

This disparity in and of itself is perhaps less revealing than it seems. Despite the significant and even fundamental challenges from epigenetics to conventional genetics, epigenetics in a scientific sense is perhaps best identified as a subset of genetics, and is thus neither in direct competition with genetics nor a replacement for genetics. In this context, therefore, it is unreasonable to expect the numbers of epigenetics articles to ever approach the sheer numbers of genetics articles.

A much more reasonable expectation is that epigenetics would constitute a proportion of articles on genetics, and thus its impact is better assessed via changes in this proportion. One way to conduct such an assessment, is to divide the numbers of epigenetics articles published in *Science* by the numbers of genetics articles. When this proportion is tracked over the past fifty years, a very distinct trend emerges:



For forty years, the number of articles about epigenetics published by *Science* were hardly ever 5% of the number of articles published on genetics. Beginning in 2000, though, the percentage of epigenetics-themed articles relative to genetics articles began to rise precipitously to over three times its baseline level, reaching over 20% in 2012.

While these increases in the rates of publication in *Science* are not overwhelmingly conclusive evidence of the rise of epigenetics, given the prestige of the contributors to *Science* and the size and scope of its readership, these are at least illustrative demonstrations of the vector of interest in epigenetics, which is rising at what appears to be an exponential rate.

While the previous section addressed the rising level of attention given to epigenetics in a single publication directed towards both scientists and the science-literate public, a good follow-up question is what is the attention given to epigenetics within the strictly scientific literature?

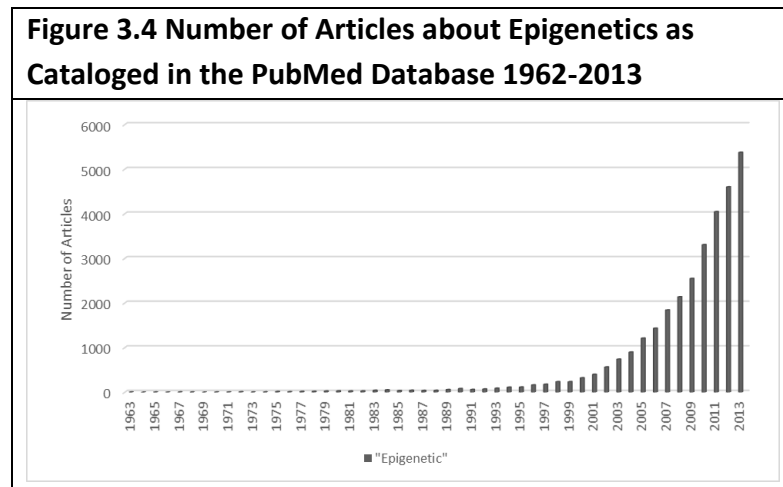
In terms of assessing the spread of epigenetics within the scientific, medical and academic literatures, I searched two major databases: PubMed and Academic Search Complete.

Epigenetics in PubMed

The PubMed database, sponsored by the National Center for Biotechnology Information, contains references to over 24 million citations from the biomedical literature, including life sciences journals. A search of this database should give a good

indication of the attention being given to epigenetics within its primary domains of research and application.

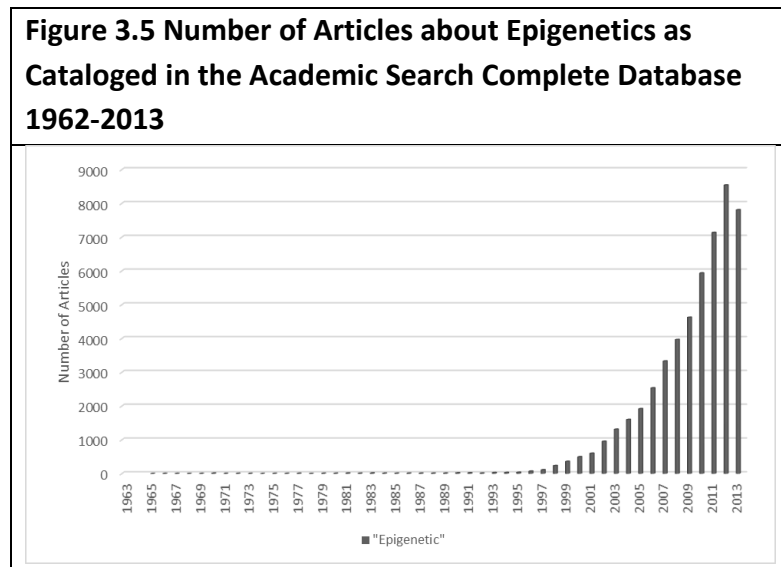
When the PubMed database is searched for articles containing the term “epigenetic” the following results are returned:



As can be seen, for the first thirty of the past fifty years the publication of articles referring to epigenetics in the life sciences and medical fields was practically nil. This marked lack of coverage of epigenetics is unmistakable evidence of the resounding lack of attention from the mainstream of conventional science given to epigenetics over these decades. Through the mid-1990s and into the 2000s, though, the number of epigenetics-based articles began to grow gradually and then precipitously, exceeding 1,000 for the first time in 2005, then doubling by 2008, doubling again by 2010 and then topping over 5,000 by 2013. This is by any measure a significant increase in attention to epigenetics, especially given the rate at which the increase has occurred.

Epigenetics in Academic Search Complete

While PubMed focuses on the medical and life sciences, the Academic Search Complete database is “the World’s Most Comprehensive, Scholarly Full-Text Database for Multidisciplinary Research” (EbscoHost 2015). Thus, the number of epigenetics-based publications returned from a search of this database is indicative of the broader level of attention of the topic of epigenetics in academia in general, likely including most of the articles from the PubMed search but also including articles from the social sciences:



As can be seen, the rate of publication of articles on epigenetics in academics more generally mirrors that for epigenetics articles in the life sciences in particular: virtually nonexistent until the late 1990s, reaching around 1,000 articles in 2002, around 2,000 by 2005, doubling again by 2008, and exceeding 8,000 articles by 2012. Again, by any measure these are significant increases in the rate of publication, indicative of a commensurate increase in the attention being devoted to epigenetics in academia.

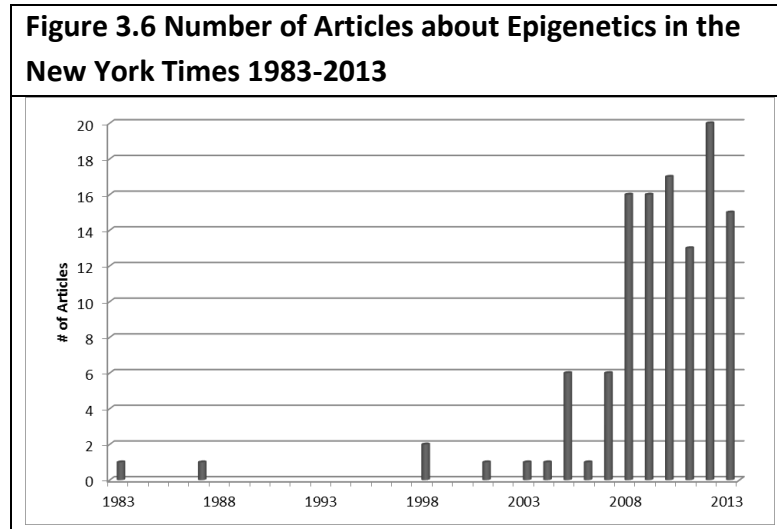
Epigenetics in the New York Times

Ideally, this level of attention by working scientists would likewise be reflected in the level of attention of the general public as well. This increasing level interest in epigenetics by the greater public would be a considerable impetus for political action. So the next question is what is the level of interest or awareness of epigenetics in the general public?

The ever-increasing attention of the science-literate public has already been addressed in the section on rates of epigenetics publications in *Science* magazine. Likewise, the ever-increasing attention of scientists and other academics has been cataloged in the previous section on the rates of publication of epigenetics articles in the PubMed and Academic Search Complete databases. A reasonable expectation would be that this same pattern of increasing attention to epigenetics is present in public media outlets as well.

In this case, one reasonable measure for public attention to epigenetics is the rates of references to epigenetics in the New York Times (NYT). While a newspaper may not be as good an indicator of the general public perception of an issue as a national survey, it is at least an excellent source for tracking how an issue is framed by and for elites, and how an issue is presented to the general public (Lawrence 2004). Also, the NYT is the number two newspaper in the United States in terms of weekday circulation (Alliance for Audited Media 2015), and is also one of only three newspapers with a national instead of a local or regional readership (Wikipedia 2015). For these reasons, the NYT is a reasonable proxy measure for public attention at the national level.

When a search of articles mentioning “epigenetics” in the NYT is conducted, a similar trend as in *Science* and the two academic databases does emerge. However, there are also some significant differences:



First, where there had been sporadic references to epigenetics in these other academic and scientific sources from the 1960s and before, there was no mention of epigenetics in the NYT before 1983. Still, per the pattern established by searches in these other sources, epigenetics received practically no mainstream public attention until the 1990s, and then suddenly took off in the 2000s. Another noticeable difference is that while there is a significant increase in the late 2000s, there is not the precipitous climb to a peak in the rate of references in the NYT. An even more portentous difference, though, is in the magnitude of the numbers of articles—instead of thousands or hundreds or even dozens of articles, the number of articles on epigenetics per year in the NYT has just barely hit double digits. This is hardly a world-changing level of attention.

Thus, while there is evidence of an increasing awareness of epigenetics by the general public, it is nowhere near the level of attention given to epigenetics in the sciences and academia. What does this meager level of attention to epigenetics in the popular media mean for assessing the political and ethical impacts of epigenetics? This question is actually of profound. Although there may be impressive levels of attention being given to epigenetics amongst scientists and academics, significant changes in political or ethical conventions—especially in a modern, technologically advanced, democratic society—can hardly be expected from a topic which is barely a blip on the radar of the public. If the public is so little aware of epigenetics, how can epigenetics possibly have the sweeping ethical and political effects I am suggesting that it will?

There is an extensive literature on the lag between scientific research, public awareness, and the eventual incorporation of that research into policy (Abbasi 2006; Bradshaw & Borchers 2000; Guthrie et al. 2014; Leshner 1997; Locke 1999; 2002; Wynne 1992; Yearley 1999). This literature suggests that given the vector of attention given to epigenetics in the sciences and academia, the pressure will build and eventually at some point epigenetics will spill over into public awareness and become a significant factor in policy discussions. That being said, there is enough information about epigenetics in the public discourse to begin to identify emerging causal narrative of epigenetics.

How long this spillover from research science to widespread public awareness will take is difficult to predict, as is what form the causal narratives of epigenetics will

take, and to what purposes these narratives will be used. As will be described in the next section, epigenetics introduces a number of unique elements and causal explanations which distinguish it fundamentally from conventional genetics and from other non-scientific policy narratives. However, there are no exclusive interpretations of these elements and explanations, which could be interpreted in any number of ways. An empirical analysis of the emerging narrative elements of epigenetics is thus a pivotal aspect of this dissertation as the composition of this narrative to establish the (potential) changes in the conceptions of self from the introduction of epigenetics into the scientific, public and political discourses. This analysis of the emerging narratives of epigenetics will be conducted in regards to the issue of obesity, and presented in chapters five and six.

Epigenetics 101

To discuss the political and ethical implications of epigenetics first requires a basic understanding of the scientific basis of epigenetics. This section will provide this basic understanding of the science of epigenetics, beginning with its distinction from genetics as the prevailing science-based causal narrative of human origins and development.

As genetics is already such a significant influence on policy, the challenges to genetics represented by the knowledge emerging from epigenetics present significant challenges to conventional policy prescriptions. Further, as discussed in the introduction chapter, the scientific assumptions of genetics are closely interwoven with the philosophical and metaphysical assumptions of our conventional ethics and politics.

Thus, the scientific challenges of epigenetics to genetics represent fundamental philosophical challenges to conventional politics and ethics as well, via the relationships depicted in the guiding model for this dissertation depicted in Figure 1.3. The magnitude of the implications of both these challenges justify the close study of epigenetics and politics.

However, to explain why epigenetic phenomena are just now being recognized as legitimate factors in biological evolution and development, and why epigenetics constitutes such a significant challenge to the discourses of not only genetics but also our contemporary politics and ethics, requires a brief survey of first what is genetics, and then how is epigenetics different from genetics at a biological level.

Genetics

First, in a nutshell, genetics is the biology-based science of heredity conducted primarily through the study of genes. Genes are defined as functional sequences of the molecule DNA which is found in the nucleus of every cell of every living thing. DNA is composed primarily of a sequence of four chemical bases (cytosine, guanine, adenine, thymine, abbreviated as C, G, A, T respectively). The functionality which distinguishes a DNA sequence as a gene is identified by the role of that particular sequence in the production of proteins used in subsequent biological processes. DNA is also noteworthy among organic molecules for its unique insulation from external influences in the production of these proteins.

These chemical characteristics of genes have lent themselves to a particular concept of gene-centered evolution. This concept of evolution has likewise resulted in a

particular concept of human selfhood. Per the guiding model of this dissertation, this concept of self as informed by genetics has become—as it must—congruent with the prevailing politics and ethics. This necessary congruence between the science and the politics and the ethics is the source of the fundamental philosophical challenges of epigenetics as the scientific challenges to genetics from epigenetics are also necessarily challenges to these other elements of the model described in the previous chapter.

According to conventional genetics, the proteins produced by these genes are involved in the eventual production of specific traits such as eye color, blood type, disease susceptibility, and so on. Expressions of these genes are called phenotypes. Differences in phenotypes are one of the main sources of distinction between individuals and between species and different forms of life (i.e., a thing is identified as possessing representative *thing-ness* via its manifestation of those traits identified as essential for being that particular kind of thing). Thus, the possession of specific sequences of DNA are identifiers of both the individual and of the species.

The insularity of DNA described above also means that the genes for these traits are practically immutable. In other words, the conventional narrative of genetics is that at a fundamental biological level our distinguishing characteristics at the individual and species level are as fixed as the underlying genes. This correspondence of these fixed genes with fixed traits, and of traits with essential thing-ness, is why DNA—as the collection of the biological sources of these traits—is perceived as the ultimate instruction book for life.

There may be differences in the phenotypic expression of these genes due to interactions with the environment (e.g., differences in height due to availability of nutritious food), but according to the prevailing view of genetics these phenotypic differences are not heritable because there are biological mechanisms which prevent their transmission. This non-heritability of differences in phenotypes due to environmental influences is one of the central tenets of contemporary genetics.

Instead, the orthodoxy of genetics is that evolution works exclusively via the genes. Gene-based traits are passed from parents to children through the transmission of these genes, and only through the transmission of these genes, via sexual reproduction and random mutation. The genes for traits that lead to more reproductive success are disseminated through a population more than the genes for traits which do not. Thus, the genes we have are adaptive *qua* traits, but not in the sense of responsiveness to the immediate environment but rather through more or less random processes of recombination and mutation and reproduction, and then selection of those traits via differential reproduction.

Notably, as per the guiding model of this dissertation, these conclusions from the conventional theory of genetics about the isolation of genes from their environments and of adaptation as a neutral and random process are all pregnant with philosophical and metaphysical import. For example, if these genetic essences are insulated from the environment, then there is a fundamental separation of our biological essences and our environments (i.e., our 'insides' are distinct from and insulated from our 'outsides'). Therefore, whatever happens in our 'outsides' does not have a fundamental impact on

our 'insides.' However, these more philosophical consequences of the prevailing science of genetics are hardly ever recognized or acknowledged as such. The recent emergence of epigenetics, though, provides an ideal platform for highlighting these political and ethical implications of the conventional science of genetics, as well as suggesting a number of unique political and ethical alternatives via epigenetics.

How Epigenetics Works

In a nutshell, epigenetics deals with the regulation of gene expression through mechanisms other than changes in the underlying DNA, some of which may be passed on to subsequent generations. As discussed before, there are a number of definitions of epigenetics, and a number of biological mechanisms which have been identified as epigenetic in nature. Of these epigenetic mechanisms, DNA methylation, chromatin remodeling, and RNA-mediated inheritance are three of the most studied. A brief elaboration of these different mechanisms will contribute to a better understanding of how the narratives of epigenetics challenge the narratives of genetics, and therefore how epigenetics introduces new causal narratives into policy discussions.

Methylation. DNA methylation occurs when methyl (CH₃) groups attach to the cytosine molecules in the DNA (the C's in the ATCG sequence that is the common shorthand for describing DNA sequence). Demethylation occurs when these methylated groups are chemically removed from these cytosine sites. Methylation suppresses the expression of the genes in the region of the genome that is methylated, while demethylation allows previously blocked genetic expression, but without changing the underlying DNA sequence in either case. A number of environmental causes for this

methylation/demethylation of DNA have been identified, running the gamut from the composition of diet (Cooney et al. 2002; Wolff et al. 1998), to exposure to chemicals in the environment (Dolinoy et al. 2007; vom Saal et al. 2007), to differing levels of maternal care (Weaver et al. 2004).

The epigenetic process of DNA methylation is one of the most prevalent processes in the functioning of genes. For example, it is estimated that eighty to ninety percent of the cytosine sites in human DNA are methylated (Ehrlich et al. 1982), meaning the vast majority of these genes are not expressed. Differences in DNA methylation have been identified as the likely mechanism for the initial divergences in gene-expression between genetically similar species—such as between humans and chimpanzees in particular (Zeng et al. 2012)—which eventually results in speciation.

Methylation is also an important in process in embryological development. For example, during the process of genomic imprinting, the gametes formed during sexual reproduction are methylated so that only one of the two copies of the gene received from the parents is active and expressed. This is an important step in the assignation of biological gender (Singer-Sam 2010). Genomic imprinting also occurs in plants (Wollman & Berger 2012). This process is epigenetic in that it does not change the sequence of the DNA but only the expression of gene sequences in the DNA and is also one of the biological moments through which epigenetic changes are inherited (Yamaguchi et al, 2013).

An important point to make, though, is that methylation does not necessarily contradict the prevailing dogma of genetics per se. Conventional genetics openly

incorporates variation in genetic expression due to environmental influences, which is one way that DNA methylation acts. Thus, while the level of attention given to methylation is new, technically this work on epigenetic methylation can be said to merely provide an explanation for a mechanism of gene expression.

That being said, this work on methylation is producing unprecedented results across a wide variety of domains such as aging (Horvath 2013; Marioni et al. 2015), cancer (Das & Singal 2004; Jones 1996; Lima et al. 2015), and autism research (Ladd-Acosta et al. 2014; Shulha et al. 2012; Wong et al. 2014). These results, which for the most part focus on differences or changes in the expression of genes, are unavailable via the conventional or popular understanding of genetics with its almost exclusive focus on the sequence of DNA (hence all the emphasis on gene sequencing technology as the *sine qua non* of contemporary genetics). Epigenetic research involving methylation also exposes a direct link between the environment and gene-level expression which is not readily available via the ontological commitments and the methods of conventional genetics.

Chromatin Remodeling. Chromatin are the end product of DNA being tightly wrapped around proteins called histones. These chromatin are then also tightly wrapped together which bundling allows the meters of DNA to be packed into cell nuclei only 5 to 10 μm in diameter.

This tight bundling also gives DNA its unique three-dimensional structure which also has a significant effect on genetic expression. Those genes which are located on the outside of a bundle are the most accessible to processes like methylation, and thus are

most susceptible to changes in suppression or expression; vice versa, those genes located inside a wrapped bundle are likewise shielded from changes in expression. Also, the three-dimensional structure produced by the wrapping of chromatin places some genes adjacent to each other which are actually quite distant sequentially, which proximity also impacts the expression of these gene loci in ways which are not detectable using conventional gene sequencing (Phillips-Cremins & Corces 2013; Xu, Lefevre & Felsenfeld 2012; Xu et al. 2014).

Again, according to the prevailing narrative of evolution via conventional genetics, the sequences of genes in a tightly-packed segment of DNA are the information that provide the basic ‘instructions’ for the development of living organisms; only as these sequences are changed are the instruction for the expressions of those genes changed as well. Francis Crick, one of the people responsible for our current understanding of the double helix structure of DNA, is also credited for this emphasis on sequence over structure as the pivotal characteristic of DNA (Crick 1958; Strasser 2006). Because genes are functionally isolated from their environments, changes in gene sequence occur only through random mutation and sexual recombination. These random changes in gene sequence then ultimately produce differences in expression (i.e., differences in phenotypes), which differences contribute to the differential reproductive success within a population of the genotype that is the basis of the successful phenotype.

However, according to the research in epigenetics, sections of DNA can be acetylated causing the chromatin to relax and open up—which process is called

chromatin remodeling—thereby exposing different gene sequences to methylation which can then change the pattern of on/off switches and therefore the nature of the gene expression. Chromatin remodeling also affects gene expression in other ways. Recent work in epigenetics demonstrates how many sequentially distant but structurally proximal genes actually work together to regulate gene expression (Doyle et al. 2014; Hancock 2014; Kulaeva et al. 2012). This chromatin relaxation therefore also changes the relative proximity of different genes and gene sequences which can also affect the pattern of expression—all without changing the actual DNA sequence in any way (Thurman et al. 2012).

Chromatin remodeling is an important step in basic cell growth and differentiation. Thus, perturbations of chromatin remodeling patterns can disrupt this basic process. As such, epigenetic modifications of DNA structure via chromatin remodeling have been associated with a number of cell-based diseases such as cancer (Lehner 2012; Crews & McLachlan 2006), and chromatin remodeling has also now been associated with obesity as well (Wang et al. 2010), all in ways which elude conventional gene-centered assumptions and methodologies which focus primarily on the chemical sequence of genes but not their three-dimensional structure.

RNA-mediated Inheritance. RNA-mediated inheritance of traits is another form of the epigenetic regulation of gene expression, but one that specifically involves non-genetic inheritance.

RNA is a single-strand nucleic acid similar to the double-strand of DNA located in cell nuclei. RNA is made when a section of DNA uncoils and a sequence is copied by an

RNA polymerase enzyme to transcribe the single strand of RNA from the DNA. RNA then migrates out of the cell nucleus to be used in the synthesis of other proteins as the DNA section recoils back into its original place. In this way RNA transmits genetic information from the DNA without the DNA itself leaving the nucleus. This transcription process protects the DNA and its specific genetic code from damage or corruption, and is one source of the 'central dogma of molecular biology' as codified by Francis Crick that information comes out of DNA but not back in (Crick 1970). The political and ethical implications of this central dogma will be discussed in subsequent sections.

However, in this transmission of information from the DNA there are at least three different ways that RNA can silence genes in one cell which can then be inherited by the subsequent generations of that cell: through degradation of the target of the RNA which can then be passed on in subsequent transcription, through transmission of the methylation patterns introduced by the RNA, and through the excision of DNA sequences in the production of the RNA which excisions are then passed on in subsequent transcriptions (Jablonka & Lamb 2010).

While the preceding is in reference to RNA-mediated inheritance at the cellular level, this nongenetic inheritance at the cellular level has been associated with organism level effects (Vastenhouw 2006), and even with the nongenetic inheritance of traits at the level of organisms (Rassoulzadegan 2006; Rassoulzadegan & Cuzin 2015).

