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The Politics of the Gene: Social Status and Beliefs about Genetics for Individual Outcomes

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Social scientists have predicted that individuals who occupy socially privileged positions or who have conservative political orientations are most likely to endorse the idea that genes are the root cause of differences among individuals. Drawing on a nationally representative sample of the US population, this study examines belief in the importance of genes for understanding individual differences in a series of broad domains: physical illness, serious mental illness, intelligence, personality, and success in life. We also assess whether the belief that genetics are important for these outcomes is more common among those in relatively advantaged positions or among those who are more politically conservative. Finally, we consider whether such beliefs predict attitudes toward genetics-related social policies. Our analyses suggest that belief in the importance of genetics for individual differences may well have a substantial effect on attitudes toward genetics-related policies, independent of political orientation or other measures. Our study identifies high levels of endorsement for genes as causes of health and social outcomes. We describe a cultural schema in which outcomes that are "closer to the body" are more commonly attributed to genetics. Contrary to expectations, however, we find little evidence that it is more common for whites, the socioeconomically advantaged, or political conservatives to believe that genetics are important for health and social outcomes.

It is increasingly apparent that social scientists need to engage the rapidly accumulating developments in human genetics research. This imperative has been advanced by several decades of provocative reports from behavioral genetics, enormous media attention given to the Human Genome Project, the increasing availability of genetic testing to assess individuals' risk for myriad illnesses, and multiple initiatives to include genetic assays in ongoing large-scale social survey projects. One critical area for social scientists to engage is the assessment of people's beliefs about the causal importance of genes for individual and group differences. For while biological and social scientists debate the importance of genetic differences for important health and social outcomes, people outside the academy have their own views about the role of genes in creating individual and group differences. These public conceptions may be sociologically important in their own right, particularly as a way of understanding how people interpret social problems and respond to policy initiatives regarding genetics (Schnittker, Freese, and Powell 2000). Indeed, many such policy issues—including public support for genetic testing programs or for

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funding large projects like the Human Genome Project and the International HapMap Project—may be intimately connected to how important individuals believe genetic differences are to understanding differences in individual fates.

To date, social psychological research on the public consequences of genetics has focused predominantly on individual and family experiences of receiving results from genetic testing (Babul et al. 1993; Cox and McKellin 1999; Koehly et al. 2003; Lafayette et al. 1999; Lerman et al. 1994). However, for social psychology, genetic attribution provides an intriguing vantage point because of the multiple ways in which genes may be understood as causes of individual and group differences (Freese 2006). One issue is whether people construe genes as causes that are internal to individuals (and therefore subject to individual control) or external to the individual (and therefore beyond individual control). Genes are physically internal, however they otherwise share characteristics of external attributions and therefore may be interpreted as influencing outcomes in ways that mitigate perceptions of individual responsibility. A second issue raised by the prevalence of genetic information is how genetic and biological variation may enter into processes of system justification, whether through explanations for health disparities (Sankar et al. 2004) or ideologies of social group dominance (Jost and Hunyady 2005). A third, and related question, is under what conditions individuals generalize information about individual biological and genetic variations to defined social groups (Sternthal, Jayaratne, and Feldbaum, N.d.), a process that reasonably might be anticipated to reify social categories.

Indeed, social scientists are particularly concerned with the rising influence of genetics in shaping the public's views about individual and group differences (Duster 2006; Geller et al. 2004). History clearly warrants such concerns; it is tragically replete with situations in which genetic explanations have been used to designate some groups as genetically (or constitutionally) inferior and to justify oppression and discrimination (Duster 2003a; Kevles 1985; Nelkin and Lindee 2004; Reilly 1991; Rothman 1998). The potential consequences of genetic information for reifying racial classifications (Omi and Winant 1994) have been of particular concern to social scientists (Duster 2005; Reardon 2004). Certainly, these concerns are reasonable, as beliefs about genetic variation among racial groups still may be used to promote discriminatory programs (for reviews, see Condit and Bates 2005; Condit et al. 2004; Duster 2003a).

