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Epigenetic Inheritance and the Moral Responsibilities of Mothers

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Mothers are widely considered to bear special responsibilities for the health of their children. Warning labels directed at pregnant women on containers of alcohol or cartons of cigarettes are indicative of social expectations regarding maternal responsibilities to provide their future children with the healthiest prenatal environment. Beyond pregnancy, as Rebecca Kukla has argued:

mothers bear a disproportionate responsibility for managing their children's contact with professional health institutions, maintaining their health at the domestic level (through feeding and hygiene practices and the like), and training them in safety and self-care. Correspondingly, mothers are held disproportionately responsible for their children's physical and mental health imperfections [1].

Recent research in epigenetics raises complicated questions about maternal responsibility for health. Epigenetic changes are alterations in gene functions, including whether and to what degree a gene is expressed, that persist through mitosis and meiosis and that are not attributable to an alteration of the genes themselves [2]. For example, research suggests that a variety of factors, including nutritional inadequacy and exposure to environmental toxicants, especially in utero and in early life, induce epigenetic changes that last throughout the life span [3].

One of the best understood instances of epigenetic inheritance concerns the effects of maternal nurturing behavior during the first week of life. Among genetically identical rats, the more nurturing pups receive from their mothers, the more serotonin they produce. Serotonin levels then influence the process of genetic expression in the pups, with high serotonin levels ultimately leading to a more relaxed phenotype and lower serotonin levels leading to a more stressed phenotype. More stressed rats tend to be low nurturers, so in this way the nurturing style of mothers is heritable, not directly via the genome itself but rather through a complex process connecting maternal behavior and gene expression [4].

It is possible that epigenetic effects might be observed across multiple generations. According to one analysis of three successive generations in Sweden, for example, one generation's nutritional status during its prepubescent years correlated with the longevity of and morbidity experienced by that generation's grandchildren [5]. One possible explanation is that nutritional scarcity in developmental years may induce

meiotically stable epigenetic changes in the gametes, though this has not been shown [6].

On one hand, awareness of epigenetic impacts on health would seem to compound the moral responsibility that mothers bear for their children's health. For example, the University of Utah's Genetics Science Learning Center website points out that, when pregnant women smoke, three generations are being exposed to the smoke: the woman herself, her fetus, and the third generation by way of the fetus's germ cells [7]. The possibility that such exposures would lead to epigenetic changes durable throughout the lifetimes of each of these three generations creates a heavy responsibility on the pregnant woman not to smoke; and the possibility that such exposures could lead to gametic epigenetic effects in the fourth generation only adds to her already considerable moral responsibilities.

On the other hand, however, epidemiological research demonstrating patterns of health inequalities among populations suggests that individuals may be much less responsible for their own health, or the health of their children, than we might have thought [8, 9]. The pioneering Whitehall study demonstrated that health inequalities among civil servants in England correlated with seemingly insignificant differences in social status [10]. A more recent study shows that, among Nobel Prize nominees, those who actually win the prize live on average 2 years longer than those who are nominated but do not win [11]. These and other studies provide evidence that socioeconomic status (SES) influences health outcomes even among relatively affluent individuals who have secure access to medical care. Moreover, epidemiological research shows that there are significant disparities in health along racial lines in the United States [12]. These racial differences are apparent at all socioeconomic levels, so again, these disparities cannot be neatly attributed to poverty or lack of access to care alone.

Most causal explanations for how race or SES might influence health tend to emphasize either direct impacts of social conditions on the health of individuals or the prevalence of genetic predispositions for disease within social groups. Taking both the epigenetics research and the population health perspective seriously, however, illustrates how social experiences might become literally embodied in potentially inheritable ways. As one analysis concludes, "when combined with the evidence...that psychosocial stress can influence epigenetic profiles and health, it is clear that socially disadvantaged individuals are at increased risk of exposure to these stressors and are thus more likely to develop adverse disease outcomes" [13].

In turn, this suggests that moral categories such as blame and desert, which emphasize personal responsibility, may not be adequate or appropriate from a population health perspective. The prevalence of health-related behaviors for which we are most tempted to blame individuals, such as smoking, often themselves track SES [14]. According to one study, for example:

low-income women use smoking as a means of coping with their economic pressures and the resulting demands placed on them to care for others.... Having to care for more, while simultaneously living on less, provided the context in which relatively few women attempted or succeeded at smoking cessation [15].

Instead of turning further towards a model of attributing individual moral responsibility for health, then, we should more carefully attend to whether the social structures that lead to health disparities (including those that lead to women's disproportionate responsibility for children's health beyond pregnancy) are themselves just.

Most theories of social justice incorporate a demand of equality. According to political philosopher John Rawls, for example, the point of egalitarian justice is not to make everyone the same (for example, equally rich or equally healthy) but rather to ensure that the basic institutions of society are organized so that no one is treated as morally inferior to others simply because he or she is poor, or sick, or female, or a member of a marginalized religious or racial group [16]. In other words, the goal of a just society is to ensure that that people are treated as moral equals rather than as more or less worthy of respect depending on characteristics like race, economic class, sex, age, sexual orientation, or similar attributes [17].

Importantly from a health perspective, an egalitarian society that treated all persons with moral respect would reduce the prevalence of psychosocial stress experienced due to discrimination and the consciousness of one's lower status, which would in turn reduce the prevalence of adverse health outcomes that result from this kind of stress. The research on epigenetics that shows that these adverse health outcomes might be more durable than we previously believed, and may even have transgenerational impacts, provides additional reasons to pursue a more just and egalitarian society. What we should be aiming for is a society in which health is not linked to one's SES or race, in which pregnant women have the support they need within their relationships and from society in keeping themselves and their children healthy, and in which family members and social programs shoulder some responsibilities traditionally borne by mothers after pregnancy.

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