As described by one researcher, "after many years of living in the shadows, RNA is being revealed as an inheritance molecule in its own right" (Casci 2006). This new story of inherited responsiveness to the environment presents a significantly reworked

picture of evolution and development. Per the epi-politics model described in the previous chapter, these fundamental changes in our understanding of our biology should either be the cause or the indication of commensurate changes in our politics and ethics. The elaboration of these potential political changes as changes in narratives of causal responsibility is one of the main purposes of this dissertation.

Epigenetic Inheritance: The Past, the Present and the Future

That there is inheritance of traits not controlled by genes has been known for decades, but until the recent surge of interest in epigenetics there was little understanding of how this inheritance works. As notes one researcher, “the earliest observations were just that something was not being transmitted the way Mendel would have predicted. What that something is has taken a long time to figure out” (Phillips 2006). Given that this inheritance occurs via epigenetic mechanisms which have been excluded from serious consideration in mainstream genetics for the past few decades, it is no surprise that the physical mechanisms for this non-Mendelian inheritance are just now being figured out; which also means that the recognition and discussion of the ethical and political implications of these non-genetic mechanisms are lagging even further behind.

Epigenetic inheritance is found to occur at a couple of different levels, and in a couple of different ways. First, there is cell-cell and organism-organism epigenetic inheritance. Second, there is parental or intergenerational inheritance, or the passing of nonsequence-based effects from parent to offspring (Heard & Martienssen 2014; Jiminez-Chirallon et al. 2009), and what is called transgenerational epigenetic

inheritance, in which epigenetic traits are passed on to more than just the first generation (Daxinger & Whitelaw 2010; Jirtle & Skinner 2007; Manikkam et al. 2014; Watson & Goodman 2002). There is also substantial evidence for non-genetic inheritance through both the cells involved in sexual reproduction (the germline) and the somatic cells involved in formation of the body.

These levels and kinds of epigenetic inheritance can combine and interact, such as transgenerational cell-cell inheritance or intergenerational organism-organism inheritance, and each have significant scientific, political and ethical repercussions of their own.

Cell-cell epigenetic inheritance. As suggested by the name, this kind of epigenetic inheritance occurs during the cell division cycle as cells divide and duplicate into daughter cells. This is the process by which single-celled fertilized eggs, for example, develop into multicellular organisms. As with conventional evolutionary theory, the maintenance of the integrity of the genome that is passed from the mother cell to the daughters is the focus of this process, as the assumption is that the information contained in the mother's genome determines the fitness of the offspring cells.

Cell-cell epigenetic inheritance can be either intergenerational, in which the effects are passed on to only the next generation of cell, or transgenerational, in which the effects are passed on to the daughter cells, and their daughter cells, and so on.

A number of epigenetic mechanisms control and coordinate these processes of cell division (Burton & Torres-Padilla 2014; Elledge 1996; Houben et al. 2013). This is

also a point at which perturbations in these processes can affect the fidelity of DNA replication and chromosome segregation, which effects can be passed on to the daughter cells to then become part of that cellular lineage. These cell-level moments are increasingly being identified as factors in the emergence of cancerous behaviors in cells (Ashwell & Zabludoff 2008; Liu & Kwiatkowski 2015).

The political and ethical implications of this kind of cell-cell epigenetic inheritance is that through mechanisms such as methylation a direct link is opened between the environment and gene-level effects. If conditions in the environment can be shown to increase the rate of perturbations in cell divisions which lead to an increased risk of colorectal cancer, for example, and these environmental conditions can also be shown to be under the control of human agency, then there is also suddenly an ethical imperative to act so as to reduce the risk of cancer where there was not one before the new causal attributions introduced by epigenetics. As mentioned in the introductory chapter, this identification of new causes also likely entails the highly political act of assigning blame and responsibility, which is a principal function of policy narratives (Stone 2002). Notably, none of this—not the identification of the causal pathways between environmental influences and their gene-level effects or the resulting ethical and political imperatives—is available via the conventional or the prevailing popular understanding of genetics because of its ontological commitments (e.g., the isolation of the gene) and its subsequent and almost exclusive focus on gene sequence.

Organism-organism epigenetic inheritance. Organism-organism epigenetic inheritance occurs via the same epigenetic mechanisms as cell-cell inheritance described before, but instead of working at the level of cellular division these mechanisms manifest as modifications of the phenotype such as changes in hair color (Morgan et al. 1999) or disease susceptibility (Jirtle & Skinner 2007; Nadeau 2009) which do not result from changes in the sequence of the gene. This kind of non-genetic inheritance has been found in plants (Lolle et al. 2005), non-human mammals (Carone et al. 2010; Ng et al. 2010), and humans (Nadeau 2009; Pembrey et al. 2006; Schulz 2010; Stouder & Paoloni-Giacobino 2010; Yehuda et al. 2005).

This organism-organism inheritance of nonsequence-based differences in phenotypes is most similar to the genetic inheritance most people know. The important difference in this case is that the modifications of gene expression are not due to changes in the chemical sequence of the genes, or in response to environmental influences—which until now were the only two viable options for explaining gene expression and changes in gene expression—but as differences in the chemical configurations that regulate the expression of the genes, although most likely in response to the environmental conditions present two or more generations before. The proposition of this third way of inheritance and of gene expression via all these different kinds of epigenetic inheritance is the root of the profound ethical and political dilemmas posed by epigenetics.

Again, though, organism-organism epigenetic inheritance can also be either intergenerational, in which the nonsequence-based modifications of phenotype are

passed on only to the next generation, or transgenerational, in which these nonsequence-based traits are passed on through multiple generations.

Intergenerational epigenetic inheritance. This kind of epigenetic inheritance is the passing on nonsequence-based changes in phenotype to a subsequent generation, usually in response to environmental conditions of the first generation (Jiminez-Chirallon et al. 2009; Stone & Bales 2010). In this case, the epigenetic changes are manifest in the next cellular or organismic generation, but are not passed on to subsequent generations.

One of the most interesting aspects about intergenerational epigenetic inheritance is the way it complicates the conventional barriers between individuals, in this case between parents and children in particular. (Ng et al. 2010; Yehuda et al. 2005). Much of the work being done on intergenerational inheritance focuses on the transfer of information from mother to fetus (Drake & Walker 2004; Drake et al. 2005; Godfrey et al. 2010; Weaver et al. 2002), although some work does also identify father-offspring intergenerational inheritance as well (Dietz & Nestler 2012; Ng et al. 2010; Perrin et al. 2007), particularly in regards to the effects of the obesity of the father on their offspring (Soubry et al. 2013; Whitaker et al. 2010).

Transgenerational epigenetic inheritance. This kind of epigenetic inheritance is basically the same as intergenerational inheritance, just with the added gravity that the effects identified for intergenerational inheritance are passed not just to the next generation, but to subsequent generations as well (i.e., to not just the children, but to grandchildren and great-grandchildren, and so on), up to four generations so far in some

laboratory studies (Greer et al. 2011; Manikkam et al. 2014; Pang & Curran 2012). Thus, the profound problems raised by intergenerational inheritance of epigenetics are compounded exponentially by the possibility of the inheritance across multiple generations.

That there are specific environmental and behavioral factors which can produce such significant changes in gene expression in the present, and which can now be linked to such far-reaching transgenerational effects in the future (Jirtle & Skinner 2007; Manikkam et al. 2014; Watson & Goodman 2002), presents a significant collective action problem similar to problems such as air and water pollution, or global climate change. As resolving or mediating collective action problems is perceived as one of the primary functions of government, the collective action problem of transgenerational epigenetic inheritance recommends a significant role for government in the regulation of such factors.

Soma-germline epigenetic inheritance. There is also substantial evidence for non-genetic inheritance through both those cells involved in sexual reproduction (the germline) and the somatic cells involved in forming the body of an organism (Aiken & Ozanne 2013; Champagne et al. 2006; Francis et al. 1999; Sharma 2013; 2014a; 2014b; Sharma & Singh 2009; Stone & Bales 2010; Vicker 2014; Weaver et al. 2004). Non-genetic inheritance through the germline—which is the normal conduit for conventional inheritance—presents a significant enough challenge to the orthodoxy of genetics, but primarily because the traits being passed on are not due to changes in DNA sequence. Non-genetic inheritance of information from the environment that is registered in the

somatic cells and then passed through the germline is an especially fundamental challenge to not only the orthodoxy of conventional genetics but also to our prevailing politics and ethics.

Epigenetics in Action

Examples of this work in epigenetics in non-human mammals and in humans will be presented below. These examples illustrate the scope and the nature of this scientific work being done in epigenetics, which helps to explain the urgency of the ethical and political implications of epigenetics.

Epigenetics in Non-human Mammals

Perhaps the most prominent example of epigenetics in action is the agouti mouse model, which has been used to link prenatal and early postnatal nutrition and gene expression (Morgan et al. 1999). Agouti mice have a gene which produces the agouti protein which affects coat color and body composition (Lu et al. 1994; Miltenberger et al. 1997). Notably, humans also have this agouti gene (NCBI 2015), which is 85% identical to the mouse gene (Kwon et al. 1994) and performs many of the same functions, having been closely linked to traits such as monogenic diabetes in humans (Kim et al. 2004).

The way the expression of this gene works is that in the promoter region of the agouti gene there is a piece of foreign DNA (called a retrotransposon) which can be either methylated or not methylated. If this retrotransposon is methylated, then the gene is not expressed at higher levels and is therefore not translated into its protein product, which produces mice that are thin, healthy and have brown coats. If this

retrotransposon is not methylated, this leaves the DNA open so that the agouti gene is expressed, which in mice produces yellow coats and obesity, as well as a higher susceptibility to diabetes and cancers (Morgan et al. 1999; Whitelaw & Martin 2001).

Notably, this methylation of the agouti gene can be manipulated via the methyl-rich or methyl-poor diets fed to pregnant mice and weaning pups (Morgan et al. 1999; Waterland & Jirtle 2003). In other words, mice which are bred to be identical at the DNA level can have very different body types and susceptibilities to disease depending on the kinds of foods they or their mothers consumed. The levels of methylation in newborn mice can still be manipulated until up to 60 days after birth, but after this time there are no more effects from methyl manipulation, indicating that there are critical epigenetic developmental windows that open and close at different points in development (Cooney et al. 2002; Wolff et al. 1998).

There is also a connection between methylation and maternal care in these agouti mice. Experiments have found similar differences in agouti gene expression as described above, though this time with the primary environmental difference being the frequency of maternal attention via licking and grooming behaviors (Champagne & Curley 2009; Champagne et al. 2006; Weaver et al. 2004). That this gene—which is shared by both mice and humans—can be methylated via environmental stimuli in the form of behaviors such as maternal affection, and that this behaviorally-modulated methylation can have these subsequent effects on health outcomes such as obesity and diabetes, points the way towards the political and ethical implications of epigenetics.

Other similarly remarkable and relevant results from these animal studies on epigenetics demonstrate that these epigenetic effects can be both sex-specific and can skip a generation. For example, while the daughters who received high levels of maternal care showed the benefits of this care, the mice daughters of mothers who were licked (i.e., the granddaughters) actually inherited the beneficial methylation patterns, even if these granddaughters did not receive high levels of maternal care from their own mothers (Bohacek & Mansuy 2013; Daxinger & Whitelaw 2010). Further, these granddaughters also exhibited high levels of maternal care similar to their grandmothers even if they did not receive this level of care from their own mothers (Weaver et al. 2004). Again, the potential for consequences like these in the context of human morals and ethics and politics demonstrate the utility and even the urgency of the study of these ethical and political implications of epigenetics.

Epigenetics in Humans

To wit, these kinds of epigenetic effects and inheritances are not confined to animals, as there are similar results for humans as well (Adams 2008; Nadeau 2009; Pembrey et al. 2006; Schulz 2010; Stouder & Paoloni-Giacobino 2010; Yehuda et al. 2005). This is where the political implications of epigenetics begin to become more obvious, as politics and ethics play or can play a significant role in all of the conditions identified with epigenomic modifications, such as the composition and availability of nutritious food (Landecker 2010; 2011).

A number of studies have been conducted on people at different developmental stages during famines (i.e., in utero, post-natal, pre-pubescent, adolescent, etc.). These

studies identify persistent epigenetic effects on health, both detrimental and beneficial. As with the mice described before, these epigenetic effects caused by exposure to environmental conditions during different stages of development are manifest into adulthood and passed onto subsequent generations—the main difference being that many of the environmental circumstances identified in these studies are the result of overtly political events; in other words, these studies provide both the empirical verification of epigenetic effects and epigenetic inheritance in humans, as well as linking these epigenetic events directly to human politics.

For example, a study of the survivors of the Dutch Hunger Winter of 1944-1945—which resulted from the German Army blockade of the western parts of the Netherlands after the D-Day invasion and the failure of the Operation Market Garden offensive by the Allied forces (Stein et al. 1975)—found that individuals who were *in utero* during the acute periods of the famine showed increased susceptibility for diabetes and other persistent detrimental health effects than did their siblings sixty years later and epigenetic methylation patterns of those genes known to be associated with those health outcomes (Gluckman et al. 2009). Other studies have linked the prenatal deprivations of specific micronutrients experienced during the famine to an increased risk of schizophrenia in the offspring (Brown & Susser 2008). On the other hand, another study on individuals who lived through the Dutch Hunger Winter found that those who experienced significant calorie deficits during childhood and adolescence also demonstrated persistent epigenetic methylation patterns which significantly reduced their risk of developing colorectal cancer (Hughes et al. 2009), so

these epigenetic effects are not always necessarily bad. The important point is that there are epigenetic effects triggered in response to environmental cues, cues which have significant political causes and effects and which could be manipulated through political processes.

Still other studies revolving around one landmark dataset, the Overkalix study (Lalande 1996), have also found significant links between the food supply of grandparents with the mortality risk ratio of their own offspring as well as with that of their grandchildren, and often in sex-specific patterns. For example, when fathers experienced poor food availability just before puberty, their sons (but not their daughters) were protected against cardiovascular death. Likewise, if paternal grandfathers lived through a famine just before puberty, their grandsons (but not their sons) were significantly protected from diabetes; however, it was also found that when paternal grandfathers had access to food surpluses during this same developmental stage, their grandchildren had a fourfold over-risk of diabetes. (Kaati et al. 2002). Other Overkalix studies have identified other significant transgenerational and sex-specific epigenetic effects as well, in which the environmental conditions and even the personal habits of grandparents (e.g., the timing of the decision to begin smoking tobacco) were manifest epigenetically in the lives of their grandchildren (Northstone 2014; Pembrey et al. 2006).

Likewise, other studies have identified specific factors such as maternal body mass index, maternal nutrition, and complications during birth as risk factors for adult schizophrenia, and that it is through the epigenome that these effects are transmitted

from mothers to their children (Lahti et al. 2014; Sorensen et al. 2014). As with the animal studies, these studies on humans also suggest the existence of critical developmental windows. For example, one of these studies in particular found that low maternal Vitamin A – an essential nutrient which is required by the early embryo and fetus for gene expression and regulation, and cell development – during the second trimester was associated with threefold increased risk of schizophrenia spectrum disorder for the unborn fetus as an adult, while no effects at all were observed for low Vitamin A in the third trimester (Bao et al. 2012).

Political Implications of Epigenetics

So now that the basic science of epigenetics has been established, what are the political and ethical implications? And how profound are they?

According to the basic assumptions of genetics, not only is the DNA sequence insulated from environmental influences, any influences which may accrue to the genes over the life of a parent are washed clean by chemical processes or otherwise kept from infiltrating the germline and being passed on via reproduction. The result is that every new generation is born with their pristine and individual copy of the genome of the species free of any influence from the previous generations.

Per the epi-politics model, these scientific assumptions from genetics should be congruent with the modern liberal conception of the political and ethical self, and they are: To quote Thomas Jefferson's rough draft of the Declaration of Independence, "We hold these truths to be self-evident that all men are created equal & independent," with the corollary that "from that equal creation they derive rights inherent & inalienable"

(Jefferson 1776). In other words, just as the basis of modern genetics is the inviolability and independence of the gene as the basic unit of heredity and the “blueprint for life” (Stanford at the Tech 2013), the basis of the system of basic human rights that is such a distinguishing characteristic of modern liberal society likewise deemed inviolable and independent.

However, according to these assumptions, this intergenerational inheritance of environmental effects of the parents is simply not possible. But what happens to this whole system of modern liberal ethics and politics if this founding assumption of equal and independent creation is scientifically demonstrated to be invalid? This is a question that needs to be answered.

For example, in the case of mother-fetus intergenerational inheritance described before, if epigenetic markers from the life experiences of the mother are passed on to her offspring, where is the “equal & independent” creation that is such a necessary component of the political and ethical structure of modern liberalism? Likewise, in terms of the individualism that is at the core of modern liberal politics and ethics (Siedentop 2014), if the effects of the mother’s (and father’s) choices and experience are passed on to offspring, at what point does the mother (or father) cease to be an autonomous individual—with the fundamental right to choose—and become rightfully considered the environment of the fetus? How in our modern liberal system of ethics and jurisprudence are rights to be assigned to persons-as-environments relative to persons-as-individuals? Is there even a way to conceptualize persons-as-environments? Likewise, if these heritable epigenetic markers begin to accrue to both parents even

years before the parents know each other, at what point can the choices of these mothers and fathers be legally and ethically circumscribed to protect the rights of their as yet unconceived offspring? Can the rights of a not yet existent person be protected by infringing upon the rights of other persons? And so on.

According to the ontologies of the prevailing popular narratives of genetics described before, and the corresponding ontologies of the politics and ethics of modern liberalism, there are no such confusions as to where one individual begins and the other ends, or between an individual and an environment—those distinctions are very clear. But just this one facet of the research in epigenetics produces a laundry list of fundamental contradictions with these conventional dichotomies, and this list does not even scratch the surface of the political and ethical implications from epigenetics. Intergenerational epigenetic inheritance muddies the waters of our conventional scientific, political and ethical distinctions in the ways just described, but consider the compounding effects from the transgenerational inheritance of these epigenetic effects across multiple generations and not just from parent to child (e.g., what happens to basic legal concepts such as statutes of limitations if the effects of environmental exposures and the results of choices can be traced down through three or four generations? What happens in terms of civil or criminal or corporate liability?). As shown by these few brief examples, conventional modern liberal society as currently constituted is—much like conventional genetics—not configured to incorporate the challenges introduced by epigenetics.

Why? As Jennie Dushek also observes, the “answers lie deep in the political and scientific history of biology” (2002). As will be shown in the next couple of chapters, one of the reasons why an assumption such as the inheritance of cleansed and pristine genes was accepted for so long—especially in the face of initially scant empirical support—is that this scientific assumption mirrored the prevailing political and ethical assumptions of the time regarding the individual self as equal and independent. This congruence facilitated the acceptance of this particular take on the science of genetics with its exclusion of epigenetics and epigenetic-like explanations. Again, there are no objective reasons why epigenetics and genetics should have been kept so separate for so long; that they were, though, per the epi-politics model, is an indication of the relationships between the prevailing biology, politics and ethics. The result, though, is that now this new information emerging from epigenetics constitutes the unique scientific and political and ethical challenges that it does.

Chapter IV

Epigenetics and Genetics: Science, History and Narrative

To better understand how and why contemporary epigenetics has come to constitute the fundamental political and ethical challenges it now does requires the contextualization of epigenetics vis-à-vis contemporary genetics. The main purpose of this chapter is to provide important details of the intertwined histories of genetics and epigenetics which will help to explain the current positions relative to each other, and also help to situate them both in history in terms of their effects on politics and ethics. In the process, this chapter will also show the influence of politics and ethics on the development of scientific narratives, which in turn—per Stone’s causal responsibility discussed in Chapter 2—influence politics and ethics. Again, the purpose of this analysis of the often strained history between genetics and epigenetics is not to take a stand *per se* on the sciences of genetics and epigenetics; rather, the point is to show how fluid and open is the process of the formation of even scientific narratives.

Epigenetics versus Genetics?

Epigenetics is just one aspect of what is being called the Extended Synthesis of evolutionary biology (Pigliucci & Muller 2010), in distinction to what is referred to as the Modern Synthesis of evolutionary biology, or the combination of the Mendelian view of genetics with Darwinian evolution which coalesced during the first half of the 20th century (Mayr 1980). Since this time, there have been remarkable advances in technology and in our understanding of the processes involved in biological development and evolution. Contemporary epigenetics is a product of these recent

advances, but the basic concepts of epigenetics have a long history of their own, some of which predate the major components of the Modern Synthesis.

The term 'Modern Synthesis' was brought to prominence by Julian Huxley in his book *Evolution: The Modern Synthesis* published in 1943, but primary credit for this particular integration of evolution and genetics is often given to four seminal figures and the books they wrote between 1937 and 1950, all of which were published by Columbia University which at this time was the seat of gene-focused experimental science (Kandel 1999): Theodosius Dobzhansky and his *Genetics and the Origin of Species* (1937), Ernst Mayr and his *Systematics and the Origin of Species* (1942), G.G. Simpson and his *Tempo and Mode in Evolution* (1944), and George Stebbins and his *Variation and Evolution in Plants* (1950). These books are singled out as the "quartet of classics" of the Modern Synthesis for the different ways these authors "molded Darwin's evolution by natural selection within the framework of rapidly advancing genetic knowledge" across the disparate fields of genetics, zoology, paleobiology and botany respectively (Ayala, Fitch & Clegg 2000, 6941; See also Callebaut 2010).

The work of these authors, though, was representative of the work of many other scientists during this time who were also integrating ideas from different fields to challenge the traditional understanding of evolution that had been prevalent since the publication of Charles Darwin's *On the Origin of the Species* in 1859. The result of this integration was the scientific consensus of evolution as a gene-centered process which came to be called the Modern Synthesis. In fact, this movement is called the Modern Synthesis because until the synthesizing work of Dobzhansky and the others, Mendelian

genetics and Darwinian evolution were actually competing and seemingly irreconcilable paradigms (Burian 2005; See also Bowler 1983; 1988; 1989; Depew & Weber 1995; Gayon 1998; Provine 1971).

Epigenetics and Genetics

Epigenetics is often presented as a challenge or an alternative to conventional genetics. In one sense, though, the Extended Synthesis of which epigenetics is such a significant aspect is—as indicated by the name—properly understood as the extension of the Modern Synthesis, and not its replacement. As explained by Massimo Pigliucci:

Let me again be clear on a fundamental point underlying this whole discussion: one can reasonably argue that none of this contradicts any tenet of the [Modern Synthesis], although it seems to me at least reasonable to concede that the new concepts and empirical findings...may eventually force a shift of emphasis away from the population genetic-centered view of evolution that characterizes the [Modern Synthesis] (Pigliucci 2007).

In this sense, at least, the Extended Synthesis and its constituent parts are not fundamental challenges to genetics per se, but rather a shift in focus. In particular, according to Pigliucci, this shift of emphasis merely involves the incorporation into conventional genetics and developmental biology of concepts such as evolvability, phenotypic plasticity, epigenetics, complexity and the nonlinearity of adaptation in high-dimension adaptive landscapes (Pigliucci 2007).

However, this point of view does not consider the political or the ethical aspects of these extensions of conventional genetics especially as differences in the narratives of genetics and the narratives of epigenetics. As will be shown, the popular perception of genetics is very simplistic and more similar to the conception of genetics from the

1950s than to the current highly nuanced scientific understanding of genetics. Likewise, the expectation is that there will be a similar disconnect between the popular and the scientific understanding of epigenetics, both of which will play a role in the emerging policy narratives of epigenetics.