Drawing on these examples, social scientists have speculated that beliefs about genetic causation will promote "essentialism" (Alper and Beckwith 1993; Lippman 1992; Nelkin and Lindee 1995), "naturalize" differential treatment, (Condit and Bates 2005; Duster 2003a, b; Nelkin and Lindee 1995), and provide "legitimating myths" that justify existing inequalities (Jayaratne et al. 2006). Some analysts have argued that beliefs in genetic causation are likely to resonate most strongly with the world views of people who occupy socially privileged positions or who have conservative political orientations (Jayaratne et al. 2006; Nelkin and Lindee 1995). Accordingly, social scientists who favor progressive social change may worry that genetics research might someday put us in a position not far from that expressed by Darwin's contemporary Lady Ashley upon learning of his theory of natural selection: "Let's hope that it is not true; but if it is true, let's hope that it doesn't become more widely known" (Buss et al. 1999:443).

At the same time, speculation about the possible causes or consequences of beliefs about genetics has run far ahead of empirical analysis with general population samples. In this study, we examine beliefs concerning the importance of genes for understanding individual differences in physical illness, mental illness, intelligence, personality, and success in life. We consider whether beliefs in the importance of genetics are more common either among people in relatively advantaged socioeconomic positions or among those who are more politically conservative. We also consider whether such beliefs predict attitudes toward genetics-related social policies, independent of political orientation or other measures. Our analyses suggest that belief in the

importance of genetics for human outcomes may well have a substantial independent relationship to attitudes on genetics-related policy questions, but there is little reason to regard such beliefs as more common among whites, the socioeconomically advantaged, or political conservatives.

BACKGROUND

There is neither extensive data on public beliefs about genes as causes of human health, behaviors, abilities, and social outcomes in the general US population nor on the consequences of such beliefs for policy orientations. However, what data are available suggest variation in genetic attributions by both sociodemographic characteristics and outcomes of interests. This highlights the importance of population-based studies that can better describe these patterns of attribution and their relationships, if any, to attitudes towards public policies.

Much of the empirical research on beliefs about genes as causes of individual outcomes considers attitudes towards genetic testing for specific conditions. Because many studies of attitudes towards genetic testing are clinically oriented, they tend to rely on highly selected nonprobability samples of individuals from families affected by illnesses with genetic etiology (e.g., Babul et al. 1993; Lafayette et al. 1999; Lerman et al. 1994). While these studies provide important insights about how people in families affected by specific illnesses conceptualize genetic risk for those illnesses, they do not assess uses of genetic attributions more broadly.

Research on attitudes towards genetic testing also has examined whether racial/ethnic differences in use of genetic testing reflect differences in beliefs and values or differences in access to care (Singer, Antonucci, and Van Hoewyk 2004). This research indicated that African Americans and Latinos are more eager than whites to avail themselves of both prenatal and adult genetic testing (Singer et al. 2004). One might infer that endorsement of genetic testing reflects underlying beliefs about genes as causes for these traits. Importantly, however, the study questions asserted the importance of genes for the disease outcome *as a premise to the question,* and therefore this work does not speak directly to beliefs about the importance of genes for individual health or social outcomes (Singer et al. 2004).

A few recent studies have endeavored to assess sociodemographic variation in genetic attributions for specific traits. In a telephone survey of 1,200 black and white respondents, researchers found that whites were significantly more likely than blacks to report genetic attributions for group differences in traits such as athleticism, math performance, drive to succeed, tendency toward violence, intelligence, and sexual orientation (Jayaratne 2002). A special topical module of the nationally representative General Social Survey (GSS) presented respondents with a vignette featuring an individual suffering from symptoms consistent with one of four mental illnesses (schizophrenia, major depression, drug problem, alcohol dependence). An analysis of this data found that blacks endorse genetic explanations of mental illness significantly less than do whites (Schnittker et al. 2000). Also, African-American respondents did not summarily reject biological explanations of mental illness; there was no significant racial difference in endorsement of "a chemical imbalance in the brain" as an explanation of mental illness. This suggests that "black skepticism of biological explanations may be confined to those explanations that attribute mental health problems to genetic origins" (Schnittker et al. 2000:1114). These findings highlight the importance of analyses to ascertain whether similar patterns of attribution exist for different individual health and social outcomes.