At the level of straightforward science, it is probable that the ideas of epigenetics can be incorporated into the theoretical structure of genetics without too much difficulty. In fact, there are far more science-based reasons for the inclusion of epigenetics within genetics than for its exclusion, which actually makes the historical exclusion of the interactivity as revealed by epigenetics from genetics that much more of a puzzle: If epigenetics is so obviously already a part of conventional genetics, and so easily reconcilable with genetics, why has it been so ignored and even maligned for so long?

A plausible answer, per the epi-politics model, is that there must be even stronger non-scientific reasons for this exclusion of epigenetics. My working theory is that an analysis of the scientific assumptions of genetics as revealed by the research in epigenetics reveals important differences in the influence of non-scientific narratives on genetics and epigenetics over time, particularly in the 'hidden' political and ethical commitments of epigenetics compared to those of conventional genetics.

Given the ultimate affinities in the sciences of genetics and epigenetics, this focus on differences in the narratives is the best explanation why epigenetics and genetics have been kept so separate for so long when in a strictly scientific sense they are actually so closely aligned. Thus, again a focus of this dissertation is on revealing the

unseen ethical commitments of conventional genetics and epigenetics through a discussion of their different narratives as a means to analyze the political implications of the (re)emergence of epigenetics.

Politics, Ethics and Darwin

Per the guiding model of this dissertation, the scientific changes suggested by the recent emergence of epigenetics suggest commensurate political and ethical changes as well. This dynamic is perhaps best illustrated by the historical example of the emergence of Charles Darwin's theory of evolution.

Just as Darwin's theory of evolution presented fundamental challenges to many of the prevailing ontologies of the mid 1800s, which accounts for the significant scientific and ecclesiastical opposition which greeted the publication of *Origin*, so the Modern Synthesis as it emerged in the early 20th century presented scientific, political and ethical challenges of its own, and so does epigenetics today. However, there are important differences in the circumstances of the emergence of each of these significant changes in the prevailing understanding of biology, and in their commensurate impacts on the prevailing politics and ethics, and in the impacts of these prevailing politics and ethics on these changes in biology. The elaboration of these differences is an important step in predicting what could be the political and ethical impacts of epigenetics today and in the future.

Biology and Ethics

For example, Adam Sedgwick, one of the founders of modern geology and one of Darwin's early instructors, after reading an advance copy of *Origin* wrote that the "point

blank issue” that Darwin and his theory deny—but which is actually the “crown & glory” of organic philosophy—is that “there is a moral or metaphysical part of nature as well as a physical.” “You,” Sedgwick writes to Darwin, “have ignored this link; & if I do not mistake your meaning, you have done your best in one or two pregnant cases to break it.” The repercussions of breaking this link as Darwin proposes, which Sedgwick first thanks God is not possible, is that humanity “would suffer a damage that might brutalize it—& sink the human race into a lower grade of degradation than any into which it has fallen since its written records tell us of its history” (Sedgwick 1859). These comments from Sedgwick provide just one example of the well-known negative reactions to Darwin’s theory (Desmond & Moore , 488-92), most of which revolve less around the science and—per the guiding model of this dissertation—are more concerned with the political and ethical implications of Darwin’s theory of biology.

Likewise, the science of the Modern Synthesis and its emphasis on genes as the carriers of biological essences and of evolution as a gene-focused process generated new causal narratives which differed significantly from what were the prevailing narratives of the early 20th century. An important point of departure, though, is that while the Modern Synthesis did present some significant challenges to the conventions of the early 20th century, neither Mendelian genetics individually or as a component of the Modern Synthesis generated the heat or the opposition that Darwinian evolution did. In fact, I have been hard-pressed to find any references to the kinds of censorious reactions against genetics like those of Sedgwick cited before which did not come from those espousing epigenetics-like theories.

The best explanation I can give for this marked lack of reaction, per the epi-politics model, is that the assumptions of the science of genetics were already more or less congruent with the assumptions of the prevailing politics and ethics. This congruence facilitated the acceptance and propagation of the Modern Synthesis beyond the weight of the scientific evidence in its favor, which as will be shown was not as overwhelming in its favor as it now seems in hindsight. In fact, one tantalizing possibility suggested by the application of the epi-politics model and the emphasis on narratives to the history of the Modern Synthesis is that one of the reasons for the sudden acceptance of the synthesis of Mendelian genetics with Darwinian evolution—which until then had been competing explanations—was because it allowed just such a reconciliation of the science with the politics and ethics.

In contrast, I assert that the biological assumptions of epigenetics have been fundamentally at odds with the prevailing assumptions of our contemporary politics and ethics. This incongruence has been a significant—though largely unacknowledged—factor in the longstanding antipathy against epigenetics established in previous chapters. That epigenetics has gained the recognition it has within the last decade or so, though, suggests that perhaps these political and ethical conventions are changing in alignment with the innovations introduced by the biological assumptions of epigenetics.

As discussed in the previous chapter, this potential realignment of ethics and politics to become congruent with the ontological assumptions inherent in contemporary epigenetics would represent a fundamental shift in the basic commitments of contemporary society. What forms this ‘new’ society would take are

difficult to predict. As such, a primary purpose of this dissertation is to describe this potential realignment in its early stages through the lens of the political and ethical implications of epigenetics via the guiding model of this dissertation described in the previous chapter.

The combination of the epi-politics model with a focus on narratives reveals these differences in the circumstances of the relatively smooth integration of the Modern Synthesis versus the long-delayed and begrudging acceptance of epigenetics. This unique model and focus provides cogent explanations as to why the Modern Synthesis was accepted as easily as it was—because it conformed to the prevailing politics and ethics of its time—and why epigenetics has had the checkered history it has—because it did not.

However, the epi-politics model and this focus on the shared assumptions of biology, politics and ethics also suggest that, precisely because of these differences, for epigenetics to become widely accepted and to exert an influence on public policies there must be an eventual even if uneasy reconciliation between the science of epigenetics and the prevailing accounts of ethics qua causal responsibility and politics. This reconciliation must occur either through modifications of the politics and ethics to become more congruent with the innovations introduced by epigenetics, or through modifications of the science of epigenetics to become more congruent with the politics and ethics, or through some homeodynamic adjustments of all three components. We have the benefit of hindsight as to how this dynamic has already played out in regards

to both Darwinian evolution and the Modern Synthesis with the politics and ethics of their time; the outcome of this dynamic in regards to epigenetics remains to be seen.

In this context, the position of epigenetics vis-à-vis the prevailing politics and ethics of contemporary society is likely much more similar to that of Darwinian evolution in the 1860s than of the emerging science of genetics in the early 1900s. While there was some resistance to genetics on political (i.e., ideological) and ethical (e.g., religious) grounds in the early 20th century, genetics produced nowhere near the antagonistic response to Darwinian evolution or epigenetics—at least in the West. As will be discussed in subsequent sections, the reception of genetics in the Soviet Union, while initially quite positive, quite suddenly turned negative and for openly ideological reasons. In the West, though, with the possible exception of France (Gayon & Burian 2004), genetics has enjoyed a somewhat charmed life, moving quite rapidly from fringe scientific hypothesis to almost universally accepted convention.

The Response to Darwinian Evolution Compared to Genetics

In this context, it is noteworthy that genetics has trod a much smoother path even than its partner in the Modern Synthesis, the Darwinian theory of evolution by natural selection.

As described by the American philosopher John Dewey in his 1910 essay on the influence of Darwin, “the ‘Origin of Species’ introduced a mode of thinking that in the end was bound to transform the logic of knowledge, and hence the treatment of morals, politics, and religion.” And this has clearly been the case. Even before the publication of *On the Origin of Species by Means of Natural Selection* in 1859, the reactions to Darwin’s

ideas were immediate, international and intense. As evidenced by the Scopes trial, the religious reactions against Darwinian evolution were still boiling over sixty years after the publication of *Origin*, and these reactions against the implications of Darwinian evolution continue to the present day in the ongoing debates over the teaching of evolution in public schools. Notably, few of these reactions against Darwinian evolution also include opposition to genetics; instead, Darwinian evolution is usually the sole focus of these ideology-based critiques (i.e., how many school boards have banned the teaching of genetics on religious grounds?). In fact, if the available evidence supports any conclusion, that conclusion is that genetics is also compatible with the basic assumptions of Christianity (Branch 2013; Lester 1995, 1998; Moore 2002; Morris 2000), which given the extent to which modern Western society is a product of the history of Christianity only provides further support for a fundamental congruency between genetics and the political and ethical assumptions of modern Western liberalism (Hannam 2011; Moritz 2012; Stark 2014; White 1967).

The Acceptance of Epigenetics: More like Mendel or Darwin?

Thus, given the recent emergence of epigenetics, there are at least three potential avenues that can be taken at this point: That contemporary politics and ethics are already changing to be congruent with these novel assumptions introduced by epigenetics; that these contemporary politics and ethics are not changing and will not change as needed to become congruent with epigenetics; or that epigenetics and the prevailing politics and ethics will all change together so as to become congruent with each other.

In the first case, as the politics and ethics continue to change the science of epigenetics will be increasingly incorporated into contemporary politics. In the second case, the science of epigenetics will be increasingly hounded to the brink of irrelevance or extinction—as epigenetics had been until relatively recent. In the third case, some of the aspects of epigenetics which contradict these prevailing ethics and politics will be modified to conform while some of the other aspects of the politics and ethics which contradict the findings of epigenetics will likewise be modified to conform to epigenetics, though what these homeodynamic changes might be is difficult to predict at this point.

At this early stage in the (re)emergence of epigenetics, any of these outcomes is plausible. Regardless, just as the narratives of evolution and genetics from the Modern Synthesis began to influence public policies in distinct ways even before the codification of the Modern Synthesis—for example, the influential eugenics movements of the early 20th century which produced major and controversial policies, only to eventually fade from public awareness (Adams 1990; Harper 1992; Scales-Trent 2001; Sofair & Kaldjian 2000)—so also may the emerging narratives of epigenetics already be introducing unanticipated wrinkles into contemporary public policy discussions.

Thus, one purpose of this dissertation is to empirically analyze the implications for policy of these new challenges from epigenetics via the emerging narratives of epigenetics, as compared to the conventional narratives of obesity in particular. At the same time, this dissertation is one of the first attempts to comprehensively assess this process of the reconciliation of epigenetics with the prevailing politics and ethics. As

such this dissertation constitutes an important early point of reference for future discussions of the state of epigenetics, and of its political and ethical implications.

A Brief (Political) History of Epigenetics

But first, more detail of the history of epigenetics relative to the history of genetics needs is required to properly situate the nature and the magnitude of the challenges introduced by epigenetics. The preceding has set the stage of the political and ethical implications of the history of genetics and of evolution. A more in-depth of the history of epigenetics will present a more complete picture.

As discussed in previous chapters, the discovery of epigenetic mechanisms such as methylation, chromatin remodeling and RNA-mediated inheritance almost immediately opens up the space of evolutionary and developmental possibilities way beyond the limits established by the conventional understanding of genetics. In particular, the new evolutionary and development possibilities introduced by non-genetic epigenetic inheritance as responses to environmental circumstances have significant implications for public policies which are only just now being recognized.

Again, the conventional story from the Modern Synthesis is that because genes are not responsive to their immediate environments, genes only change through the long, drawn-out process of natural selection. While the Modern Synthesis allows that the expression of these genes is affected by the environment, any changes in phenotype due to environmental conditions are definitively not inherited by subsequent generations. These assumptions of the isolation of genes and of the impossibility of the

inheritance of acquired traits, both of which are called into doubt by contemporary epigenetics, have a long and politically charged history.

That the discourse of genetics has evolved as it has over the last seventy years with the veritable exclusion of the interactivity revealed by epigenetic phenomena means that the introduction of epigenetics at this point in time now constitutes a significant challenge to the entire theoretical edifice of modern evolutionary thought. If epigenetics had been accepted into the mainstream of genetics at a relatively early stage of its development, as it just easily could have been, then the interactivity revealed by epigenetics likely would have been incorporated into the overall theoretical structure of genetics without too much disruption. However, that genetics has evolved within its specific trajectory has committed mainstream genetics to a whole nest of theories and assumptions and empirical results to which the newly reemerging science of epigenetics now represents such fundamental challenges.

In other words, that genetics has evolved as it has with this at best ambiguous acceptance of the interactivity as revealed by epigenetics is as much a historical accident and the product of external politics as it is the result of neutral scientific processes. Recognition of this contingent nature of the development of genetics actually constitutes an important aspect of the narrative analysis that is the focus of this dissertation, and will be discussed in much more depth in the subsequent sections on policy discourses and policy narratives.

C.H. Waddington

In the history of contemporary Western evolutionary theory, the first use of the term *epigenetics* is generally attributed to Conrad Waddington in an article published in 1942. In this article Waddington used epigenetics as the name for the study of the causal mechanisms through which genes bring about their phenotypic effects and which necessarily involve adaptive interaction with the environment—although it bears mentioning that the ‘epigenetics’ of Waddington was rooted exclusively in embryology and development, and is not quite the epigenetics of today with its emphasis on non-genetic inheritance, but is better conceived of as “developmental genetics” (Gilbert 2012). Years before this 1942 article Waddington had proposed the appearance of particular organs as the product of the interactions of the genotype and what he called the “epigenotype” with the external environment (Waddington 1939). He then subsequently developed this idea of an epigenotype into the more general notion of epigenetics.

For Waddington, the postulation of the epigenotype as a distinct biological layer and the recognition of epigenetics as distinct processes in biological development were necessary steps for the progress of genetics. According to Waddington, important evidence which could contribute to a more complete understanding of biological development was being overlooked because the nexus of the epigenotype between the genome and the environment was being so maligned by the prevailing gene-environment dichotomy. Importantly, according to Waddington himself, Waddington’s original project in promoting the explicit recognition of this biological layer between the

genome and the environment was not to challenge but rather to extend the conventional understanding of genetics through a more sophisticated approach which bridges the gap between the genotype and the developing phenotype via the epigenome (Waddington 1940; See also Gilbert 2012; Jablonka & Lamb 2012).

However, at this point, it may be useful to mention something about Waddington's politics. Although it would probably be imprecise to label Waddington a Marxist, *per se*, it is clear that many of his closest associates were unabashed Marxists, and that if Waddington himself was not a card-carrying Marxist he had strong ideological tendencies in that direction (Peterson 2010). Waddington's ideological inclinations and his openness to a more holistic and emergentist biology were not unique. Val Dusek, in his depiction of the emergence of the anti-mechanist and anti-reductionist biology in the late 19th and early 20th century, identifies many of the prominent scientists involved in research in this area—such as J.B.S. Haldane, a prominent figure in the mathematical theory of population genetics, J.D. Bernal, a pioneer in X-ray crystallography—as “self-proclaimed Marxists,” and discusses a couple of the ways that their ideological inclinations were manifest in their scientific work (1999, 21-22). Swann and Aprahamian also detail a number of ways in which the dialectical materialism of Marx and Engels fit the assumptions of the experimental work of these scientists including Waddington (1999, xvi-xix). These connections between politics and science were not lost on the scientists themselves, as Waddington observed that “a scientist's metaphysical beliefs are not mere epiphenomena, but have a definite and ascertainable influence on the work he produces” (2009, 72).

Bearing this political background in mind, Waddington highlighted the philosophical roots of the dogmatic limitations of the Modern Synthesis sixty years ago, and discussed the implications of the challenges introduced by epigenetics to these basic ontological commitments. In particular, Waddington described the insuperable wall between genes and their environment as evidence of the “exaggerated atomism” of modern genetics which is the “gravest defect” not just of modern genetics but of modern science as a whole (1953, 188). Again, this assumption of atomism in modern genetics is also reflective of similar assumptions of the atomistic individual which is a central pillar of modern liberalism, as expounded most notably by John Locke and Thomas Hobbes (Barbour 2006; Den Uyl & Rasmussen 2006; Hurtgen 2002; Taylor 1985).

The problem with such atomisms and their resulting dualisms—in this case the alleged isolation of genes from their environments—is that they are at best exaggerated and oversimplified, as demonstrated by the recent recognition of the importance of epigenetics in evolution and biological development. As writes Waddington, this logic of dichotomization commits modern evolutionary theorists and geneticists to the idea that:

All living things, man included, had been brought into being by the collocation of two entirely independent factors: on the one hand the occurrence of mutations whose nature was totally unconnected with any ambient circumstances, and on the other hand a sieving process in which the environment merely selected from organisms which were offered to it ready made as units of being...each [factor] having its character in its own right, which come together with as little essential inter-relation as a sieve and a shovelful of pebbles thrown on to it. (1953)

According to Waddington, this dichotomization of environment and organism which is so fundamental to modern genetics and the Modern Synthesis constitutes a breach with reality “as complete as the Cartesian dualism of mind and matter” (1953).

The Cartesian dualism of mind as substantially distinct from the matter it observes and manipulates is the ontological and epistemological basis of modern science—manifest primarily as the subject-object distinction which guides modern scientific investigation. As described in encyclopedic detail by P.F.M. Fontaine (1986), some form of dualism has been the implicit if not explicit assumption of most philosophies and sciences and religions throughout Western history going back to Plato and Aristotle. The philosopher Alfred Whitehead locates the pervasiveness of this “facile vice of bifurcation” as the inevitable result of the commonsense—but incorrect—perception of objects ‘out there’ as obviously distinct from the entity ‘in here’ that is perceiving those objects ([1920] 1964).

Because “organism and environment are not two separate things,” Waddington proposed his integrative and more interactive epigenetic theory of biological development as a means of “healing” this unwarranted and ultimately unscientific separation of ourselves from our environments (1953). Likewise, a main goal of this dissertation is to challenge and to unravel this fundamental dichotomization as a means to identify and potentially reconcile the politically relevant narratives of genetics and epigenetics, to begin to discuss how epigenetics could make its impact on public policy.

Waddington was not alone in seeing the opportunities from the integration of genetics with epigenetics. He and others had been able to marshal significant empirical

evidence in demonstration of the role of the epigenotype in phenotypic plasticity (Kirpichnikov 1947; Snyder 1950) and even in non-genetic inheritance (Ephrussi 1958; Mitchell & Mitchell 1952; Russell 1942; Waddington 1942) in the 1940s and 1950s. Regardless of this work, though, epigenetics was in Waddington's words still "so completely rejected by the rest of the scientific world that it is hardly considered to be worthy of discussion" (1953), an attitude as shown before which was carried on well into the 1990s (Haig 2012).

This almost blanket rejection of the evidence in favor of epigenetics in the development of the Modern Synthesis was for Waddington not the inevitable and justifiable outcome of scientific progress. Rather this rejection was proof of the "extremist" nature of the Modern Synthesists and their practically exclusive focus on genetic adaptation to the neglect of "the doctrines emerging from other fields of modern biology" which could be combined with genetics to produce significantly different (and ostensibly more comprehensive) conclusions (1953). The political and ethical underpinnings of both this rejection of epigenetics and of epigenetics itself in the mid-20th century will be discussed in more detail in a subsequent chapter. Suffice to say, this antagonistic attitude towards epigenetics delayed for over sixty years the significant advances being reported almost daily from research in epigenetics across a wide swath of domains, the human costs of which are incalculable.

Jean-Baptiste Lamarck

Waddington was not the first to propose such ideas about the fluidity of adaptation and inheritance; similar ideas predated Waddington by more than a century.

The first fully developed theory of evolution which included the inheritance of adaptive characteristics acquired during the life of an organism was actually formulated by Jean-Baptiste Lamarck (1744-1829), and is usually referred to as Lamarckism.

The importance of Lamarck in the contemporary debates about evolution and genetics is difficult to overstate, primarily because one of the most common epithets used against contemporary epigenetics is that it is 'Lamarckian', which distinction is presumed sufficient to invalidate any subsequent discussion. As will be shown, such references demonstrate fundamental misunderstandings of both Lamarckism and epigenetics. This invocation of epigenetics *qua* Lamarckism, though, is quite revealing of the underlying political and ethical commitments of conventional genetics.

The classic example used to describe Lamarckian inheritance is that of the elongation of giraffe necks as a result of giraffes having to stretch to reach available forage located higher and higher in the trees. The theory for this elongation that is attributed to Lamarck is that the physical effects from the constant stretching of the necks by giraffes in one generation was then passed on to their offspring in the next generation. Giraffes in these subsequent generations were then able to reach even higher into the trees, which raised the height of available forage, thereby requiring even further stretching which was then passed on to subsequent generations, and so on, thus resulting in the very long necks of the giraffe species (Moore 1970).

However, it bears mentioning that this prototypical example was not a central aspect of Lamarck's theoretical exposition of the mechanisms of inheritance. Although Lamarck did advocate a law of use-inheritance in evolution, as observed by Ron Roizen,

Lamarck's theoretical treatise regarding inheritance, *Philosophy Zoologique*, "runs fully 405 pages in its English translation yet it contains only two sentences specifically about giraffes" (1971). Thus, the historical and scientific significance of this specific example as a characterization of Lamarck's thought appears to be greatly exaggerated.

Also, in judging the validity of Lamarck's theories, there is the issue of what was known and knowable in Lamarck's time. As Hugh Samuel Roger Elliott writes in his introduction to *Philosophie Zoologique*, at the time of Lamarck "many of the known facts of evolution might be accounted for either by use-inheritance or by natural selection. If it is true that acquired characteristics are hereditary, then the giraffe might well have developed his neck through that agency. The hypothesis fits the facts." However, Elliott goes on to also note that "but so also does the hypothesis of special creation," and also that "similarly, again, natural selection is equally satisfactory as an *a priori* hypothesis." In other words, for Lamarck and others of his time, "the facts are covered by at least three different and mutually exclusive hypotheses," and without the benefit of *a posteriori* experiments, Lamarck opted for the *a priori* validity of use-inheritance. This assumption is not of itself invalid in a scientific sense; what is required next, as Elliott observes, is to verify empirically the mechanisms for such inheritances, which neither Lamarck nor anyone else of his time pursued. Still, concludes Elliott, given the specific circumstances of Lamarck "few indeed are the people who are competent to judge of the correct use of deduction in difficult biological inquiries" (Elliott 1914).

Further, as Michael Ghiselin observes:

Lamarck's approach to evolution was that of a metaphysician rather than a natural scientist. It invoked a mystical assumption (the notion that

organisms sought “perfection” and tended to become increasingly complex and man-like) which could not be treated scientifically and could not be supported or contravened by evidence. For that very reason, Lamarck’s construct was not a proper theory and was not at all comparable to the theory that Darwin would later present in *On the Origin of Species*. Darwin’s concept was a well articulated body of scientific thought that could be, and was, tested by recourse to facts. Lamarck’s was not. (1994)

In other words, there are substantial methodological and perspectival distinctions between Lamarck’s theories and Darwin’s theories that in many ways render them if not incommensurable, then at least not directly comparable. Likewise, the assumptions and methods employed by Lamarck are not the methods and assumptions of contemporary epigenetics. Therefore, for all the superficial and even substantial similarities between Lamarckism and contemporary epigenetics, the comparisons of contemporary epigenetics to Lamarckism are as unfair to epigenetics as are the uncharitable comparisons of Lamarckism with Darwinism, as neither takes into account these issues of method, perspective or historical context.

Ghiselin goes on to write that in pointing out these differences his point is not to defend Lamarck’s theories of inheritance *per se*, but rather just to demonstrate that “the Lamarck presented in schoolbooks...is a fiction—an imaginary figure who has been fashioned from hearsay and wrong guesses, and who has been replicated in countless books by successive teams of plagiarists” (1994). My point in raising these issues is also not to defend Lamarck’s theories of inheritance *per se*, but to show to what extent the comparisons of contemporary epigenetics with Lamarckism are often little more than facile straw man arguments, as the scientific flaws of Lamarckism are of little relevance to contemporary epigenetics. What is relevant, though, is how these misplaced

references to Lamarck and Lamarckism are so often used to dismiss contemporary epigenetics out of hand.

Still, for a while Lamarckism was the one of the preeminent explanations for biological origins, inheritance, and development before the emergence of Darwinism. Darwin himself actually proposed Lamarck-esque mechanisms for the transmission of acquired traits which Darwin called “pangenesis” (Geison 1969). Likewise, as discussed in detail in the sections on contemporary epigenetics research, there are many evolutionary scientists and biologists working in epigenetics today who are able to show this blanket dismissal of epigenetics has been misguided. Regardless, this Lamarckian “soft inheritance” (Mayr 1980) and other epigenetic explanations are now still often dismissed as rather quaint pre-Mendelian and non-scientific vestiges of the evolution of science. Again, I suggest that, per the epi-politics model, this dismissal of epigenetics is more a function of the conflict of the underlying ontological commitments of epigenetics with the common fundamental assumptions of modern politics and ethics and genetics than the result of the objective scientific superiority of genetics and the Modern Synthesis.

In this way, instead of constituting a valid critique of epigenetics these references to Lamarck seem to function more as a “conversation-stopper” (Rorty 1994) against further discussion of contemporary epigenetics in much the same way that the mention of religious beliefs in a polite scientific or political discussion is “one good way to end a conversation—or start an argument” (Carter 1993, 23). More will be written about how and why Lamarckism became the *de rigueur* scapegoat for the sins of all non-

selectionist and nongenetic theories of evolution and development, but suffice to say that—per the epi-politics model—there are substantial political roots beneath these contemporary Lamarck-based invectives against epigenetics going back at least to the Cold War (Gershenowitz 1984).

Some well-known evolutionary scientists such as Stephen Jay Gould—“America’s evolutionist laureate” (Dennett 1995)—likewise dispute this common distortion of Lamarck’s thought as an unfair oversimplification that discredits the actual depth of Lamarck’s more comprehensive evolutionary theory, advocating for the inclusion of at least some Lamarckian concepts into the structure of evolutionary theory (Gould 2002). For example, elsewhere Gould praises Lamarck for so strongly emphasizing “the active role of organisms as creators of their environment” as an aspect of contemporary evolutionary theory that is often overlooked, but then stipulates that “this, and only this” is valid from the thought of Lamarck (Gould 1980).

That being said, just as this openness to the influence of the environment in evolution and biology is coincident with Gould’s well-known “ferocious opposition” to biological determinism (Horgan 2011), as also displayed in his book *The Mismeasure of Man* (1996). At the same time, both of these scientific stances are coincident with what have been called Gould’s “radical” affinities with socialism and even Marxism (Lewontin & Levin 2002). Strains of Gould’s ideological preferences and tendencies have been identified in Gould’s ostensibly objective work as a scientist by a number of scientists and commentators (Lewis et al. 2011; Michael 1988; Prindle 2009; Wade 2011).

These ideological influences on Gould's endorsement of Lamarckian mechanisms are of note for a couple of reasons: First, they provide another more contemporary example of the connections between support for epigenetics-like theories of biology and an ideological orientation which is counter to the predominant political and ethical assumptions. Second, and perhaps more important, is that as with most of the examples I have given so far of the epi-political relationships between biology and politics this is another example of the association of epigenetics with a non-mainstream, particularly leftist, ideology. However, that support for epigenetics is so often associated with leftist ideologies also implies an obverse association of conventional genetics with non-leftist ideologies. That these ideological tendencies of Gould and Waddington and so many others are identifiable in their scientific work in support of epigenetics suggests there are ideological tendencies in the scientific opposition to epigenetics, which likewise suggests ideological underpinnings for the endorsement of conventional genetics which has excluded or ignored the interactivity revealed by epigenetics for so long. To suggest otherwise is to suggest that there is a quality in left-leaning scientists that is completely absent in non-left-leaning scientists.

However, this should not be taken to mean that scientists working in epigenetics must necessarily also endorse a leftist ideology, or that geneticists must endorse the opposite or even any ideology. It is perfectly plausible for a scientist to engage in experimental work in a field such as genetics and be completely apolitical, and just be following standard scientific methods and procedures. The point rather is that there are historically contextualized assumptions underlying different scientific orientations,

which guide the science and inform the results in particular ways, regardless if the individual 'normal' scientist is aware of these influences in the conduct of day-to-day science (Kuhn 1970).

Chapter V

The Narrative Policy Framework and Epigenetics

As just discussed, modern science, despite its patina of objectivity, is as much a process of narrative formation as it is a process of generating knowledge (Fuchs 2015; Sheehan & Rode 1999; Wise 2011). Not only are scientific results interpreted through ideological lenses, the practice of science itself in terms of the derivation of concepts and the determination of which issues are seen as problems worthy of scientific study, as well even which methods are appropriate to investigate an issue and what counts as evidence, are all decisions that can have multiple ideological influences, especially early on in the process of the formation of a science. Over time the ideological influences on these initial methodological choices are obscured by practice and the accretion of results to become just the 'normal' science that is conducted without reference to or even knowledge of these ideological influences (Kuhn 1970), but the vestiges of these initial ideological influences persist.

As discussed at length in the previous chapters, the until-recent exclusion of epigenetics from the orthodoxy of genetics is associated with often extreme ideological influences at key moments in the development of the science of genetics. This brief scientific history is necessary to explain the significant political and ethical implications of the recent emergence epigenetics. The conventional and popular understanding of genetics, with their emphasis on the atomistic isolation of genes from their environments, coincide with the narrative of modern political liberalism, with its emphasis on the atomistic and autonomous individual as the ultimate locus of ethical

responsibility. The science of epigenetics, though, significantly expands the possibilities of the interaction of our biological essences with our environments, as well as of our ultimate dependence on the environments and decisions of others, which do not coincide so easily with these prevailing political and ethical commitments.

One focus of this dissertation until this point has been to establish this congruence of the mainstream understanding of the science of genetics with the prevailing politics and ethics of modern society. Contemporary epigenetics is technically a subfield of genetics, but the interactivity revealed by epigenetics has also been marginalized within genetics until quite recent; this marginalization and this recent acceptance both require explanation. My contention is that there are political motivations for both the marginalization of epigenetics and its recent emergence related to this congruence of the assumptions of biology with the assumptions of the prevailing politics and ethics illustrated in Figure 1.1.

This fundamental congruence between genetics and the prevailing politics has been established primarily through a historical accounting, and through a discussion of the narratives—or causal attributions—which have both guided the development of the science of genetics and which have been derived from genetics to be congruent with the prevailing politics and ethics. Now that epigenetics has begun to emerge as a viable science, the question now becomes what are or will be the narratives of epigenetics? Are these emerging narratives of epigenetics similar to or compatible with the prevailing politics and ethics, or fundamentally different than those of both genetics and of the prevailing politics and ethics?

Narrative Analysis and Politics

The cornerstone concept of policy narrative analysis is that narratives are a critical part of the identification of causes and the assignation of responsibilities. The question at hand is to what extent epigenetics affects or will affect the policy narratives of obesity, and what might be the implications for policies in other domains. As has been discussed, political ideology has already had a significant impact on the history and science of epigenetics. As will be discussed further, ideology has and will continue to have impacts on the political use of epigenetics. Therefore, identifying possible ideological influences on the current discussion of obesity policy narratives is an important step in the discussion of the different possible forms that the emerging science-based narratives of epigenetics could take. Once these ideological influences on epigenetics are identified in regards to obesity policy, these findings can then be extrapolated to other policy domains as well.

What is Narrative?

In popular parlance a narrative is generally considered as just the telling of a story. In more precise terms, the *Concise Oxford Dictionary of Literary Terms* defines a narrative as “a telling of some true or fictitious event or connected sequence of events, recounted by a narrator...to be distinguished from descriptions of qualities, states, or situations...consist[ing of] a set of events (the story) recounted in a process of narration (or discourse), in which the events are selected and arranged in a particular order (the plot).” There is an even more specific and particular definition of ‘narrative’ than either the lay version or the literary version: the policy narrative.

Before describing and analyzing policy narratives, there are certain almost instinctual aspects of narrative itself that must be addressed, which account for the persuasiveness of narratives in policy. As summarized by Michael Jones, “the most compelling reasons to embrace narrative as a model for exogenous influence on preference formation are straightforward: there is considerable evidence that humans use narrative to organize, process, and convey information...Indeed, there is persuasive evidence that narrative cognition is fundamental to human existence” (Jones 2010).

“Narrative,” as writes David Herman, “can be construed as both reflecting and supporting a cognitive predisposition to find causal links between entities, states, and events in a sequentially presented array” (Herman 2003, 19). Through these syntactical properties of narratives, the “the ongoing stream of experience” is organized into usable ‘chunks,’ without which the world would quickly become unmanageable (Herman 2013, 233). This order-imposing function of narratives is similar to what the cognitive scientist and artificial intelligence pioneer Marvin Minsky refers to as “frames,” or the heuristics necessary to represent the unruly cacophony of realities in which cognizing entities are immersed (Minsky 1975; 1985). Others have since identified the neurological substrate for human narrative capacities (Frith 2007; Hawkins & Blakeslee 2005; Troiani et al. 2006), and cataloged the significant impairments that result when this physical capacity for constructing or assimilating narratives is damaged (Hirstein 2006; Young and Saver 2001). Thus, our human penchant for constructing narratives is more than just a preference for hearing stories, but rather appears to be a fundamental aspect of human existence, down to the physical arrangement of our brains. In all these ways, the

concept of narrative moves beyond merely recounting events to establishing an order and reasons for those events. This ordering function of narratives is extremely important in the context of policy narratives.

Policy and Narrative

In this context, the suggestion that there are narratives in regards to policies is remarkably uncontroversial. At the same time, given this centrality of narratives to human experience, what is perhaps surprising is that the systematic recognition and analysis of policy narratives is a fairly recent development in policy studies. According to the histories of the field provided by Jones (2010) and McBeth, et al. (2007), the application of narrative analysis to policy studies was likely kicked off by Deborah Stone in her seminal 1988 book *Policy Paradox: The Art of Political Decision Making*, with the first explicit reference to narratives in the policy analysis literature by Hukkinen, Roe, and Rochlin in 1990. Regardless, for the past couple of decades the policy change literature has been dominated by the advocacy coalition framework (ACF) of Sabatier and Jenkins-Smith (1993), the timing and convergence theories of Kingdon (1995), and the punctuated equilibrium theory (PET) and policy subsystems models of Baumgartner and Jones (1993). While these theoretical perspectives capture important aspects of the policymaking process, and some applications of these other approaches do make some use of narratives (Baumgartner, 1989; Baumgartner & Jones, 1993, pp. 27–9; Hajer, 1993; Radaelli, 1999; Schneider & Ingram, 2005), relatively few discussions of policy change through the 1990s acknowledged the role of narratives.

As described in McBeth (2014), although “talk of ‘narrative’ was everywhere in academia” in the 1990s, this talk did not penetrate the policy studies literature to any significant extent. This lack of attention to narrative within policy studies was largely due to the connection of narrative analyses with post-modernism and post-positivism which challenge the conventional notions of scientific objectivity and generalizability, or that a text or discourse can be separated from its sources or uses (Jones & McBeth 2010), which means that the analyses of texts and discourses also necessarily involves subjectivity and interpretation. This epistemology does not lend itself to the traditional positivist goals of generalization, quantification or prediction. This approach was thus perceived by most mainstream policy scholars as “too superfluous to underpin theory building, and too nebulous to facilitate the empirical investigation of policy processes and outcomes” (Jones & McBeth 2010). For example, responding to critiques about the exclusion of postpositivist approaches by the mainstream of policy studies, Paul Sabatier (2000) argued that because “science requires clear concepts, testable hypotheses, and falsification...by these standards postpositivism has failed to be clear enough to be wrong” (Jones & McBeth 2010).

Narrative Policy Framework

As described in McBeth (2014), in the years after Sabatier’s positivist response to these postpositivist critiques, a spate of papers which tied together Sabatier’s advocacy coalition framework and Baumgartner and Jones’ punctuated equilibrium theory with a policy narrative approach were being produced by a group of policy researchers centered at Idaho State University (McBeth, Shanahan & Jones 2005; McBeth et al.

2007; McComas & Shanahan 1999; Shanahan et al. 2008; Shanahan, Pelstring & McComas 1999). These papers, according to Jones and McBeth (2010), made the case “for a theoretically driven approach to narrative that is both empirical and falsifiable” which became called the narrative policy framework (NPF) (see also Shanahan et al. 2011). This narrative policy framework has since blossomed into a subfield of its own led primarily by the ‘Portneuf School’ of policy narrative analysis out of Idaho State University (McBeth 2014) which combines the traditional positivist goals of generalization and prediction methodologies with an approach which seeks “to deconstruct narratives for the purpose of revealing hidden ideologies” (Jones & McBeth 2010). This is the approach that will be utilized to discuss epigenetics.

This identification of causes and responsibilities via the narratives that are used to describe obesity and epigenetics is the empirical focus of this dissertation. In true structural and positivist fashion, this analysis will be conducted by counting the narrative elements of the different narratives to apply some kind of generalizability to glean some kind of prediction about the nature of the different narratives from the words that are used. However, also true to the narrative policy framework of the Portneuf School, there is an additional postpositivist component to this narrative analysis of deconstructing these narratives to uncover the underlying ideologies. This approach allows the elaboration of the emerging or potential narratives of epigenetics, and how these narratives might manifest as epigenetics-informed policy. This approach also demonstrates the utility of this recent emergence of epigenetics in revealing the hidden ideologies of the seemingly objective scientific discourses of genetics, which in

turn reveals many of the hidden assumptions of the politics and ethics of modern liberalism upon which the science of genetics has been constructed.

Health and Narratives in the USA

As exemplified by the ongoing conflicts around the Affordable Health Care Act (2009), health policy in the United States has long been marked by a certain ambivalence. On the one hand, Americans have often appealed to government to step in and intervene in health issues that do not seem resolvable through individual or market responses; on the other hand, government interventions into public health issues have also been met with considerable skepticism and resistance (Beauchamp 1976; Garrett 2000; Klineberg 2002; Starr 1982).

There are a number of deep-seeded reasons for this ambivalence. In his book *America the Unusual* (1999), John Kingdon describes this uniquely individualist American “ideological center of gravity” as having been “systematically and deliberately built into our unusual institutions” as a reflection of the beliefs and suspicions of the original settlers of North America. As a result of this historical “path dependence,” Kingdon writes:

The idea of limited government became a hallmark, not only of some sort of general American political culture but also of the very structure of governmental institutions under which Americans still live. Those institutions consequently make change difficult and reinforce the ideology of limited government. (1999)

In other words, in the United States the “default starting place” (Lawrence 2004) for the discussion of health issues such as obesity is generally individualism, as a reflection of the deep historical, cultural and even structural values of individualism and

limited government (Bellah et al. 1996; Kingdon 1999; Lipset 1991). Thus, this default starting point exerts a significant influence on the trajectory of policy making in the United States in favor of individual-based and individual-focused policies. However, individualism is by no means the only effective policy narrative. That being said, narratives based in individualism do enjoy a number of other advantages over other narrative types which have relevance for this discussion of obesity policies and epigenetics.

Establishing cause and effect is an important aspect of public policy, as this determines who or what is responsible for the problem and therefore who or what is responsible for fixing the problem. As Deborah Stone observes in her seminal book *Policy Paradox: The Art of Political Decision Making* (2002), “there is always a choice about which causal factors to address, and different choices locate the responsibility and burden of reform differently.” These choices are then used “to prevent people from causing the problem, to make them compensate other people for bearing the problem, and to punish them for having caused suffering.” Ultimately, as Stone concludes, “to identify a cause . . . is to place burdens on one set of people instead of another,” but also to allocate the reputational or fiduciary benefits from resolving the issue to certain sets of people rather than others.

The credit or blame for an outcome usually comes in the form of a narrative composed of “characters, plots, colorful language, and metaphors to analyze policy narratives” (McBeth et al. 2007); the more persuasive the narrative, the more easily accepted the accompanying assignments of credit or blame.

The choices of elements in policy narratives are also helpful in revealing the political positions and ideological commitments of the different sides in a political dispute:

In particular, the storyteller's political tactics are revealed in how they construct who wins and who loses in a policy story (or who reaps the benefits and pays the costs), how they characterize policy issues and their opposition, and how they either entangle policies in larger cultural issues or alternatively try to ground such issues in the certainty of scientifically deduced numbers and facts. (McBeth et al. 2007)

The choices of narrative elements also yields important information about the power differentials and the timing of the rise and decline of different groups involved in a policy contest. As McBeth et al. (2007) discuss, the identification of winners and losers, the kinds of symbols that are used to describe important features of the policy domain, the invocation of other policies—i.e., “policy surrogates” (Nie 2003)—and the resort to science to promote certainty or uncertainty are all functions of who has power or is perceived to have power and who does not, and all are significant components of policy narratives. Just as power positions can change over time, so also change the narratives of the different groups as their differences in power change.

The analysis of narratives through the NPF can also be used to track these fluctuations in policy domains over time. This is another way that the narrative of epigenetics as a new player in the policy arena could be used (e.g., to promote either scientific certainty through its new knowledge, or scientific uncertainty through its new knowledge), but first the composition of the narrative of epigenetics itself needs to be established as a baseline.

The Political Effectiveness of Individualistic Narratives

As discussed at length in Clemons et al. (2012), when it comes to policy narratives, research across a number of experimental formats shows that individuals are much more persuaded by narrative descriptions than more accurate technical or scientific descriptions (Golding, Krinsky & Plough 1992; Rook 1987; Small, Loewenstein & Slovic 2007), and in particular through narratives which involve identifiable victims rather than references to abstract groups (Slovic 2007). If credit or blame for a health issue is assigned to the individual, then the individual likewise has the duty or the responsibility to resolve this issue; however, if credit or blame for a health issue can be assigned elsewhere—e.g., to the government in the case of a market failure, or of health identified as a collective good—then the responsibility for addressing these health concerns naturally accrues to the party or parties identified in the narratives.

Given this long tradition of emphasizing the autonomy of the individual in the United States (Garrett 2000), the beginning point of discussion of policy narratives is usually at the individualistic end of the narrative spectrum. This uniquely American ideological and structural emphasis on the individual is especially problematic in the context of the notion of a *public* health as “the collective health of populations and their environment” because defining health problems in terms of individuals limits governmental responsibility for addressing it (Lawrence 2004). As long as attribution for the problem remains at the level of the individual, widespread support for government intervention is difficult to achieve. Nathanson (1999) catalogs how a necessary step in garnering policy attention to a health issue is the “construction of credible risks,” by

which is meant that a health issue is raised above a community's threshold of awareness and becomes defined as a risk not just to the health of individuals but to the health of everyone. Likewise, Kersh and Morone (2002) and Schwartz and Brownell (2007) provide lists and historical examples of the actions necessary to induce government intervention in health issues, all of which involve different ways to change the focus—or the narrative—of a policy issue from the level of the individual to society.

However, policy narratives which espouse these deep-seeded cultural values of individualism and limited government have been shown to be powerful motivators of support for policies which reflect these values. As a specific demonstration of which policy stories are more convincing, Clemons et al. (2012) tested the persuasive power of three kinds of narratives—individualistic, systemic, and science-based—and found that over half of the people they surveyed designated the individualistic narrative of obesity as most persuasive, with only a quarter of respondents identifying the science-based narrative as most persuasive, and only one in five identifying the system-level narrative as the most persuasive account for the causes of and solutions to obesity.

The prevalence and persuasiveness of individualistic narratives has also been identified in media sources such as news outlets. In this case, the reference to individualism is a reflection of not only these longstanding cultural values but is also a matter of convenience and a result of how narratives themselves function. In the competition for eyeballs, and given the constraints of time and space, news outlets will often simplify complex social processes by emphasizing their more melodramatic

aspects, usually through reference to individuals who “personify or stand in for larger, more difficult to grasp social forces” (Schudson 2003).

The same dynamic applies to the popular reporting of scientific results as well. For example, when comparing scientific publications with the news reporting on those publications, Saguy and Almeling (2008) observe that “compared to the science on which they were reporting, the news media used more evocative metaphors and language” and also emphasize the role of individuals even more than the underlying scientific publication. In the end, Saguy and Almeling (2008) conclude, this narrative bias towards individualism “means that the news media tend to blame social problems on individuals rather than on systemic forces,” which seems to bestow a significant structural advantage in favor of individualistic narratives over those which emphasize sociocultural or other environmental factors, especially in combination with the ideological influences mentioned above which predispose Americans towards individualistic explanations.

The Emergence of System-level Narratives

However, even given all these structural advantages of individualistic narratives, systemic and science-based narratives are also powerful motivators, in particular in regards to obesity policy. The categories of individualistic and systemic and scientific narratives identified by Clemons et al. (2012) reflect the basic narrative orientations identified in the academic research of ‘individualizing’ causes and effects versus ‘systemic’ attributions of causes and effects. This research has found that policy narratives will tend towards one of these basic poles, with scientific explanations being

used to justify either the individualizing or the systemizing of causes and effects (Edelman 1988; Entman 1993).

As will be shown, these two basic narratives also have deep connections with the two predominant and prevailing ideological orientations, which seems to suggest some sort of fundamental incompatibility. However, as discussed in previous chapters, the science of epigenetics also contains elements that are compatible with both the individual-level and these system-level narratives, which suggests that epigenetics is also potentially compatible with both seemingly mutually exclusive ideological orientations as well. That epigenetics could present such a union of these longstanding ideological oppositions likewise suggests that epigenetics could precipitate some fundamental political changes—per the epi-politics model as diagrammed in Figure 2.1. What form these narratives of epigenetics will take is yet to be seen. Identifying the narrative and policy possibilities at this preliminary stage, at the cusp of the emergence of epigenetics as a significant policy player, is one of the main goals of this dissertation.

Health Policy and Ideology

Previous work has identified ideological differences in the promotion and acceptance of different health policy narratives and the policy solutions recommended by these different narratives, with liberals emphasizing social and environmental causes and solutions for adverse health outcomes and conservatives emphasizing the personal responsibility of the individual (Cozzarelli, Wilkinson & Tagler 2001; Kluegel & Smith 1986; Skitka, Mullen, Griffin, Hutchinson et al. 2002; Sniderman, Hagen Tetlock & Brady 1986). This opposition of personal responsibility versus environmental influences

corresponds to the nature versus nurture dichotomy which has marked modern Western liberal culture for millennia (Bellah et al. 1996; Kingdon 1999; Lipset 1991). As will be discussed, just as epigenetics complicates the conventional dichotomizations of genetics, epigenetics also complicates the conventional dichotomizations of nature versus nature and of these attendant narratives, which complications have important implications for health policy.