The importance of attending to differences in patterns of attribution for different health and social outcomes gains additional support from research that indicates that "people do not make a global 'deterministic' evaluation of the role of genes in human characteristics, but rather understand that the relative role of genes and other factors varies for different traits" (Parrott et al. 2003:1103). For example, when asked to partition pie charts to represent the relative contribution of genes,

the physical environment, the social environment, and personal action, participants assigned to genes 71 percent of etiologic responsibility for height, 41 percent for weight, 54 percent for breast and prostate cancer, 26 percent for talent, and 40 percent for mental abilities (Parrott et al. 2003; see also Condit et. al 2004). Additionally, when asked to compare the role of genes and individual behaviors in determining health outcomes, generally people assigned a greater role to personal behavior (Condit et al. 2004). Focus group data in which participants discussed a variety of personality traits, including alcoholism, bullying, nurturing, and loudness, suggest also that genes are less often seen as the cause of human behavior (Condit et al. 2004). Poll data similarly provide evidence that endorsement of genetics as an explanation for health and social outcomes varies by the outcome of interest and, possibly, perceptions of individual responsibility for specific outcomes. For example, in a 1995 Harris poll (n = 1005), 90 percent of respondents attributed success in life to learning and experience (vs. 8 percent to "genes you inherit") while 63 percent of respondents attributed being substantially overweight to genetics (vs. 32 percent who chose learning and experience) (Singer, Corning, and Lamias 1998).

Only a very few studies examine the relationship between genetic attributions and orientations to specific policies. Those studies that do examine such relationships tend to focus on genetic attributions for specific traits (e.g., race or sexual orientation) and measures of prejudice and traditional or modern forms of discrimination (Jayaratne et al. 2006). Taken together, these studies provide evidence of a positive relationship between genetic attributions for perceived racial group differences and greater prejudice towards blacks, as measured by respondents' orientation to a (hypothetical) son or daughter dating or marrying a black person (Jayaratne et al. 2006; Keller 2005). Genetic attributions for perceived racial group differences are associated also with measures of modern racial prejudice, as assessed by responses to statements with clear policy implications, including "Many groups of Americans overcame prejudice and made it on their own; blacks should do the same" and "blacks are too dependent on government help to get ahead" (Jayaratne 2006:83). In contrast, genetic attributions for differences in sexual orientation are associated with greater tolerance towards homosexual men and women, as measured by attitudes towards gay marriage, adoption by gay couples, and whether "homosexuals should be allowed to teach in elementary schools" (Jayaratne et al. 2006:84; see also Tygart 2000). These studies also suggest that many sociodemographic factors shape the association between attributions and attitudes; these include education, political conservatism, age, gender, residence in the South, and religiosity (Jayaratne et al. 2006). However, despite speculation in the sociological literature indicating that biological explanations for human differences are shaped by "the values of the conservative right" (Nelkin and Lindee 2004:132), we are unaware of any studies which explicitly investigate possible relationships between political orientation and the likelihood of making genetic attributions in explaining individual differences in outcomes.

Insofar as they provide evidence that the likelihood of attributing individual differences to genetics is increasing, data from polls highlight the timeliness of these concerns. For example, in 1979, 36 percent of respondents reported that heredity was more important than the environment in determining whether or not a person was overweight; in 1995, as noted above, 63 percent of respondents attributed "being substantially overweight" to genetics (Singer et al. 1998: 637–8).[1] Given the pertinence of such attributions to a wide variety of health and social policies, population-based, empirical analyses of beliefs about the importance of genes in causing differences in individual fates and how these beliefs relate to attitudes on genetics-related policy questions are critically important.

[1] Changes in the wording of the question and the structure of responses also may have contributed to this change (Singer et al. 1998:638).

HYPOTHESES

Our analysis takes up three lines of inquiry, focusing on: (1) variation in genetic attributions for different types of outcomes; (2) associations between individual sociodemographic characteristics and likelihood of making genetic attributions; and (3) relationships between genetic causal attributions and endorsement of specific policies, including support for the Human Genome Project and mandatory genetic testing before marriage. We develop hypotheses for each of these in turn.

First, as noted above, both polling and focus group data suggest that individuals see the greatest role for genetics when it comes to physical characteristics, followed by psychological characteristics, with social attainment being seen as the least likely to be strongly influenced by genetic causes (Condit et al. 2004; Parrott et al. 2003; Singer et al. 1998). From a sociological perspective, this would seem to raise the idea of a cultural schema, at least in the United States, where individual characteristics are perceived as more genetic the more closely they are identified with the body.[2] Such a schema could be seen as rooted in the legacy of Cartesian dualism, which insists that the causes of bodily states, such as physical illness, are located in the body (Scheper-Hughes and Lock 1991). A close link between genetics and physical conditions also receives support from popular and scientific rationales for genetic research, which emphasize the potential of genetic information to prevent and cure common diseases (Collins and McCusick 2001; Guttmacher and Collins 2005).

In the data we examine, respondents were asked for generic judgments of the importance of genetics to: (1) physical illness, (2) serious mental illness, (3) intelligence, (4) personality, and (5) success in life. Applying to these items the idea of a cultural schema in which individual characteristics perceived as closer to the body more often are seen as caused by genetics, we can make the following predictions.

> *Hypothesis 1a:* Genetic makeup will be perceived as more important for physical illnesses than for the psychological characteristics (mental illness, personality, intelligence).

> *Hypothesis 1b:* Genetic makeup will be perceived as more important for psychological characteristics than for success in life.

Meanwhile, considering the aforementioned psychological characteristics, we posit that serious mental illness, at least since the 1990s "decade of the brain," will be perceived as closer to physical characteristics and thus more likely to be seen as genetically caused than personality or intelligence (Horwitz 2003). Accordingly, we predict that

> *Hypothesis 2:* Genetic attributions for mental illness will be greater than for personality or intelligence.

In sum, we hypothesize that genetic makeup will be perceived as most important for physical illnesses, then for mental illness, followed by personality and intelligence, and least important for success in life.

Second, we earlier discussed historical and contextual literature that highlights the uses of genetics as a legitimating rationale for extant inequalities. Social psychological literature on the tendencies of individuals to exhibit self-serving cognitive biases might then lead us to expect that genetic explanations of outcomes will be most appealing to those already in positions of privilege. A diverse literature indicates that individuals more commonly attribute positive outcomes to aspects of themselves and (less consistently) negative outcomes to aspects of their circumstances (e.g., Bradley 1978; Duval and Silvia 2002). Moreover, we predict that groups

[2] This idea obviously is at best a characterization of domains in genetic terms rather than specific variables; that is, presumably no one would claim that all physical variables would be perceived as more genetic than all psychological variables. Additionally, we note that Condit et al. (2004) and Parrott et al. (2003) use a forced-choice style method of asking respondents to allocate percentages to causes of outcomes including not just genes and types of environment, but also personal action. While how respondents understand the etiology and consequence of individual will is of obvious interest, this methodology collapses the cause and consequence of behavior into personal action in a way that makes the meaning of responses hard to interpret (i.e., causal narratives of the influence of genes—and, for that matter, environments—on human outcomes often involves genes as a cause of the individual action which is a cause of the outcome.)

which have historically been denigrated, marginalized, and disenfranchised based on alleged genetic inferiority will be less likely to make genetic attributions. This leads to two specific hypotheses:

Hypothesis 3: People of higher socioeconomic status will regard genetic makeup as more important for individual outcomes than people of lower status.

Hypothesis 4: African Americans and Latinos will regard genetic makeup as less important for individual outcomes than do whites.[3]

We might expect to observe the above especially with regard to hypotheses regarding intelligence and success in life.

In addition to differences by socioeconomic status and race, speculation about the status of belief in genetic influence as an essentializing ideology or system "legitimating myth" (Jayaratne 2006)—might also lead us to expect, net of other characteristics, that genetic explanations will be regarded most favorably by those whose broader political orientation is more conservative.

Hypothesis 5: People who identify as political conservatives will perceive genetic differences as more important for determining individual outcomes than those who are politically liberal.