For example, one recent study found that eighty percent of respondents in a nationwide survey identified individuals as primarily to blame for the rise in obesity and parents were the next-most blameworthy group. These responses also factored into three dimensions—individual responsibility, agribusiness responsibility, and government-farm policy—which revealed an ideological component to these survey answers, in that “individuals with a more statist score on the economic political ideology scale [i.e., reflective of the basic liberal viewpoint mentioned before] were more likely to blame the government and agribusiness for obesity” as compared to individuals with a less statist score [i.e., reflective of the basic conservative viewpoint mentioned before] (Lusk & Ellison 2013).

Gollust, Lantz & Ubel (2009) also find that Republicans were much more likely to strongly emphasize personal responsibility for health outcomes and that the responses of Republicans to messages emphasizing social determinants of health were significantly more negative than either Democrats or Independents. Likewise, a national opinion poll found that “liberals were also much more likely than were conservatives to consistently

report that broader social determinants of health have a very strong effect on health” (Robert & Booske 2011).

At the level of automatic reactions, though, Skitka et al. (2002) find that at first pass liberals and conservatives make roughly the same attributions of personal responsibility for actions and outcomes, but that these initial ‘gut’ reactions are later modified by liberals when found to conflict with their ideological values or goals. At the same time, other research shows that the more time spent processing stories about both individual and social causes for adverse health outcomes, the more likely participants were to eventually support traditionally liberal policies for addressing such issues through government intervention regardless of ideology.

Thus, while at a basic level there does seem to be a fairly consistent ideological difference in attributions of causes for and solutions to health issues—with conservatives emphasizing personal responsibility, while liberals emphasize social and environmental factors, and advocate government intervention—there also appears to be a significant amount of overlap, contextual influences, and changes over time in the nature of these attributions, particularly in response to different kinds of narrative configurations. For these reasons, identifying the current composition of the narratives of obesity is an important step in better understanding the nature of the emerging narratives of epigenetics.

One interesting anomaly, though, with particular relevance for the emerging narratives of epigenetics is in the domain of health narratives, ideology and genetics. Gollust, Lantz and Ubel (2009) found that there were no statistical differences between

Republicans and Democrats in their attributions of genetic or behavioral causes for adverse health outcomes, as did Robert and Booske (2011).

However, Suhay and Jayaratne (2013) find that while there are identifiable ideological differences in the use of genetic narratives, these differences are quite nuanced. Suhay and Jayaratne (2013) first reference the literature which suggests that conservatives are more likely than liberals to endorse narratives of genetics because of the potential such genetic narratives have to legitimize differences that are perceived as ‘natural,’ thereby discouraging efforts to equalize or eliminate these kinds of differences. Through their analysis, though, Suhay and Jayaratne find that ideologues of both types “will tend to endorse genetic explanations where their policy positions are bolstered by ‘naturalizing’ human differences”—i.e., while conservatives were more likely to endorse genetic explanations for differences in race and class, liberals were more likely to invoke genetic factors to explain differences in sexual orientation. Suhay and Jayaratne conclude with the observation that:

Americans’ political perspectives and their beliefs regarding genetic influence are often intertwined. If differences in human characteristics and behaviors are perceived as natural, then they are more likely to be perceived as good and as difficult or even impossible to change. Thus, the dominant political thrust of beliefs about genetic explanations seems to be a libertarian one. In present-day American politics, this suggests that genetic explanations bolster both economic conservatism and social liberalism.

This ambivalence and ambiguity around assigning responsibility for causes and effects in regards to genetics provides one potential opening for the introduction of epigenetics into policy discussions.

Although a basic assertion is that epigenetics is fundamentally different from genetics, at least in its history and narratives, in a scientific sense epigenetics is most appropriately categorized as a subfield of genetics. Likewise, genetics is likely the most common and accessible avenue through which epigenetics can be introduced to politicians, policymakers and the general public. Whatever the differences between genetics and epigenetics discussed in previous chapters, a reasonable assumption is that genetics will compose a significant aspect of the emerging narratives of epigenetics; thus, whatever are the prevailing narratives of genetics, including their ideological components, will likely be a part of the epigenetics narrative in some way.

Why Obesity and Epigenetics

Again, a main contention is that epigenetics presents a fundamentally different understanding of human biology than the prevailing interpretation of genetics. Per epigenetics in the epi-politics model as diagrammed in Figure 1.3, these differences in the understanding of biology introduced by epigenetics should translate into changes in politics, ethics, and in the concept of self at the center of it all. To begin to establish the composition of the emerging narrative (or narratives) of epigenetics, as to whether it is in fact significantly different from the prevailing narratives in its concepts of self and in the policies it prescribes, I have chosen obesity as the policy domain of interest. Obesity is particularly apt for this purpose for a number of reasons.

Overweight and obesity have long been an issue of social commentary, much of which revolves around attributions of blame or responsibility for the conditions (Farrell 2011; Forth 2013; Fraser 2009; Levy-Navarro 2010; Rogers 2010), but only recently has

obesity emerged as a primary health concern on a par with cancer. For example, in a recent Associated Press survey seventy five percent of respondents report that being obese is an extremely or very serious health problem, ranking overweight and obesity second only to cancer, and a more serious health risk than diabetes, heart disease, alcohol and drug abuse, and smoking and tobacco use (Tompson et al. 2013).

The emergence of obesity onto the public policy agenda is often fixed at around 2001, coincidental with the release of the report of the Surgeon General of the United States titled “A Call to Action to Prevent and Decrease Overweight and Obesity” which identified obesity as an epidemic of nationwide proportions (U.S. Department of Health and Human Services 2001). Notably, just prior to 2001 no more than 2 to 3 percent of the public considered obesity to be an important health problems facing the country (Schlesinger 2005). Likewise, less than a dozen stories on obesity appeared in major U.S. media outlets during the final quarter of 1999, but by the final quarter of 2002 the number of obesity articles in major U.S. media outlets topped 1,200, and over 1,400 stories by the second quarter of 2003, with the observation that “the total has remained well over 1,000 stories per quarter since” (Kersh & Morone 2005).

This increased public awareness of obesity is one factor in the rise of obesity-related public policies. Another is just the scope of the issue and the costs involved. Obesity is associated with hundreds of billions of dollars in medical expenses, and is one of the leading causes of death in the U.S. and Western Europe (Alwan 2011; OECD 2014). Increasingly, obesity is also not just an issue for post-industrial societies, but is increasingly becoming a serious health concern in developing countries as well (Stevens

et al. 2012; Tran 2014; WHO 2000). As a result, there are an increasing number of obesity-related policies and programs already in place or being considered at all levels of government around the world.

Obesity: Narratives and Ideology

Different obesity policies are a function of different causal explanations—or narratives—of obesity. These causal narratives are in turn the products of more general ideologies (e.g., conservatism and liberalism). In other words, different ideologies produce different narratives which result in different policy prescriptions. The two currently dominant narratives in obesity policy are the narrative of personal responsibility, which is generally associated with a conservative ideology, and the narrative of a toxic environment, which is generally associated with a liberal ideology. Depending on where the primary causes for obesity are located determines what will be the focus of policies intended to address those causes.

Notably, the epigenetics of obesity are frequently researched in both animals (Seki et al. 2012; Manikkam et al. 2013; Milagro et al. 2009) and humans (Campion 2009; Friso & Choi 2014; Slomko, Heo & Einstein 2012; Stoger 2008). The recent surge in policy focus on obesity and the focus on obesity within epigenetics research make obesity policy a prime example with which to begin to assess the public policy implications of epigenetics. Given the unique causal mechanisms epigenetics proposes, epigenetics also generates its own unique narratives which challenge many of the core assumptions of these two currently dominant narratives. These novel narratives generated from the discourse of epigenetics produce equally novel recommendations

for obesity policy. The purpose of this dissertation is to begin to elaborate what are these new narratives, and to suggest what might be the potential policy recommendations from epigenetics.

Obesity Narratives

In keeping with the findings for health issues in general discussed above, previous work has identified the prevailing narrative of obesity as based primarily in individual rationality and personal responsibility (Crandall and Schiffhauer 1998), but also that the narrative landscape of obesity policy appears to be gradually changing over time due to social, political and scientific influences (Bonfiglioli et al. 2007; Clemons, McBeth & Kusko 2012; Kersh & Morone 2005).

The nature of this changing landscape is extremely relevant for the introduction of the emerging narratives of epigenetics, but there are a number of important nuances in the influence of ideology on these narratives which have been identified thus far which must be addressed. As discussed by Brownell et al. (2010), while at first glance the concept of personal responsibility which is woven through the social, political, and legal roots of our culture seems inconsistent with widespread support for government actions to protect the public's health, these two positions can actually be reconciled depending on which elements are emphasized. Epigenetics, with its unique combinations of internal and environmental and genetic narrative possibilities is uniquely poised to facilitate this reconciliation; whether it does so will depend on what forms the emerging narratives of epigenetics take, which forms will in turn likely be influenced by the ideologies of the policy players involved.

Obesity and Ideology

As with health policies in general, narratives have been found to be much more persuasive in the obesity policy debate than nonnarrative accounts. Obesity narratives have also been found to exhibit identifiable ideological biases similar to those discussed. For example, one recent study found that eighty percent of respondents in a nationwide survey identified individuals as primarily to blame for the rise in obesity and parents were the next-most blameworthy group. These responses also factored into three dimensions—individual responsibility, agribusiness responsibility, and government-farm policy—which revealed an ideological component to these survey answers, in that “individuals with a more statist score on the economic political ideology scale [i.e., reflective of the basic liberal viewpoint mentioned before] were more likely to blame the government and agribusiness for obesity” as compared to individuals with a less statist score [i.e., reflective of the basic conservative viewpoint mentioned before] (Lusk & Ellison 2013).

Other research also shows ideological vectors in the persuasiveness of obesity narratives. In one case, the researchers found that “the narrative condition increased the belief that societal actors (government, employers) are responsible for addressing obesity, but only among liberals.” The reason for this pattern, according to the authors, is that the narrative reduced “reactive counterarguing, relative to the evidence condition” among liberals in particular (Niederdeppe, Shapiro & Porticella 2011). However, another study found that stories that did not mention or acknowledge personal responsibility as a factor in obesity and which emphasized environmental

causes and solutions were actually successful at “increasing societal cause attributions about obesity” across the board, and were actually able to increase support for obesity-related policies among conservatives compared to the control group (Niederdeppe et al. 2014). In other words, while ideologies do seem to exert a significant influence on health policy preferences, in some circumstances narratives can be so persuasive as to counteract the gravity-like pull of ideologies. This counteractive effect of narratives provides one such opening for epigenetics to introduce change into the obesity policy arena—if the novel narratives produced from epigenetics are able to strike the right chords.

Barry et al. (2009) analyze support for sixteen different obesity policies, grouped as *redistributive policies* which provide help for obese persons through public assistance but which will also increase taxes, *compensatory policies* which mandate legal concessions for obese persons (e.g., zoning laws, food labeling and advertising laws, etc.), and *price-raising policies* which target obese persons through junk-food taxes and increases in insurance premiums. They find that in regards to individual policies the levels of blame attributed to obesity “were more often significant predictors of policy support than political attitude measures,” with low-blame metaphors—obesity as the product of industrial manipulation, toxic food environment, etc.—generating the most support. Likewise, belief in the highest-blame metaphor (obesity as “sinful behavior”) was negatively associated with policy support across the board, except for the punitive policy requiring higher insurance premiums for obese persons. As the authors note, this result is consistent with previous work indicating that “those respondents attributing

obesity to personal choices were less likely to support government intervention in private behavior” regardless of ideology (Oliver & Lee 2005). The authors attribute this relative lack of the influence of ideology to the newness of obesity on the public policy agenda, suggesting that as time goes on ideological influences should become more and more apparent.

However, Barry et al. (2009) did find some significant results associated with political ideology and party affiliation when looking at groups of policies. In particular, liberal and Democratic respondents demonstrated significantly more support for the redistributive and compensatory policies than conservatives. The authors suggest that this is not surprising as the attitude towards tax increases coincides with conventional ideological and partisan orientations. In other words, while the authors previously attributed the relative lack of the influence of ideology to the newness of obesity on the public policy agenda, where there are more obvious connections with existing ideological tendencies these preexisting tendencies can shine through. This dynamic could potentially apply to the emerging narratives of epigenetics as the preexisting ideological tendencies will likely color the ways epigenetics is interpreted and integrated into existing ideological structures through the narratives it engenders.

While ideologies are not the core of their analyses, McBeth et al. (2014) do consider ideological influences in their analysis of the causes and solutions recommended for obesity by contrasting the reporting of three conservative newspapers (the Washington Times, the New York Post, and the Wall Street Journal) with one liberal newspaper (the New York Times) and one moderate newspaper (USA

Today). They find that the New York Times—a traditionally liberal news outlet—scored the highest on attributing cause to the individual, while the Wall Street Journal—a traditionally conservative outlet—was firmly on the societal side of the spectrum, which runs counter to the conventional understanding of the ideological orientations.

However, in regards to solutions, while the New York Times was evenly split between individual and societal solutions the Wall Street Journal and conservative papers as a whole strongly favored individual-level solutions, which more closely match the already established ideological patterns. In other words, McBeth et al. found differential effects from ideologies depending upon whether causes or effects were being discussed. Again, although ideologies do appear to exert a significant influence over policy preferences in general, these influences are not monolithic or consistent across the board. This lack of consistency in regards to causes versus effects provides another possible opening for the new narratives from epigenetics to make an impact in the obesity policy arena.

Finally, in keeping with the necessity mentioned before of moving from policy narratives which emphasize the role of the individual to narratives which locate the responsibility of obesity to society in order for policy change to occur, Lawrence (2004) and Kim and Willis (2007) both find that while the dominant narrative frame of obesity has been individualistic there has been a marked movement towards systemic frames, and that the prevailing narrative of obesity is now composed of both individual and systemic narratives. Kersh (2009) likewise details how the frame of *personal responsibility*, which was until fairly recently the dominant and best-established frame,

is being increasingly challenged by the *obesogenic* or toxic food environment narrative, which emphasizes “expanding portion sizes; foods high in fat, sugar (or artificial sweeteners like corn syrup), and sodium; the ubiquitous availability of food at outlets ranging from gas stations and drug stores to bank lobbies and elementary schools; and the incessant advertising of high-fat, low-nutrition foods” as primary causes of obesity.

At the same time, though, McBeth et al. (2014) conclude that evidence of a shift towards a new dominant narrative is “decidedly mixed.” According to McBeth et al. (2014), while the attributions for the causes of obesity were almost evenly split between social and individual attributions, the solutions for obesity in the articles they examined were “exceedingly individual based;” as a result, they conclude that “such framing of solutions at the individual rather than the societal level illustrates that societal solutions may to continue to be perceived as unpopular.”

Ultimately, the balance of the evidence does suggest that political debates around obesity are “hardening” around the opposing personal-responsibility and environmental frames to constitute an *issue* or *policy* regime (Kersh 2009). The formation of an issue regime is marked by three main characteristics: “(1) swirling debates narrowing into a few primary frames, or basic descriptions of the issue that diffuse across jurisdictions; (2) the emergence of a relatively small group of stakeholders and public officials who dominate media coverage and legislative debates; and (3) legislative responses shrinking from dozens of options to a select handful,” which appears to be a very apt description of the current state of the obesity policy arena.

The main problem of such an issue regime from a policy responsiveness point of view, according to Kersh, is that it represents “a relatively stable state of equilibrium, which could make comprehensive reforms to limit rising obesity rates less feasible.” According to Kersh, a disruption of the status quo is needed to break out of this gridlock, which will require a change in the existing narratives. Epigenetics, given the ways it complicates both of these existing dominant narratives, as well as the narrative of genetics, and also introduces entirely new narrative elements, could present just such a tool for the disruption of this status quo.

Obesity and Epigenetics Narratives

As yet there are no epigenetics-based or even epigenetics-informed policy discussions per se, at least not at the level of widespread public awareness. However, as discussed in previous sections, given the significant and increasing attention devoted to epigenetics in academic research, and the lag that exists between scientific research, public awareness and incorporation into policy (Abbasi 2006; Bradshaw & Borchers 2000; Guthrie et al. 2014; Leshner 1997; Locke 1999; 2002; Wynne 1992; Yearley 1999), epigenetic narratives will likely soon constitute a significant factor in policy discussions. At this early stage, though, the first glimpses of what forms these epigenetics-based policy narratives will take are available through an analysis of how epigenetics itself is being discussed in mass media outlets, which is the primary purpose of this dissertation.

As discussed before, the science of epigenetics combines both internal and external causes of obesity. Epigenetics therefore also allows for the proposition of both internally- and externally-focused policy solutions. Also, in particular through the

discovery of transgenerational inheritance of acquired epigenetic markers thereby linking the biological propensities of present generations with the environments and choices of their ancestors, epigenetics significantly problematizes the assumptions of individual autonomy which are central to the dominant narrative of rational personal responsibility. In other words, the emerging science of epigenetics proposes unprecedented opportunities for the synthesis of concepts which until now seemed mutually exclusive.

However, at this early point in the emergence and development of the narratives of epigenetics there is no telling which of the many possible interpretations will become the dominant narrative of epigenetics in obesity, or even if epigenetics will emerge as a narrative of its own or will be co-opted within other narratives—for example, epigenetics could become just another component of the genetics-based narrative of obesity for either the liberal or conservative sides of the obesity policy contest. Thus, an important service provided by this dissertation is establishing some of these possibilities, in particular through analysis of the different ideological influences to which epigenetics-based narratives may be subjected.

As it stands, because of all the implications of epigenetics which have been highlighted above, many different possible narratives for obesity from epigenetics are available depending on which elements of epigenetics are emphasized. This opens up the field of possibilities for the use of such narratives, either as a new weapon in the arsenal of an existing policy player, or as a unifying narrative which brings together supposedly competing players, or even as the impetus for the emergence of an all new

policy player. As a result, the introduction of epigenetics in obesity has the potential to significantly disrupt the status quo of the obesity policy arena with all new findings and realignments.

Chapter VI

Obesity Narratives and Ideology

Some of the preliminary questions to be answered, then, are what the narratives of obesity are, whether ideological differences are noticeable in the discussion of obesity policies, and whether these ideological differences conform to specific narrative structures. The guiding hypothesis is that there are noticeable ideological differences in obesity policy narratives related to the source of the narrative—in this case, major national newspapers. The result of this narrative analysis will then be applied to the emerging narrative of epigenetics, with the supposition that many of the same patterns will hold for the reporting on epigenetics as well, but also that there might be significant differences as well.

Sources

Searches for obesity narratives were conducted on articles in two major newspapers: the New York Times (NYT) and the Wall Street Journal (WSJ). These newspapers were selected for the level of circulation of both their print and digital editions, the scope of their readership, and their differences in ideological biases.

The level of circulation and the scope of readership are important factors for establishing the political saliency of the narrative elements used to describe obesity and obesity policies to the public. As discussed by Lawrence (2004), while these two papers are not as good an indicator of the general public perception of an issue as a national survey, they are at least excellent sources for tracking how an issue is framed by and for elites, and how an issue is presented to the general public.

According to the Alliance for Audited Media (2015), the WSJ and the NYT are respectively the number one and number two newspapers in the United States in terms of weekday circulation. These two media sources are also two of only three U.S. newspapers with a national instead of a local or regional readership, therefore the selection of articles from these two papers is a reasonable proxy measure for generally accepted obesity narratives.

Also, according to the analysis of Gentzkow and Shapiro (2010), on a scale of user-based ratings of conservativeness—from 1 (liberal) to 5 (conservative)—the NYT (owned by the NYT Company) scores a 2 and the WSJ (owned by Rupert Murdoch’s News Corp) scores a 4. Each paper is also located on opposite ends of the liberal-conservative slant index constructed by Gentzkow and Shapiro. The differences in political ideology are important for identifying possible differences in the composition of these narratives. Therefore, if there are noticeable ideological differences between these news outlets, and there are identifiable differences in obesity policy narratives related to political ideologies, these differences should show up as differences between these two outlets in their reporting on obesity and obesity policies.

Obesity Narratives Rubric

Searches for obesity policy narratives were conducted through the publicly accessible search engines of both newspapers. The primary search term was “obesity,” with the secondary terms “policy,” “legislation,” and “cause” applied in different iterations. The results were ordered according to relevance and limited to articles only. The results of this search from each source were then read for content, focusing on

attributions of causes for obesity, recommendations for solutions to obesity, and the type of narrative being used. Articles in which causes or solutions for obesity were not identified were excluded from analysis. This process was repeated until fifty articles from each source were read and coded.

The primary rubric for coding the obesity narrative elements is Niederdeppe, Robert & Kindig (2011). This article was chosen primarily for the comprehensiveness of the rubric it provides for analyzing obesity narratives. This rubric was derived from the responses of focus groups to which participants were assigned according to their self-reported political ideology. Discussions of obesity were facilitated in each of these groups through semistructured discussion guides to assess each groups' perceptions of obesity, and in particular to identify the influence of any ideological orientations where present.

Following Niederdeppe, Robert & Kindig (2011), via the rubric shown in Appendix A, the causes for obesity were coded as either internal or external, with *Internal Causes* consisting of three sub-classifications (*Moral*, *Rational* or *Genetic*), and *External Causes* consisting of five sub-classifications (*Food Accessibility*, *Family Circumstances*, *Institutional Culture and Policy*, *Physical Environment* and *Media Influence*). Solutions were also coded as *Internal*, subdivided as either increasing the *Personal Knowledge* of individuals or promoting *Public Education*, and *External*, subdivided into enhancing *Social Supports*, encouraging changes in *Organizational Culture* without legislation, and legislation itself, which was then further subdivided into *Legislation of Internal Causes* versus *Legislation of External Causes* for obesity.

Therefore, an additional contribution of this dissertation is in the use of the instrument provided by Niederdeppe, Robert & Kindig (2011). As this rubric was constructed through focus group discussions, this dissertation is a test of the validity of this instrument for assessing obesity narratives from external sources—in this case, news articles from two major national newspapers.

Niederdeppe, Robert & Kindig (2011) also explicitly incorporate ideology into their design and their results. The ideological biases for the different narrative elements registered by the participants in their focus groups mirrors the pattern of preferences identified in the literature cited above. Therefore, the assumption is that these ideological biases will also manifest in the obesity narratives reported in the different media sources—in particular, that the articles in the liberal NYT will emphasize the external causes and solutions of obesity, while the articles in the conservative WSJ will emphasize the internal and dispositional aspects of obesity and recommend more internally-focused solutions for obesity, as well as recommending fewer legislative solutions.

Next, following Kersh (2009), the articles were also coded via the rubric in Appendix B for whether they promoted an overarching narrative of *Personal Responsibility* or a *Toxic* [i.e., obesogenic] *Environment*. *Genetics* was also included as a possible overarching narrative. The personal responsibility category was further subdivided using four key concepts: *Lifestyle*, *Choice*, *Habit* and *Willpower*. If any of these words were explicitly or implicitly mentioned as a cause for obesity in an article, that narrative element was coded as present in the article. The toxic environment

category was subdivided further as either *Food Access or Composition* being causes of obesity or as the advertisement of food in the *Media* being a cause of obesity. The category of *Genetic* was further subdivided into whether the genetic attribution emphasized the *Genes* or whether it emphasized the interaction of genes with the *Environment*.

Media Source and Obesity Narrative

Probit regressions were used to test the hypotheses that the narratives of obesity will fit the rubrics of Niederdeppe, Robert & Kindig (2011) and Kersh (2009), and that there are definable ideological differences between these narratives which are reflected by the source of narrative: the NYT for the liberal narrative, the WSJ for the conservative narrative. This approach is selected because it allows for the statistical analysis of the influence of independent factors on a dichotomous variable—in this case, media source.

Also, tests for multicollinearity were run for all the variables in each of the categories used in this analysis. There were no indications of significant correlation between variables, which indicates that the variables are not overlapping in the phenomena they are purported to explain.

Causes and Solutions and Overarching Narratives

First, each category of causes and solutions as identified by Niederdeppe, Robert & Kindig (2011) and each of the overarching narratives from Kersh (2009) were modeled as the predictors, and then each individual narrative element within each category. These probit models were run with media source as the binary dependent variable

(BDV), with both the NYT and the WSJ. The coefficients returned by the probit regression models are an estimate of the impact of that variable on the probability that the BDV is the source of the narrative.

The coefficients, standard errors and p-values of all the significant results of the probit regressions are provided in Appendix C, but these results are displayed graphically in Table 7.1 for ease of comparison and interpretation:

Table 7.1 Composition of Obesity Narratives by Source				
		NYT	WSJ	
Causes and Solutions				
Internal Cause				
	Moral	-	+	
External Cause		+	-	
	Media	+	-	
	Physical Env.	+	-	
	Inst. Culture	+	-	
External Solution				
	Ext. Legislation	+	-	
Overarching Narratives		NYT	WSJ	
Personal Responsibility		-	+	
	Lifestyle	-	+	
Toxic Environment		+	-	
	Food	+	-	
Genetic				
	Genes	+	-	

The plusses in Table 7.1 reflect those instances in which the probit model returned an element as a significant predictor of the source; the minuses represent the necessary obverse of the positive result. As the BDV in a probit regression is a binary variable, if a predictor increases the probability of one source (a plus), that predictor necessarily decreases the probability of the other source (a minus).

Nierderdeppe Rubric. Of the four narrative categories and fourteen narrative elements, one narrative category and five narrative elements are found to significantly increase the probabilities of an article being from either the NYT or the WSJ (the plus signs). Per expectations, each of these significant narrative categories and elements

matches the hypothesized ideology of the source. That being said, only one element is a significant predictor that the article is from the WSJ (*Moral*), while one narrative category (*External Causes*) and four elements (*Media*, *Physical Environment*, *Institutional Factors*, and *Legislating External Causes*) are significant predictors that the article is from the NYT.

Still, the results from the probit regressions of the Niederdeppe rubric support the hypotheses that there are liberal and conservative obesity narratives, that the two newspapers in question are ideologically distinct in the hypothesized directions, and that therefore the reporting on obesity in these newspapers reflects these ideologically distinct narratives.

Kersh Rubric. The results of the probit regressions utilizing the Kersh (2009) rubric are also reported in the table Appendix C, and displayed in Table 7.1 above.

In this case, *Personal Responsibility* and *Toxic Environment* were found to be significant predictors of the source, and in the expected directions, with *Personal Responsibility* predicting the source as the WSJ and *Toxic Environment* predicting the source as the NYT.

In terms of the individual narrative elements of the Kersh rubric, the results again support the hypothesis of narrative source reflecting the expected ideology. Three of the four elements under *Personal Responsibility* (*Lifestyle*, *Choice* and *Willpower*) are significant predictors of the source as the WSJ. Likewise, regarding the narrative elements of an obesogenic environment, both the access to food and the media are significant predictors of the source as the NYT. For the *Genetic* narrative, the only

component found to be a significant predictor is the narrative emphasis on the genes, and not the interaction of genes with the environment. As there was no predicted ideological bent for the obesity narrative of genetics in the literature, that *Genes* is a significant predictor of the NYT is an important—but preliminary—addition in this sense.

Again, as with the causes and solutions from the Niederdeppe rubric, the outcome of these probit regressions support the hypotheses that there are identifiable narratives of obesity, and that these narratives fit the expected ideological associations via the sources of the narratives.

Obesity Narratives and Ideology

While these are very relevant findings in terms of establishing what are the actual narratives of both obesity and epigenetics as presented in real media sources, and for moving forward in the policy narrative analysis of epigenetics, there is an extra step to be taken: What do the obesity and epigenetics narratives look like apart from explicit considerations of the source—in particular in terms of ideology?

Ideology and Narrative Source

This is an important question to answer. Ideological purity of narratives from mass media sources like the NYT and the WSJ is an unrealistic expectation. While significant results from using the NYT and the WSJ as proxies for liberal and conservative ideologies were described in the previous section, these sources are not perfectly representative of their respective ideologies. When an index is constructed to emphasize the conservative and liberal ideologies of these narratives (described below), the correlation between the source of a narrative and this index is only .18 ($t = 1.62$, p -

value = .055). In other words, there is substantial overlap between the NYT and the WSJ in terms of the ideological elements in their narratives of obesity. Again, it is not that these ideological differences do not exist, just that they are not as clean and distinct as reported from these two sources as might be expected. Therefore, to better identify the potential influences of ideology on the emerging narratives of epigenetics, this overlap recommends further analysis of the ideological narratives themselves and not through the proxies of media sources.

The rubrics and the methods for more directly assessing the ideological composition of these narratives are the same from the previous chapter, only substituting an index of ideology as the BDV in place of the source of the narrative.

Ideology Index and Obesity Narratives

This index—*IdeoIndex*—was constructed by first going through the data collected through the Niederdeppe rubric used to code the information from the articles and then summing the items in each of the four categories of causes and solutions. Next, ideological thresholds were derived and each category was assessed as either 1 for Conservative or 0 for Liberal depending upon whether they fell below or above the threshold—for example, in the category *External Causes*, if an article registered two or more of the five categories of external causes, it was designated as Liberal for that category; otherwise, it was designated as Conservative for that category. Finally, the scores of the four categories were summed up. An article with less than two liberal narrative categories was designated as Conservative, and articles with more than two liberal narrative categories were designated as Liberal. This approach excludes 32

articles which registered a two on the index, but permits the isolation of only those articles which exhibit a clear conservative or liberal narrative of obesity. This process resulted in the identification of 49 conservative articles (29 from the WSJ and 20 from the NYT) and 34 liberal articles (14 from the WSJ and 20 from the NYT).

Again, the coefficients, standard errors and p-values of all the significant results of the probit regressions are provided in the table in Appendix D, but these results are displayed graphically in Table 7.2 for ease of comparison and interpretation:

Table 7.2 Composition of Obesity Narratives by Ideology					
	Lib.	Cons.		Lib.	Cons.
Causes and Solutions			Overarching Narratives		
Internal Cause	-	+	Personal Responsibility	-	+
Moral	-	+	Choice	-	+
Genetic	-	+	Toxic Environment	+	-
External Cause	+	-	Food	+	-
Phys. Env.	+	-	Genetic	-	+
Family Circ.	+	-	Environment	-	+
Food Access	+	-			
Internal Solution	-	+			
Personal Knowledge	-	+			
External Solution	+	-			
External Legislation	+	-			
Internal Legislation	+	-			
Institutional Change	+	-			
Social Supports	+	-			

Causes and Solutions. As shown, when only those articles composing the ideological index are used, all four of the categories and ten of the possible fourteen

narrative elements are significant predictors of the ideological position, and all in the anticipated directions.

In terms of the overall categories of causes and solutions for obesity, per the conservative emphasis on personal responsibility *Internal Causes* and *Internal Solutions* predict the conservative narrative just as *External Causes* and *External Solutions* predict the liberal narrative with its emphasis on environmental influences.

One significant wrinkle is in the attribution of *Genetics* as an *Internal Cause*. As mentioned before, there was no identifiable prediction for the ideology of the causal attribution to genetics in the obesity narrative literature. When the BDV was the newspaper of origin, references to genes were a significant predictor of the New York Times as the source, which suggested that genetics may be associated more with the liberal narrative of obesity. When the BDV is the ideology of the obesity narrative, though, *Genetic* as an *Internal Cause* is now a significant predictor of the conservative narrative, along with the attribution of obesity as a *Moral* issue. Thus, it appears that the predictive power of references to genetics by newspaper source was related less to ideology and more to some other factor specific to the New York Times.

In terms of external causes of obesity, the *Media*, the *Physical Environment* and *Institutional Factors* are significant predictors of the liberal source, but *Physical Environment*, *Family Circumstances*, and *Food Accessibility* are the significant predictors of a liberal narrative of obesity.

When it comes to the specific solutions which predict the different obesity narratives, as expected internally-focused solutions which focus on increasing *Personal*

Knowledge predict the conservative narrative, while solutions which focus on changing the environment through legislation, *Organizational Change* and changes in *Social Support* systems predict the liberal narrative.

Overarching Narratives. In terms of the overarching narratives from Kersh (2009), the *Personal Responsibility* narrative, in particular explicit references to the role of *Choice* in obesity, and the *Toxic Environment* narrative as references to the availability and composition of *Food*, are significant predictors of the conservative and liberal obesity narratives respectively, as expected.

Again, though, an interesting twist is that references to *Genetics* are now predictive of the conservative narrative, especially as references to the interaction of genes with the *Environment*. This is particularly noteworthy as one of the rare times a reference to the environment constitutes a significant part of the conservative narrative of obesity. This combination of genetics in interaction with the environment is particularly relevant to the early formation of the narrative of epigenetics.

Liberal and Conservative Narratives of Obesity

Liberal Narrative. Thus, the liberal narrative of obesity conforms to the theoretical and empirical expectations of an emphasis on conditions in the external environment as the primary contributors to obesity, with no significant references to the internal dispositions of individuals as either causes of or solutions to the problem of obesity. External causes of obesity are described, and externally-focused solutions to obesity are therefore recommended: Because obesity is caused by the configuration of the physical environment (e.g., “food deserts”), or by families not having sufficient time

to prepare healthy meals, or by the obesogenic composition of food itself, then the solutions are to remediate these external factors through legislation (e.g., banning sodas and trans fats), or through changes in institutional cultures at work and at school to increase access to more healthy food and opportunities for exercise.

For example:

For decades, people have treated obesity as a personal failure. They blame individuals and families for eating junk food and choosing television over exercise. But experts in this country and other industrialized nations have increasingly recognized that obesity is caused mostly by social and environmental factors that limit people's ability to eat healthy foods and get enough exercise (Boffey 2012).

The suggestion that obesity is not a disease but rather a consequence of a chosen lifestyle exemplified by overeating and/or inactivity is equivalent to suggesting that lung cancer is not a disease because it was brought about by individual choice to smoke cigarettes (Pollack 2013).

Unfortunately, behavior changes won't work on their own without seismic societal shifts, health experts say, because eating too much and exercising too little are merely symptoms of a much larger malady. The real problem is a landscape littered with inexpensive fast-food meals; saturation advertising for fatty, sugary products; inner cities that lack supermarkets; and unhealthy, high-stress workplaces (Singer 2010).

In other words, the influences of the environment are currently overpowering the capacities of people to recognize or even make the right choices about their health.

For people to realize their true potential these external impediments must first be removed, then people will have the freedom and the ability to make the choices that are in their own best interest.

Epigenetics and the Liberal Narrative. How does this configuration of narrative elements portend for the incorporation of the emerging narrative(s) of epigenetics? The most likely avenue for the incorporation of epigenetics into the liberal narrative of

obesity is via this emphasis on the overriding influence of the environment which is obscuring and preventing the full flourishing of people. In particular, this emphasis on obesity as an environmental and structural malady coincides quite well with the intergenerational and transgenerational epigenetic inheritance described before.

In this case, the predispositions to obesity, and to a wide range of other medical and behavioral issues, are being identified in the environmental conditions of the parents, grandparents and even great grandparents, the effects of which are being passed on via epigenetic inheritance. The environmental conditions of progenitors, as well as their decisions to engage in certain behaviors, are now being identified as setting the gene-level baseline of their children and grandchildren. In other words, the liberal narrative of epigenetics could say the environmental conditions and choices of people in one generation are limiting the ability of individuals in subsequent generations to even be able to make the correct decisions they would if they were encumbered by these biogenetic legacies of their forbearers. As with obesity as currently conceived in the liberal narrative, this emphasis on the overriding influence of external factors (which epigenetically become internal factors) suggests the most appropriate remedies are externally-focused solutions via legislation and other institutional and structural changes.

However, one notable missing element to this current liberal narrative of obesity which could limit its ability to effectively incorporate the emerging science of epigenetics is the surprising lack of significance of genetics in this narrative. The orthodoxy of conventional genetics which holds that our gene sequences are fixed by

natural selection and therefore not responsive to our immediate environments seems a perfect fit for the liberal narrative of obesity. According to conventional genetics, differences in phenotypic expression can only result from genotype-environment interaction (GxE). If obesity is a recent deviation from normal phenotypic expression, and our genetic endowments are more or less fixed and immutable, the only malleable factor in this equation is the environment: to change the product of the GxE interaction, the environment (which is the only thing that can be changed) must be changed. But instead of genetics assuming its seeming natural place in the liberal narrative of obesity, genetics is a significant factor only for the conservative narrative with its emphasis on personal choice; this seeming paradox will be explained in the discussion of the conservative narrative below.

Conservative Narrative. As with the liberal narrative, the conservative narrative of obesity as reported in the major mass media conforms to the theoretical and empirical expectations of an emphasis on personal responsibility and individual choice, with an almost total lack of any significant references to environmental or other external factors as either causes or solutions to the problem of obesity. Also, as expected, the only significant solutions for obesity from the conservative narrative emphasize the buttressing of internal capacities through measures which increase personal knowledge about the causes of obesity.

There are a couple of major wrinkles, though, revealed by this narrative analysis. First, despite all the expected emphasis placed on personal responsibility and choice in the conservative narrative, the conservative narrative also has a highly significant

genetic component. This presents an interesting puzzle as this suggests the conservative narrative allows or describes obesity as the product both of our genes, which conventional genetics tells us are beyond our control, and as a *Personal* choice; in other words, that obesity is the product of biological forces beyond our control, for which we are somehow also morally responsible. This seems to set up an intractable and irreconcilable opposition of narrative elements.

This invocation of genetics by the conservative narrative as revealed by this analysis also introduces the second major wrinkle: That despite the expected emphasis on personal responsibility there is also actually an environmental component of the conservative narrative as well, and through a somewhat surprising route via the invocation of genetics, which is exclusive to the conservative narrative.

To explain, it is important to note as shown in Table 7.2 that in referring to the conservative narrative specifically emphasizes the interaction of genes with their environments, and specifically not simply genes as genes over which we have little control. This explicit linking of our genes with our environments provides both the means to resolve this seeming opposition of irreconcilable narratives, and also provides an interesting opening for the incorporation of the emerging science of epigenetics into the conservative narrative.

For example, as described in a couple of articles in the sample from the WSJ:

The reason that gluttony is a problem—the reason people tend to crave more food than is healthy (at least in the long term) to eat—is biological...The problem is that the human body is not optimally designed for conditions of such plenty. If you simply follow your appetites, you're likely to get fat. Eating healthy requires knowledge, cognitive ability and self-discipline (Taranto 2013).

The biggest disservice that public health has ever done to Americans is to make them believe that they and their kids were fat because the schools, the food companies, the fast-food restaurants and the government made them that way. It stripped people of their hope and empowerment, and it left them resigned to never try anything other than an occasional "Lose 40 Pounds in a Week Turnip Diet."; What government can do is to give people hope and to give them the tools to make it happen (McKay 2012).

Thus, even though genetics as a non-dispositional factor for obesity is acknowledged within the conservative narrative (i.e., as providing the basic immutable design of the body), and the environment is invoked as a significant factor in obesity ("...conditions of such plenty."), the ultimate onus for obesity is still located in the cognitive capacities and moral dispositions of the individual.

Epigenetics and the Conservative Narrative. This recognition within the conservative narrative of both genetics and the gene-environment interaction, but mitigated through the efficacy of personal disposition and choice, is a unique combination of factors that could facilitate the incorporation of the emerging science of epigenetics into the conservative narrative. This coincidence suggests that the conservative narrative may already be on its way towards incorporating the narratives of epigenetics, or at least that the conservative narrative is better positioned to incorporate this narrative at this early time in the emergence of the epigenetic narrative.

The next section will detail the components of the epigenetic narrative such as it is at the present time as revealed by the reporting on epigenetics and obesity available from the New York Times and the Wall Street Journal. This will allow the comparison of

the emerging narrative of epigenetics with the established liberal and conservative narratives of obesity.

Chapter VII

The Emerging Narratives of Epigenetics

Through the analysis conducted using the rubric constructed by Niederdeppe et al. (2011) and the guidance from Kersh (2009), the composition of the current obesity narratives has been confirmed and linked with ideologically differentiated media sources. Then an index was constructed to identify which articles best represent the conservative and liberal narratives of obesity, and identifiable configurations of narrative elements were found to correspond to each ideological narrative of obesity.

Each of these ideological narratives of obesity met the expectations from the literature. The significant elements of the conservative narrative exclusively emphasized the internal causes of obesity, with the only significant solution for obesity associated with this narrative being a focus on enhancing personal knowledge. In terms of overarching narratives, the conservative narrative again emphasized personal responsibility for obesity, and the element of choice in particular. The liberal narrative of obesity likewise exclusively emphasizes external causes and solutions for obesity, and an overarching narrative emphasis on a toxic environment, with a particular focus on food composition and access in particular. The only surprise, perhaps, was the emphasis on genetics in the conservative narrative; although, as suggested in Chapter Six, there is precedent for this conservative emphasis on genetics.

Epigenetics, Ideology, and the Media

The previous chapter laid the groundwork for identifying the emerging narratives of epigenetics by providing a point of comparison with obesity narratives. The next step

is to begin to paint a picture of the epigenetics narrative itself, at least as available from data collected from the NYT and the WSJ. As discussed before, the primary hypotheses are that the nascent narratives of epigenetics will reflect some of the ideological tendencies that have been found for the obesity narratives, but also that the emerging narrative of epigenetics will introduce novel configurations of narrative elements that are uniquely its own. This snapshot of the narrative of epigenetics—the first of which I am aware—can then be used as the baseline for comparison for subsequent research into not just obesity but other policy domains as well.

Again, the primary purpose of this dissertation is to identify the emerging narratives of epigenetics, to see how well these narratives fit the contemporary ideological frameworks as evidenced by obesity policy narratives, and to see if these ideological influences play a role in the emerging narratives of epigenetics. As epigenetics presents both internal and external causal explanations for obesity, it is difficult to say at this preliminary stage if there will be a clear ideological bias around epigenetics and what forms that bias will take. The more obvious assumption is that—given the ideological biases of the media sources in this analysis—those narrative elements of epigenetics which fit the ideological preferences of the source of the article will be emphasized over those elements which do not. In other words, articles from the more conservative WSJ which discuss epigenetics will emphasize the internal aspects of epigenetics, while articles from the more liberal NYT will emphasize the external aspects of epigenetics. An additional assumption is that given the novelty of epigenetics as an

emerging discourse, the narratives of epigenetics will also demonstrate patterns distinct from either of the conventional ideological orientations.

This talk of narratives ties back into the epi-politics model elaborated in Chapter Two. The fundamental point of the epi-politics model is that changes in the understanding of biology are reflected in changes in politics and ethics and the underlying concept of self, and vice versa. The main assertion is that epigenetics presents just such a fundamental modification in the understanding of biology, which should likewise translate into modifications of the politics and ethics *qua* narratives of causal responsibility and the prevailing concept of self. The previous chapters looked at the science and the history of epigenetics and of genetics to show that although technically epigenetics is a conventional modern science and a subfield of genetics, some of the underlying assumptions of epigenetics are fundamentally distinct from those of genetics, which also suggests that epigenetics should introduce all new narrative elements into the politics as well via novel attributions of causal responsibility.

One way to begin to establish whether or not there are these fundamental differences between epigenetics and the prevailing politics and ethics and concepts of self is to compare the causal narrative of epigenetics—assuming there is a coherent narrative at all—with the known causal narratives, and especially with their ideological aspects. Obesity was chosen as the policy domain because obesity is a pressing concern of contemporary policy, and because obesity explicitly and intimately involves considerations of the concept of self, and because the narratives and ideological associations of different narratives of obesity have been well established. The previous

chapter undertook the analysis of the narratives of obesity to provide the necessary points of comparison with the narratives of epigenetics, both in terms of the media source and in terms of the conventional ideologies. This chapter will complete this comparison, to discuss the implications of epigenetics for policy per the epi-politics model.

The first hypothesis to be tested is that the patterns of narrative elements in the epigenetics narrative will not fit the patterns of either of the existing ideological narratives. The epi-politics model suggests that if the science of epigenetics does in fact introduce new causal descriptions, there must be commensurate changes in the prevailing politics and ethics and in the prevailing concept of self. According to the NPF discussed in Chapter Six, these new causal attributions available from epigenetics will manifest in the narratives of epigenetics. These new narrative possibilities and the ideological realignments these new narratives could represent could have the potential to significantly disrupt the current policy arena. However, as has been shown with the narratives of obesity, the composition of these narratives could also reflect the ideological positions being defended, which would influence the interpretation of the science, and so on.

Following the assessment of Kersh (2009) the policy debates around obesity do seem to be “hardening” around the personal-responsibility and environmental frames, with their corresponding conservative and liberal ideological bases. To break this gridlock, Kersh proposes that something like “rapid-response research identifying a set of promising reforms, combined with concerted lobbying action” as necessary. The

recent results from the scientific work on epigenetics appear poised as just this kind of emerging research which could break the political gridlock forming around obesity and, in the language of Baumgartner and Jones, produce an all-new punctuated equilibrium in obesity policy (Baumgartner & Jones 2010; Jones & Baumgartner 2005; Jones & Baumgartner 2012; True, Jones & Baumgartner 1999).

Whether or not the narratives of epigenetics get utilized as the justification for new obesity policies and as the impetus for new lobbying activities remains to be seen. What seems certain is that the forms these narratives take will depend upon the ideologies of the groups which seize upon these epigenetics-based narratives. Identifying the possible influences of these ideologies on the narratives of epigenetics, and the possible influences of epigenetics on these ideological orientations, is the purpose of this dissertation.

The second hypothesis is that the different media sources will emphasize those aspects of epigenetics which are compatible with their respective ideological tendencies as identified in the previous chapter. In other words, that the narratives of epigenetics as reported in the Wall Street Journal will emphasize the internal aspects and individual-level attributions of epigenetics, while the narratives of epigenetics and obesity as reported in the New York Times will emphasize the external aspects and environmental influences on epigenetics.

This hypothesis is related to the first hypothesis as it goes to answer the question of whether or not the narratives of epigenetics will be utilized as the

justification for new obesity policies and as the impetus for new lobbying activities, and how it might be used in these lobbying efforts.

As mentioned before, two of the possibilities from the introduction of epigenetics into a policy domain such as obesity is that epigenetics could introduce a new narrative that is not reflective of either of the predominant existing ideological narratives, or that the narrative of epigenetics will contain elements of both current narrative and ideological orientations.

In the latter case, following the recommendations of Kersh (2009) and Brownell et al. (2010), this kind of narrative of epigenetics could break the issue regime which is currently calcifying the obesity policy domain and allow for the introduction of unprecedented policy prescriptions not currently available from within either of the existing narrative structures. For example, if (per the outcome of the tests of the first hypothesis) the epigenetic narrative is composed of roughly equal parts of the conservative and the liberal narratives, then these policy prescriptions could both focus on the environment and focus on the individual as the locus of responsibility at the same time, instead of the dichotomous exclusions that currently dominate the obesity policy arena. This more holistic policy approach is precisely the outcome advocated for by obesity policy analysts such as Schwartz & Brownell (2007) and Brownell et al. (2010), but is difficult to imagine given the ideological oppositions which currently dominate obesity policy and most other policy domains for that matter, so it is quite significant that such an outcome could be realized through the introduction of epigenetics and its new narrative possibilities.

On the other hand, another intriguing possibility in this circumstance would be if the emerging epigenetics narrative is found to be completely at odds with both the conservative and liberal narratives. In this case, it is difficult to conceive of the policy prescriptions which could result from such a narrative, primarily because the only conceivable policy prescriptions emanate from either the basic conservative or liberal ideological orientation—because this dichotomization is all we know. This outcome would also be a strong indication of just how unique epigenetics is in relation to the two existing predominant ideological orientations around which so much of our politics are and have been organized. The implications of the introduction of such an avowedly non-ideological narrative (at least in terms of the two prevailing ideological orientations) which is so at odds with the organizing principles of contemporary society are difficult to predict, but the possibilities from such a ‘third-way’ foundation for a viable politics and ethics are exciting to consider.

However, in the case in which the emerging narrative of epigenetics is found to contain significant elements of both currently dominant ideological narratives, one very real possibility is that policy entrepreneurs and advocates from the prevailing camps will simply cannibalize those aspects of the new narrative from epigenetics which are already compatible with their current orientation. In this case, the likelihood for the truly transformative possibilities mentioned before are quite low. Instead, such an outcome would likely just contribute to the ongoing ossification of the policy regime currently forming in the obesity policy domain. An analysis of the existing ideological biases of the narratives of epigenetics—if there are any such ideological biases—as

revealed through an analysis of epigenetic narrative by source will be a good first step in determining if the emerging narrative will be cannibalized by the respective ideologies, or if the narrative of epigenetics is strong enough to assert its own unique position.

However, if the emerging narrative of epigenetics is found to contain significant elements of the conservative and liberal narratives, there is also the potential for the epigenetic narrative to act as a bridge between the two camps. Until now, as evidenced by the formation of the policy regime identified by Kersh (2009), there has been little communication between the seemingly opposed ideological orientations; and, according to most conventional analyses premised upon these same ideological oppositions, there is little common ground upon which the two sides could meet. However, if the narrative of epigenetics does contain the right configuration of elements to serve as such a bridge between the ideologies, the effects could be almost as powerful as the circumstance in which the epigenetic narrative is completely at odds with the conventional ideological orientations. In both cases, per the guiding model of this dissertation diagrammed in Figure 2.2, epigenetics provides a unique ‘third-way’ which would introduce unanticipated innovations into our politics and ethics.

To gather the data to test these two hypotheses, in the initial round of sampling six articles from the WSJ and ten articles from the NYT were found to clearly reference epigenetic mechanisms as a significant factor in obesity, though none of these articles explicitly mentioned “epigenetics” as a factor. These articles were coded as ‘epigenetic’ in addition to any other narrative elements or narratives that were present. However,

no articles which explicitly mentioned epigenetics were returned by the initial round of searches.

To include as many articles on epigenetics as possible, additional searches were conducted on each source to identify as many articles on epigenetics and obesity as possible. An additional six articles from the NYT and seven from the WSJ—which as far as I could tell exhausted the relevant articles on epigenetics from both sources—for a total sample of 113 articles (57 from the WSJ and 56 from the NYT). These articles were coded for references to general internal and external causes and solutions, as well as for their mention of any of the other narrative categories.

The Unique Ideology of Epigenetics

First, though, simple models and correlations were run to see whether or which one of the newspapers and ideologies were significant predictors of an article being about epigenetics.

Table 8.1 News Source and Ideology as Predictors of Epigenetics Articles				
	WSJ			
	Coeff.	Pr > z 	Corr.	p-val.
<i>Epigenetic?</i>	0.72 (.31)	.021*	0.22	.010*
	Conservative			
<i>Epigenetic?</i>	1.13 (.48)	.018*	0.27	.006**

As shown in Table 8.1, when the source of an article is used to predict whether or not it is about epigenetics, only the Wall Street Journal is a significant predictor; likewise, when ideology is used as a predictor only the conservative narrative is a significant predictor. Thus, at this very broad level the narrative of epigenetics seems to

already be somewhat conservatively inclined, which fits the discussion of the previous section regarding the unique combination of genetic and environmental and dispositional narrative elements in the conservative narrative.

To establish the composition of the narrative of epigenetics, probit models were used with *Epigenetic?* as the BDV. As in the previous chapter, each category of causes and solutions as identified by Niederdeppe, Robert & Kindig (2011) and each of the overarching narratives from Kersh (2009) were modeled as the predictors, and then each individual narrative element within each category.

The significant results of the probit regressions are reported in the table in Appendix E and displayed graphically in Table 8.2:

Table 8.2 Composition of the Epigenetic Narrative			
		Epi.	Epi.
Causes and Solutions		Overarching Narratives	
Internal Cause		Personal Resp.	-
Genetic	+	Choice	-
External Cause	-	Habit	-
Food Access	-	Toxic Environment	-
Internal Solution	-	Food	-
Personal Knowledge	-	Genetic	+
External Solution	-	Genes	+
Legislating Ext. Causes	-	Environment	+
Legislating Int. Causes	-		

There are sixteen narrative categories and elements that are significant predictors that an article is about epigenetics. This is good news, in terms of establishing

that there is in fact an identifiable narrative of epigenetics even at this early stage in the hype cycle of epigenetics. There are a couple of patterns, though, that bear mention.

First of all, of the sixteen significant narrative categories or elements, only four are positive predictors that an article is about epigenetics; twelve are significant in predicting that an article is not about epigenetics. These twelve significant but negative items may not give as much information about the composition of the epigenetics narrative as the four positive predictors, but they do at least provide information about which narrative elements do not compose the emerging epigenetics narrative.

The Negative Narrative of Epigenetics

In terms of the negative elements of the epigenetic narrative—those narrative categories or elements which predict that an article is not about epigenetics—epigenetics is significantly not associated with references to any external causes of obesity, and food accessibility in particular is not associated with epigenetics as a causal factor. In regards to the solutions for obesity, epigenetics is also not associated with either internal solutions or external solutions. In fact, the mention of enhancing personal knowledge or of either kind of legislation (internally or externally focused) actually predicts that an article is not about epigenetics.

In terms of the overarching narratives (i.e., the Kersh rubric), again epigenetics is significantly not associated with either the personal responsibility narrative or the toxic environment narrative. In this context, references to either choice or habit in particular predict that an article is not about epigenetics, as do references to the composition or accessibility of food.

The Positive Narrative of Epigenetics

The only positive predictors of an article being about epigenetics are references to genetics. This is perhaps not surprising as although a basic assertion is that epigenetics is fundamentally different from genetics, at least in its history, assumptions and narratives, in a scientific sense epigenetics is most appropriately categorized as a subfield of genetics. Likewise, genetics is likely the most common and accessible avenue through which epigenetics can be introduced to politicians, policymakers and the general public. Thus, a reasonable expectation is that genetics would compose a significant aspect of the emerging narratives of epigenetics, and these results have borne out those expectations. However, given the results of the last chapter that showed genetics to be a significant component of the conservative narrative of obesity, this verified emphasis on genetics in the epigenetic narrative also suggests that the emerging narrative of epigenetics may have more in common with the conservative narrative and ideology, with its emphasis on individual autonomy and personal responsibility, than with the liberal narrative and ideology and its emphasis on the formative influences of the physical and social environment. These results likewise suggest which ideology may be taking the lead in forming the narrative of epigenetics, and which aspects of epigenetics may therefore be emphasized in this emerging narrative. More will be written about this in the next section when this epigenetic narrative is compared more directly with the conservative and liberal narratives.

The next step is to compare this now established narrative of epigenetics with the conservative and liberal narratives identified before. To test the first hypothesis that

the epigenetics narrative is unique from the two predominant ideological narratives, the results of the epigenetic narrative from the table in Appendix E and Table 8.2 are displayed graphically in Table 8.3 in comparison with the liberal and conservative narratives from Table 7.2:

Table 8.3 Comparison of the Epigenetic Narrative with the Conventional Ideological Narratives							
Lib. Epi. Cons.				Lib. Epi. Cons.			
Causes and Solutions				Overarching Narratives			
Internal Cause				Personal Resp.	-	-	+
Moral	-		+	Choice	-	-	+
Genetic	-	+	+	Habit		-	
External Cause				Toxic Environment	+	-	-
Physical Environment	+		-	Food	+	-	-
Family Circumstances	+		-	Genetic	-	+	+
Food Accessibility	+	-	-	Genes		+	
Internal Solution				Environment	-	+	+
Personal Knowledge	-	-	+				
External Solution							
Legislating External Causes	+	-	-				
Legislating Internal Causes	+	-	-				
Organizational Change	+		-				
Social Supports	+		-				

As can be seen, there is at least partial support for the hypothesis that epigenetics would have a unique narrative of its own. At the same time, though—as shown by the gray boxes indicating overlaps between the narratives—there is also

support for the alternative hypothesis that the narrative of epigenetics would actually have much in common with either or both of the existing narratives.

The minuses in the light gray boxes in Table 8.3 are those negative elements of the epigenetics narrative which match similarly negative elements of either the liberal or the conservative narratives of obesity. There are eight such instances of matches between the epigenetics narrative and one of the other narratives. Again, these negative relationships are not as strong a result as matching positive predictors, but they do indicate a significant congruence of sorts between the epigenetics narrative and the other main narratives.

For example, while a moral attribution increases the probability that the narrative is conservative, it also necessarily decreases the probability that the narrative is liberal by the obverse amount. Likewise, because a reference to personal responsibility significantly increases the probability that an article is not about epigenetics, it also necessarily decreases the probability that an article is about epigenetics, in which case the epigenetics narrative is similar to the liberal narrative. In this way, the epigenetics narrative is negatively congruent with the conservative narrative for five different narrative elements, and congruent with the liberal narrative in a negative sense for three different elements. This pattern of negative congruence, suggests more of an affinity of the epigenetics narrative with the conservative narrative—or at least a significant lack of affinity with the liberal narrative in a way that is similar to the lack of affinity of the conservative narrative with the liberal narrative.

However, in support of the hypothesis of a unique narrative, the epigenetics narrative has five other elements that are significant predictors which are not shared by either other narrative. Of these, only the *Genes as Genes* element of the overarching *Genetic* narrative from the Kersh (2009) rubric—which marks references to genes that are about the genes themselves—is a positive predictor of the epigenetic narrative; the rest of the narrative elements which are significant in regards to epigenetics actually predict that the article using that element is not about epigenetics.

This lone positive predictor is indicative of the other three positive predictors which are congruent with the conservative narrative in that they all involve references to genetics. In other words, the main points of positive congruence between the epigenetics narrative and either of the other narratives are those somewhat anomalous references to genetics from the conservative narrative of obesity discussed in the previous section.

Discussion

In conclusion, the best information available about the composition of the emerging narrative of epigenetics is that it seems to share more in common—both in a positive sense and in the negative sense just described—with the conservative narrative with its emphasis on personal responsibility and insulation from the influences of the environment.

The Negative Sense. In this negative sense, emphases on external factors such as a toxic or obesogenic environment are negative predictors of both a conservative and an epigenetic narrative, but particularly in regards to the accessibility of food and not in

regards to the other possible factors such as an emphasis on media manipulation which had no significance one way or the other for epigenetics.

At the same time, the epigenetics narrative is also similar to the liberal narrative but only in this negative sense. The only significant points of congruence between the liberal and the epigenetic narratives are in regards to the narrative elements of increasing personal knowledge as a solution to obesity, and personal responsibility as an overarching narrative, and references to choice in particular, all of which are significant predictors that a narrative is neither epigenetic nor liberal. Thus, personal responsibility and choice are not significant elements of the emerging narrative of epigenetics, which is an important distinction from the conservative narrative.

The Positive Sense. The epigenetics narrative is congruent in a positive sense only with the conservative narrative, and only via their common references to genetics and the interactions of genes with their environments, which references increase the probability that the narrative is either conservative and/or epigenetic.

Again, that such references to genetics are a significant component of the narrative of epigenetics is not surprising, as epigenetics is in many ways a proper subset of genetics, and genetics provides the most accessible and easily understandable context for the explanation of epigenetics. That references to genetics are a significant component of the conservative narrative, though, is somewhat surprising given the ontological commitments of this narrative as discussed before.

In both cases, though, the common emphasis on the interactions of genes with their environments make sense in both narratives, but for different reasons: for the

epigenetics narrative, the science of epigenetics is basically the explanation of the nature of these interactions between our genes and our environments; for the conservative narrative with its emphasis on individual responsibility, as the environment is the only aspect of the GxE interaction that is open to manipulation it makes sense that this is the aspect that is emphasized in the conservative narrative. The question that remains open, though, is why does the conservative narrative emphasize genetics in the first place, especially when genetics seems a much more natural fit with the liberal narrative? This question remains to be answered.

The Conservative Narrative of Epigenetics?

That the epigenetic narrative as currently constituted is more congruent with the conservative narrative at this early stage suggests that the personal and dispositional aspects of epigenetics will be emphasized. At the same time, this early congruence of the conservative and the epigenetic narrative suggests a number of implications for the developments of both the epigenetic and the conservative narratives.

For one, as the science of epigenetics involves the interaction of genes and the environment, the incorporation of epigenetics into the conservative necessarily extends the conservative narrative much wider than it otherwise would be. For example, in an article in the Wall Street Journal titled “How Dickensian Childhoods Leave Genetic Scars” the author writes how the “still largely mysterious” field of epigenetics is revealing that “being maltreated as a child can perhaps affect you for life. It now seems the harm might reach into your very DNA.” (Ridley 2012a). The author goes on to cite the results of a number of studies demonstrating that exposure to violence and mistreatment

during childhood is being registered biologically via epigenetic mechanisms in ways which affect healthy function later in life. This is an interesting extension of the conservative narrative, as references to the formative influences of the environment have not been significant parts of the conservative narrative.

However, instead of emphasizing the overriding influence of the physical and social environment as revealed by epigenetics, true to the thrust of the conservative narrative identified in this analysis the author returns again to the dispositional emphases of the conservative narrative and declares that “to have your fate determined by your early experiences is not much different from having it determined by your genes, and when experience acts by changing genes, the distinction vanishes,” and that “fortunately, given medical advances, [just as] genetic determinism is not necessarily a life sentence...the same will almost certainly be true for epigenetic determinism: Understanding the mechanism should bring forward possible cures” (Ridley 2012a).

This admission of the formative influences of the environment via epigenetics on the one hand, and then the return to an emphasis on personal disposition and the value of taking action against the environment on the other hand sets an interesting stage in terms of what will be the uses of epigenetics in the conservative narrative. In other words, the emerging narrative of epigenetics could influence the conservative narrative to incorporate environmental influence as much as the conservative narrative could affect the narrative of epigenetics in downplaying its environmental aspects in favor of its dispositional aspects.

It is difficult to say at this early stage what forms the conservative-epigenetic narrative will take—how much gravity the conservative narrative will exert versus the gravity of the narrative of epigenetics. Just by virtue of the science of epigenetics, though, epigenetics seems likely to open up the conservative narrative to recognition of environmental influences much more than currently manifest by the conservative narrative in practice. Preliminary indications, though, are that the implementation of the conservative narrative of epigenetics will still ultimately return to the core of the conventional conservative narrative and its emphasis on individual autonomy.

More will be written about this in the subsequent section when the actual narratives of epigenetics of the Wall Street Journal and the New York Times are analyzed and discussed.

The Liberal Narrative of Epigenetics?

However, this is not to say that because of these early influences the epigenetics narrative is necessarily bound to the conservative narrative. A stronger positive congruence of the epigenetic narrative with the liberal narrative—with its emphasis on the overriding influence of environmental causes of obesity, and its commensurate recommendations for externally-focused solutions, and legislative solutions in particular—would obviously lend itself to emphases of the environmental aspects of epigenetics and to recommendations for legislative remedies for these externally-located epigenetic influences.

A potential opportunity for the liberal narrative to commandeer the epigenetic narrative is via the intergenerational and transgenerational inheritance described

above. For example, the same author who wrote in the Wall Street Journal about the epigenetic scars from a Dickensian childhood cited above, in a subsequent article then dismisses the potential for the inheritance of these epigenetic effects (Ridley 2012b), while in an article in the New York Times from around the same time, another author observes that “biology is making it clearer by the day that a man’s health and well-being have a measurable impact on his future children’s health and happiness” and that the study of epigenetics is revealing that “environmental toxins leave even more florid traces on grandchildren and great-grandchildren” (Shulevitz 2012).

One wrinkle is that, per the composition of the narrative elements of epigenetics first noted in Table 8.2 and also displayed in Table 8.3, references to both external causes and solutions are negative predictors of articles about epigenetics. So, at the current time at least, the strongest predictors of a liberal narrative are not associated with epigenetics in anything other than a negative way. Still, there is time for this to change, and epigenetics does have many aspects which are compatible with the liberal narrative, so it is not impossible for these aspects of epigenetics to come to constitute significant components of the narrative of epigenetics. Whether it does or not, though, will likely depend upon the source of the narrative. It is to this that we turn next.

Media Bias and the Emerging Narratives of Epigenetics

Given the previous analysis of the congruency and the distinctness of the epigenetics narrative with both the liberal and conservative narratives, the second hypothesis becomes even more salient. From this analysis, although the epigenetics narrative currently appears to be more similar with the conservative than the liberal

narrative, this similarity is not overwhelming and is actually only due in a positive sense to their common invocation of genetics. There is enough latitude as revealed by the prior analysis to suggest that the actual composition of the narrative of epigenetics will depend substantially upon the source of the narrative, and the ideological biases of that source. Thus, establishing whether there is an identifiable ideological bias to the narrative of epigenetics according to the source of the narrative will help to answer this question, as well as to point to things to keep an eye out for in the future in regards to the discussion of epigenetics in the popular media and in public policy circles.

Again, as before, each category of causes and solutions as identified by Niederdeppe, Robert & Kindig (2011) and each of the overarching narratives from Kersh (2009) were modeled as the predictors of the source of the article (i.e., these probit models were run with media source as the BDV, with both the NYT and the WSJ), only this time in interaction with whether or not the article was also about epigenetics. After each category was modeled, each individual narrative element within each category was modeled in an interaction with whether or not the article was about epigenetics. Again, the coefficients returned by the probit regression models are an estimate of the impact of that narrative element in interaction with *Epigenetic?* on the probability that the BDV is the source of the article.

Methods

However, there are a couple of methodological and interpretive issues that arise in testing the hypothesis that the different media sources will emphasize the different

aspects of epigenetics which are compatible with their respective ideological tendencies.

First, using probit models to test the hypothesis that an article containing specific narrative elements and also being an article about epigenetics will increase the likelihood that the article is from a particular source would require an interaction of the binary variable *Epigenetic?* (1 = Yes; 0 = No) with the other narrative categories and elements. Per Brambor, Clark and Golder (2006), the proper interpretation of such an interaction would require the calculation of marginal effects and other techniques. Given the nature of the data itself, though, that there are relatively few cases and instances, this level of fine statistical analysis requires more of the data than the data can deliver.

Still, as the goal at this stage is to just get an idea of the shape of the narratives of epigenetics through the relative rates of usage of different terms, an alternative approach with much fewer moving parts but which accomplishes more or less the same result as the probit models is to just take simple correlations of the different categories and elements. In this case, all the results from the NYT and WSJ are taken separately and correlations are run for each of the narrative categories and elements with *Epigenetic?*. This method reveals the basic relationship between the source of an article and the significant positive and negative associations of each category or element in those articles about epigenetics, as well as giving an idea about the magnitude of each category or element in the narrative.

Notably, this same method of assessing the correlations would produce identical results as the probit models used in the previous analyses to assess the epigenetic narrative. In each case, the significant probit results reported in previous tables also had a correlation of greater than ± 0.20 , or in the weak to modest range, to up to 0.49, or the moderate range of correlation. Thus, this level of correlation will provide the baseline for the assessment of the potential media source biases in the narratives of epigenetics: Any narrative category or element that registers a correlation of ± 0.20 or greater will be marked as significant. Given the relationship between the results of the probit models and these correlations, this method also still allows for the comparison of the results, particularly in terms of which categories or elements have gained or lost significance and which have potentially flipped signs.

Results

The results of the correlations for all the narrative categories and elements of significance in each of the media sources are reported in Appendix E. The epigenetics narratives by source are also displayed graphically in Table 8.4 in the same manner as before, with plusses and minuses indicating significant correlations (i.e., above the threshold of ± 0.20):

Table 8.4 Significant Elements of the Epigenetic Narratives from the New York Times and the Wall Street Journal				
	NYT Epi.	WSJ Epi.		NYT Epi. WSJ Epi.
Causes and Solutions			Overarching Narratives	
Internal Cause			Personal Resp.	-
Personal Disposition		-	Choice	-
Genetic	+	+	Habit	-
External Cause	-	-	Lifestyle	+
Food Access.	-	-	Toxic Environ.	-
Inst. Culture	-	-	Genetic	+
External Solutions		-	Genes	+
Ext. Legislation	+		Environment	+
Int. Legislation	-	-		
Social Support		-		

The shaded boxes indicate those elements shared in common by the epigenetics narratives from both media sources. The light gray areas indicate narrative elements shared by both sources with significant negative correlations, and the dark gray areas indicate shared significant positive correlations.

First, the results displayed in Table 8.4 provide mixed support for the hypothesis that each source would emphasize aspects of epigenetics which are congruent with its ideological tendencies. If this hypothesis were perfectly supported, there would be no shaded areas. That of the seventeen significant correlations found there are eight such instances of congruence between the narratives of the NYT and the WSJ suggests the epigenetic narratives of each source are as similar as they are different.

Composition of the Narratives of Epigenetics

For the Wall Street Journal, in terms of causes and solutions, both external causes and solutions as a category, and food accessibility and institutional culture and

changes in social support and legislation focused on internal causes in particular negatively correlated epigenetics. In terms of the overarching narrative themes, epigenetics in the WSJ is also negatively correlated with references to a toxic environment. These are the relationships which would be expected given the ideological biases of the WSJ described before. However, there are four instances in which the epigenetics narrative of the WSJ defies the conservative narrative in general, and the conservative narrative of the obesity narrative in the WSJ.

In the NYT, though, there is only one narrative element with a significant correlation that is congruent with a liberal ideology. This congruency occurs through references to legislation focused on external causes. Other than that, all the other significant narrative elements in the NYT epigenetic narrative—except for references to genetics—are actually counter to the expectations of liberal bias. These counter-ideological results and the references to genetics will be discussed in more detail below.

Differences between the Narratives

In partial support of the source bias hypothesis that there are differences in epigenetic narratives according to the ideology of the source of that narrative, there are nine elements that are significant in one narrative but not the other. In particular, attributions of personal responsibility are negatively correlated with epigenetics in the WSJ, and not significantly associated in either direction with epigenetics in the NYT. Also, references to external solutions, as enhancing social supports in particular, are negatively correlated with epigenetics in the WSJ, but do not register as significant in the NYT. Finally, the invocation of the external environment as a causal factor is also

negatively correlated with epigenetics in the WSJ, but does not register one way or the other in the NYT. However, while the last two are prototypically conservative positions, attributions of personal responsibility are a cornerstone of conservative narratives. Thus, the WSJ narrative of epigenetics at once reflects some of the elements of the conservative narrative, but also contradicts these expectations.

The only differences in the epigenetic narrative of the NYT from that of the WSJ are in the positive correlation of references to legislation focused on external causes and epigenetics, and in the positive correlation of references to lifestyle as a significant narrative element. Again, though, while the former is a prototypically liberal position, the latter is usually identified as a conservative orientation. Thus, the epigenetics narrative from the NYT exhibits both liberal and conservative aspects even in its differences from the epigenetics narrative of the WSJ.

Similarities between the Narratives

The narratives of epigenetics from the NYT and the WSJ share significant negative correlations in regards to external causes and the external solution of legislation focused on internal causes. These are typical conservative positions, which suggests that there is something about epigenetics that exerts a conservative influence, at least in the context of external causes and solutions. However, as just described, epigenetics also exerts a liberal influence on the ostensibly conservative narrative of the WSJ, so again the effects from epigenetics do not exclusively tend towards one or the other ideological pole but appear to incorporate aspects of both. This is another indication of the trans-ideological potential of epigenetics suggested before.

The identification of these specific components which are negatively correlated with epigenetics is one meaningful preliminary result from this analysis. However, these 'negative' results reveal an even more meaningful aspect of the narrative of epigenetics than just its composition. While it is true that these elements are 'only' negatively correlated with epigenetics, these common negative indicators are also the first evidence that, as discussed previously, because of the unique causal juxtapositions provided by the science of epigenetics the narrative of epigenetics offers the potential to link or potentially to transcend the two predominant ideological binaries. As described before, the obesity narratives of the NYT and the WSJ both maintained the anticipated and longstanding ideological dichotomizations. Even at this early stage, though, the epigenetics narrative has introduced a significant wrinkle in these conventional ideological dichotomizations just through these negative correlations.

Likewise, the only elements with positive correlations shared by the epigenetics narratives from both sources are in regards to genetics. This unification of the supposedly exclusive ideological tendencies of the narratives of the NYT and the WSJ through genetics is also noteworthy. As discussed above regarding genetics and ideology, the conventional wisdom is that conservatives are more likely to invoke genetic explanations, although Suhay and Jayaratne (2013) show that ideologues of both orientations will invoke genetics to explain a trait when naturalizing that trait is congruent with their preexisting ideological stances. In the context of the obesity narratives of the NYT and the WSJ, previous analyses shows that the more liberal NYT refers to genetics and genes as genes much more than the more conservative WSJ. The

suggestion was that this tendency fits the liberal characterization of obesity as beyond personal responsibility, similar to liberal attributions of sexual orientation as a genetically fixed trait, with the commensurate implications for policy from this change in the locus of responsibility. In the case of epigenetics, though, both narratives share almost identical levels of reference to genetics and genes, both as genes and in interaction with the environment. More will be said about this potential ideological bridge via genetics in a subsequent section, but these shared instances in the epigenetics narratives of the NYT and the WSJ again present unique points of convergence between these two ideologically distinct sources.

The Ideological Complications of Epigenetics

A good way to explore this counter- or trans-ideological potential of epigenetics in the context of policies and policy narratives is to compare the narratives of epigenetics from each source with the narratives of obesity from that source. As discussed in a previous section, the obesity narratives of each source confirmed the expectations of ideological bias related to media source. Comparison of the epigenetic narrative from each source with the corresponding obesity narrative demonstrates how the epigenetic narratives are similar to or distinct from the obesity narratives and the expected ideological tendencies. This is done for the causes and solutions identified in the Niederdeppe rubric in Table 8.5 and the overarching narratives identified in the Kersh rubric in Table 8.6.

Table 8.5**Comparison of the Epigenetics and Obesity Narratives from the New York Times and the Wall Street Journal (Niederdeppe Rubric)**

	NYT Obesity	NYT Epi.	WSJ Epi.	WSJ Obesity
Internal Cause				
Personal Disposition	-		-	+
Genetic		+	+	
External Cause	+	-	-	-
Media	+			-
Physical Env.	+			-
Food Access.		-	-	
Inst. Culture	+	-	-	-
External Solutions			-	
Ext. Legislation		+		
Int. Legislation	+	-	-	-
Social Support			-	

Table 8.6**Comparison of the Epigenetics and Obesity Narratives from the New York Times and the Wall Street Journal (Kersh Rubric)**

	NYT Obesity	NYT Epi.	WSJ Epi.	WSJ Obesity
Pers. Resp.	-		-	+
Choice	-		-	+
Habit	-		-	+
Lifestyle	-	+		+
Toxic Environ.	+		-	-
Media	+			-
Genetic	+	+	+	-
Genes	+	+	+	-
Environment		+	+	

In Tables 8.5 and 8.6, the instances in which a narrative element is shared between narratives—either between the epigenetics narratives of both sources or

between the epigenetic narrative and the obesity narrative of a source—are highlighted with bold borders. Also, as shown in Tables 8.5 and 8.6, the instances in which the epigenetic narrative shares a narrative element with the obesity narrative but flips the sign of that element are indicated in dark gray. In addition to representing a significant difference between the epigenetic narrative and the obesity narrative of that source, these instances also represent examples of the counter-ideological influence of the epigenetic narrative contrary to the first part of the second hypothesis. In all, there are ten such instances, four for the NYT and six for the WSJ.

The elements which changed from positives in the obesity narrative to negatives in the epigenetic narrative are external causes as institutional culture in the NYT, and attributions of personal disposition and responsibility in the WSJ. These are both fundamental aspects of the liberal narrative exemplified by the NYT and the conservative narrative exemplified by the WSJ. That these elements have not just not faded from significance but rather flipped their signs in the accounts of epigenetics suggests, as discussed before, that epigenetics both contains and contradicts significant elements of both of the conventional ideological orientations.

Media Bias and Narratives of Epigenetics

To test the hypothesis that epigenetics will also have a configuration of narrative elements independent of the narratives from either of the media sources, the basic epigenetics narrative found in previous analyses and displayed in Table 8.1 can be compared against the epigenetics narratives from each source as displayed in Table 8.4:

Table 8.7			
Comparison of the Epigenetics Narratives (Niederdeppe Rubric)			
	NYT Epi.	Epi.	WSJ Epi.
Internal Cause			
Personal Disposition			-
Genetic	+	+	+
External Cause	-	-	-
Food Access.	-	-	-
Inst. Culture	-		-
Internal Solution			
Personal Knowledge	-	-	-
External Solutions			-
Ext. Legislation	+		
Int. Legislation	-		-
Social Support			-

Table 8.8			
Comparison of the Epigenetics Narratives (Kersh Rubric)			
	NYT Epi.	Epi.	WSJ Epi.
Pers. Resp.		-	-
Choice		-	-
Habit			-
Lifestyle	+		
Toxic Environ.		-	-
Genetic	+	+	+
Genes	+	+	+
Environment	+	+	+

As before, overlapping elements between narratives in Tables 8.7 and 8.8 are outlined in bold. The dark gray in these tables indicates those elements in which the standalone epigenetic narrative is different than either of the other narratives.

If the standalone epigenetic narrative were completely different in its significant emphases from both of the other narratives, there would be no bold outlines and the significant elements of the epigenetic narrative would all be marked as dark gray squares. That there are so many bold outlines suggests that the standalone epigenetic narrative shares much in common with the NYT and WSJ narratives. Given the way these narratives were derived, this level of commonality might be a reasonable expectation. However, that there are instances in which the standalone epigenetic narrative does not match one or both of the other narratives (indicated by the dark gray squares) shows that there are moments of significant divergence between the different narratives, which suggests that there is an epigenetic narrative that is distinct from these other source-bound narratives. In other words, while the standalone epigenetic narrative is not completely independent of the other two narratives, there appear to be ways in which this standalone epigenetic narrative is distinct from both the NYT and the WSJ narratives.

As shown in Tables 8.7 and 8.8, there are many bold outlines and seven gray squares. The bold outlines show that the standalone epigenetic narrative shares narrative elements in common with both of the other narratives in seven instances—three negative (as references to external causes and enhancing personal knowledge as a solution) and four positive (all involving references to genetics)—and four instances in which the standalone epigenetic narrative is congruent with the narrative from the WSJ. Notably, all of these elements shared only with the WSJ are negative correlations, but two are prototypically conservative positions and two are liberal positions, which

suggests again the strange property of the emerging epigenetic narrative as containing significant elements of both conventional ideological orientations at the same time.

All of the instances in which the standalone epigenetic narrative is distinct from either of the other narratives (either as a positive or a negative) are all noteworthy as the absence of that element in the standalone epigenetic narrative and not as an element of the standalone narrative not found in the other two. There are two such instances in which the NYT and WSJ narratives share a negative correlation of a narrative element not present in the standalone epigenetic narrative (as references to institutional culture as an external cause and internally-focused legislation as an external solution). There are five instances in which the standalone epigenetic narrative does not contain a narrative element that is significant in one of the other narratives. Again, some of these uncommon instances reflect the conventional ideological orientations, but some contradict these expectations, which again demonstrates the ideological novelty of the emerging narratives of epigenetics even coming from sources with ostensible and identifiable ideological biases.

Genetics and Epigenetics

Finally, and not surprisingly, Tables 8.7 and 8.8 also show that all three of the narratives share the significance of their references to genetics. Given the conceptual and material similarities between epigenetics and genetics, this deep connection between epigenetics and genetics is perhaps to be expected. Even so there are a couple of important political implications for this connection of genetics and epigenetics which must be addressed.

As discussed before, according to the literature there does not yet seem to be a clearly defined ideological bias in regards to genetic attributions, although the assumed fixedness of genes and their direct causal role in the manifestation of traits (i.e., a “gene for...”)—which is actually more a function of the narrative of genetics than of the science of genetics per se (Dupre 2005; Stelmach & Nerlich 2015)—suggest that conservatives are more likely to emphasize the role of genes. To wit, according to Niederdeppe, Roberts and Kindig (2011) in the construction of their rubric of obesity narratives, the attribution of genetics as an internal cause was a distinctly conservative position.

However, Suhay and Jayaratne (2013) found that both conservatives and liberals incorporated genetic narratives depending upon whether the naturalization of the trait in question fit their preexisting ideological assumptions. As such, in the obesity narratives analyzed before, genes as genes was a significant component of the more liberal NYT narrative. This emphasis suggests that genetics are being emphasized more in the liberal narrative, and that obesity in the liberal narrative is being painted as a fixed trait similar to sexual orientation. On the other hand, genes are not emphasized in the conservative narrative, such that obesity is not fixed by genetics, which also fits the conservative narrative emphasis on personal responsibility for health outcomes.

These different narrative emphases on genetics are relevant to policy because different causal explanations result in different policy prescriptions. An emphasis on obesity as a fixed genetic trait removes much of the onus on personal responsibility for

obesity, and focuses policy on what is amenable to change (i.e., the environment). A de-emphasis on the causal influence of genes focuses policy back on personal dispositions.

This connection between competing narratives and policies is buttressed by the analyses of Kersh (2009) and McBeth et al. (2013) which identify the calcification of a dichotomous policy regime in obesity marked by the opposition of these two ideological orientations and their competing narratives. As shown above, the current use of genetic narratives in obesity fit this pattern of conforming to ideology. In this context, a reasonable assumption is that so would the narratives of epigenetics. However, instead of conforming to the preexisting ideologies, the emerging narratives of epigenetics already appear to be bridging the chasm between these two camps across a number of causal explanations including genetics. Whether this pattern is maintained as the narratives of epigenetics develop remains to be seen.

At the same time, though, given the substantial and perhaps fundamental differences between the sciences of genetics and epigenetics discussed in previous sections, this close identification of the narrative of epigenetics with genetics may function to conceal many of the important aspects of the science of epigenetics and the novel causal mechanisms it introduces. As the mechanisms of genetics are already part of the common parlance, the nuances of epigenetics may get lost in or overshadowed by the genetic narrative. If the nuances of epigenetics do get overpowered by the narratives of genetics, a safe bet is that this will occur along ideological lines which, per Suhay and Jayaratne (2013), will likely depend on the ideological salience of the trait at

issue. However, even in this case at this early stage it appears that epigenetics is already blurring the boundaries between ideological orientations.

The Trans-ideological Potential of Epigenetics

At the beginning of this chapter, two suggestions were offered for the emerging narratives of epigenetics. Because of the causal mechanisms revealed by the science of epigenetics which blur the conventional boundaries of our insides and our outsides and between the individual and their environment, epigenetics is capable of both conservative and liberal narratives. One possibility is that each ideological orientation would just co-opt those aspects of epigenetics which fit its preconceptions. The other possibility is that epigenetics would compel a unique third way narrative which, while containing elements of both ideological narratives, is actually beholden to neither conventional ideology.

The preceding suggests the latter much more than the former, at least in the context of obesity. There is already a great deal of work being done on the science of the epigenetics of obesity in both animals (Seki et al. 2012; Manikkam et al. 2013; Milagro et al. 2009) and humans (Friso & Choi 2014; Slomko, Heo & Einstein 2012; Soubry et al. 2013; Stoger 2008; Wang et al. 2010; Whitaker et al. 2010). The results of this scientific research will obviously push and constrain the resulting policy recommendations, but this science will not be the only factor which influences the resulting policies.

As discussed before, science-based policies are the result both science and narrative development. Science-based narratives do not reflect just the science but also

an ideological interpretation of the science, just as science itself is a process of narrative formation often informed by ideology (Fuchs 2015; Sheehan & Rode 1999; Wise 2011).

A valid question is therefore which factor will have more influence on the other.

Indications are that at this early stage the narratives of epigenetics are molding the existing narratives and not vice versa.

Given the high level of attention devoted to epigenetics in the sciences, the incorporation of epigenetics into policies is only a matter of time. Although there are as yet no epigenetics-informed policies per se, this vector of influence suggests that when there are such policies they will be composed of both individual and environmental aspects and not isolated to either ideological orientation, regardless of the source. What these new policy prescriptions will be which result from this unique combination of the previously juxtaposed environmental and individual narratives remains to be seen, but the science and narratives of epigenetics promise potentially transformative possibilities for politics and policies.

Next Step

An important question at this point, though, is how reflective of their underlying ideologies are the NYT and the WSJ? As shown in Table 8.9 below, when an index of conservative-liberal narratives is constructed and used as a predictor of the source in a probit regression, the coefficients do not quite reach standard levels of significance, and neither do the correlations. Thus, the connection between ideology and source—at least as the NYT and the WSJ—appear to be weak at best.

Table 8.9 Ideology and Source				
	Ideology			
	Coeff.	Pr > z	Corr.	p-val.
Source	0.46(.28)	.11†	0.18	.055†

This is not to say that ideological influences are not present in the NYT and the WSJ. As reported above, a number of ideological influences on both the obesity narrative and the narratives of epigenetics have been found. This weak connection between the source and ideology, though, suggests that these media sources are only a weak proxy for the underlying ideologies. The identification of unmediated ideological influences on the narratives of epigenetics would therefore be an important step in identifying the actual composition of the emerging narratives of epigenetics and their actual relation to these conventional ideologies.

Caveats

Although this analysis has been able to put some flesh onto the bones of the skeleton of the emerging narrative of epigenetics, perhaps for the first time, there are some significant limitations to the present study as well as much work that remains to be done.

First, there were not a lot of articles on epigenetics from these two sources over the time period sampled (2010-2014)—sixteen which obliquely referenced epigenetics, and thirteen which explicitly mentioned epigenetics. This relative paucity of sources for the narrative of epigenetics is a function of the early stage of the hype cycle of epigenetics. As discussed before, the attention being paid to epigenetics in the sciences and academia is reaching “epidemic” proportions (Haig 2012), but has yet to cross over

into the public awareness. This relative lack of attention to epigenetics in mass media renders this construction of the epigenetics narrative as exploratory at best; still, it is notable that even given this level of coverage so many statistically significant components of the epigenetics narrative were identifiable.

Second, all of this narrative analysis was conducted in the context of just two media sources. The narrative analysis was constructed so as to apply as broadly as possible using the WSJ and the NYT, which are the most read newspapers in the United States, but the epigenetic narratives from other media sources may still be significantly different. The results from this analysis of the NYT and the WSJ, although congruent with the expectations from the literature on obesity narratives and ideology, may be different when collected from other sources. Even the construction of the narratives themselves is necessarily constrained by the choice of sources. Thus, a necessary step to further confirm the conclusions regarding both the narratives of obesity and the narrative of epigenetics requires the incorporation of more sources. As of now, the generalizability of the epigenetic narrative uncovered in this dissertation remains to be seen.

Third, the main goal of this dissertation is to provide baselines for the general discussion of the emerging narrative of epigenetics, but the narrative analysis in this dissertation utilized obesity-specific rubrics which necessarily constrained both the choice of narrative elements and the results. Many of the salient narrative elements in other policy domains are likely to be different than those of obesity, although the prevalence of the two predominant ideologies also likely constrain the narratives in

these other domains as well. Still, analyses of the emergence of epigenetics narratives in other policy domains must also be undertaken.

Finally, while the obesity narrative rubrics used in this dissertation were helpful in at least providing a starting point and a baseline for the narrative of epigenetics, they do not truly reflect the unique characteristics of epigenetics, such as intergenerational and transgenerational inheritance. To obtain a truly representative picture of the narratives of epigenetics therefore requires the construction and use of epigenetics-specific rubrics. This would finally begin to reveal the true uniqueness of the cause and effect mechanisms of epigenetics, and the resulting narratives.

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Appendix A

Niederdeppe, Robert & Kindig (2011) Coding Rubric		
Title		
Author		
URL		
Blurb		
Date		
Source		
Words		
Internal Cause	Moral	
	Rationality	
	Genetic	
External Cause	Food Access	
	Family Circumstance	
	Institutional Culture	
	Physical Environment	
	Media	
Internal Solution	Personal Knowledge	
	Public Education	
External Solution	Social Support	
	Org. Culture	
	Legislating Internal Causes	
	Legislating External Causes	

Appendix B

Kersh (2009) Coding Rubric		
Title		
Author		
URL		
Blurb		
Date		
Source		
Words		
Personal Responsibility	Choice	
	Habit	
	Lifestyle	
	Willpower	
Toxic Environment	Food Access/ Composition	
	Media	
Genetics	Genes as Genes	
	Genes x Environment	

Appendix C

Obesity Narrative Categories and Elements as Predictors of News Source				
Category	NYT		WSJ	
	Coeff.	Pr > z 	Coeff.	Pr > z
Causes and Solutions				
Internal Cause				
Moral			0.89 (.39)	.022*
External Cause	0.40 (.10)	.0001***		
Media	1.03 (.49)	.037*		
Physical Environment	0.71 (.26)	.006**		
Institutional Factors	0.91 (.35)	.009**		
External Solution				
External Legislation	0.74 (.29)	.009**		
Overarching Narratives				
Personal Resp.			0.31 (.11)	.004**
Choice			0.72 (.28)	.009**
Lifestyle			0.56 (.27)	.039*
Willpower			1.21 (.58)	.037*
Toxic Environment	0.66 (.19)	.0005***		
Food	0.88 (.28)	.002**		
Genetic				
Genes	0.55 (.28)	.048*		
Notes: Coefficients are estimates from probit regression models. Standard errors are reported in parentheses. Only statistically significant results are listed. Significance codes: † .10; * .05; ** .01; *** .001. N = 113.				

Appendix D

Obesity Narrative Elements as Predictors of Ideology				
Category	Liberal		Conservative	
	Coeff.	Pr > z 	Coeff.	Pr > z
Causes and Solutions				
Internal Cause			1.87 (.36)	.0002***
Moral			0.84 (.35)	.018*
Genetic			2.00 (.34)	.0006***
External Cause	1.40 (.27)	.0003***		
Physical				
Environment	0.91 (.29)	.002**		
Family Circumstances	1.51 (.59)	.010*		
Food Access	1.72 (.32)	.0007***		
Internal Solution			0.83 (.27)	.002**
Personal Knowledge			1.54 (.40)	.0001***
External Solution	0.88 (.20)	.0001***		
External Legislation	0.77 (.40)	.056†		
Internal Legislation	1.61 (.35)	.0005***		
Org. Change	1.30 (.47)	.005**		
Social Supports	1.12 (.38)	.003**		
Overarching Narratives				
Personal Resp.			0.38 (.19)	.045*
Choice			0.84 (.35)	.018*
Toxic Environment	1.54 (.46)	.0008***		
Food	1.84 (.34)	.0005***		
Genetic			1.70 (.49)	.0006***
Environment			1.36 (.36)	.0002***
Notes: Coefficients are estimates from probit regression models. Standard errors are reported in parentheses. Only statistically significant results are listed. Significance codes: † .10; * .05; ** .01; *** .001. N = 113.				

Appendix E

Narrative Categories and Elements as Predictors of Articles about Epigenetics				
Category	<i>Epigenetic?</i>			
	Predicts Coeff.	Pr > z	Does not Predict Coeff.	Pr > z
Causes and Solutions				
Internal Cause				
Moral			1.42 (.46)	.002**
Genetic	1.32 (.30)	.0001***		
External Cause			0.48 (.16)	.0004***
Food			1.38 (.32)	.0002***
Accessibility				
Internal Solution			0.43 (.23)	.066†
External Solution			0.68 (.21)	.001**
External Legislation			0.55 (.30)	.064†
Internal Legislation			0.97 (.50)	.051†
Overarching Narratives				
Personal Responsibility			0.39 (.14)	.006**
Choice			0.96 (.38)	.011*
Habit			1.12 (.37)	.003**
Toxic Environment			0.52 (.23)	.023*
Food			0.69 (.29)	.020*
Genetic	1.94 (.35)	.0002***		
Genes	1.27 (.29)	.0001***		
Environment	1.75 (.30)	.0007***		
Notes: Coefficients are estimates from probit regression models. Standard errors are reported in parentheses. Only statistically significant results are listed. Significance codes: † .10; * .05; ** .01; *** .001. N = 113.				

Appendix F

Narrative Elements from Each Source Correlated with <i>Epigenetic</i> ?				
	NYT Epi.	WSJ Epi.		NYT Epi. WSJ Epi.
Causes and Solutions			Overarching Narratives	
Internal Cause			Personal Resp.	-0.28
Personal Disposition		-0.27	Choice	-0.23
Genetic	0.27	0.25	Habit	-0.28
External Cause	-0.20	-0.26	Lifestyle	0.24
Physical Env.			Toxic Environ.	-0.20
Food Access.	-0.30	-0.36	Genetic	0.53 0.49
Family			Genes	0.33 0.33
Inst. Culture	-0.22	-0.23	Environment	0.44 0.46
External Solutions		-0.27		
Ext. Legislation	0.23			
Int. Legislation	-0.23	-0.26		
Social Support		-0.22		
Notes: Numbers are correlation coefficients of each item with <i>Epigenetic</i> ?. All correlations greater than or equal to +/-0.20 are reported (NYT = 58; WSJ = 59).				