In posing Hypotheses 3–5, we recognize that one can imagine reasons to expect other relationships between either socioeconomic privilege or political orientation and beliefs about genes as causes. Indeed, as already discussed, Singer et al. (2004) found that blacks and Latinos express greater enthusiasm for genetic testing, even though their study did not directly address the question of beliefs in the importance of genetics. Nonetheless, the hypotheses we articulate reflect potential relationships invoked by scholars who have been particularly concerned with negative social implications of public belief that genetics are important for explaining differences in human outcomes (Duster 2006; Hubbard and Wald 1999; Nelkin and Lindee 2004).

Finally, we predict that those individuals who attribute differences in individual outcomes to genetics will be more favorably disposed to policies that support the production of genetic information and/or seek to integrate its uses in health and social policy. That is, net of whatever relationship beliefs about genetic etiology may have with broader political orientation, we propose that such beliefs may be independently relevant for predicting policy attitudes.

Hypothesis 6: Greater belief in the importance of genetics for human outcomes will be positively related to support for policies that are predicated on genetic causes being important.

In this study, we consider specifically attitudes towards: (1) support for the Human Genome Project; (2) requiring genetic testing before marriage; and (3) knowing a partner's family history of mental illness. Such a relationship, if observed, would support the proposition that understanding variation in beliefs about genetics has broader relevance than a simple academic interest in belief formation.

DATA AND MEASURES

The Genetics, Disease, and Stigma Survey (GDS) is a telephone interview of 1,241 respondents conducted in 2002–3. The sample was drawn from a list-assisted random digit-dialed method, with individuals randomly selected within households that were reached. Puerto Ricans, Chinese Americans, and people with a family history of mental illness were intentionally oversampled. The sample is reweighted to reflect these oversamples as well as differences between the race/ethnicity of respondents and national census information. The response rate was 62 percent. Weighted sample estimates indicate disproportionate nonresponse by males and by people with less than a high-school education (Phelan 2005). Interviews were conducted in Spanish, Mandarin, and Cantonese in addition to English, they averaged 20 minutes in length, and respondents were offered $10 for their participation.

[3] While there can be no question that African Americans have borne the greater burden of allegations about purported genetic and biological inferiority, similar claims have been made about the intergenerational transmission of "low IQ" among Latinos (Herrnstein and Murray 1994:366–7, 688).

Table 1. Unweighted Proportions and Means for Explanatory Variables Used in Study

	All Respondents	Whites	Blacks	Latinos
Age	47.5	50.1	43.0	41.8
Female	.64	.65	.63	.64
Education	2.75	2.86	2.82	2.02
Family Income (× $10,000)	2.84	2.98	2.45	2.44
Liberal	.25	.23	.28	.29
Conservative	.42	.44	.43	.44
Black	.09			
Latino	.16			
Other Race/Ethnicity	.09			
N	1281	832	113	209

Reference groups for nominal independent variables are moderate (political orientation) and white (race/ethnicity).

Beliefs about genetic causation are measured by five items that share the common stem "How important do you think a person's genetic makeup is in influencing [*attribute*]?" Items complete the stem by asking about "the major illnesses they will develop in life," "whether or not they will develop a serious mental illness," "their personality," "their intelligence," and "their success in life." Items were presented to respondents in randomized order. Response categories were "very important," "somewhat important," "not very important," and "not at all important." The factor structure of these items will be presented in the results section.

Covariates in the study include age (in years); sex; education (here measured using a four-point scale from less than a high-school degree to a bachelor's degree or higher); race/ethnicity; family income (measured by five categories; recoded based on the midpoint of the categories); and political orientation (assessed on a five-point scale from 1 = very liberal to 5 = very conservative).[4] Reported race/ethnicity of respondents are combined into the categories of white (not Latino), black (not Latino), Latino, and other. As noted, the Latino category is disproportionately Puerto Rican due to the oversample and the other category is disproportionately Chinese, although weighted analyses are used except where specified. Multiple imputations based on the other covariates were used for item nonresponse on income (16 percent of all cases) and political orientation (4 percent).

Unweighted summary statistics for the covariates used in models are included as Table 1.

RESULTS

Table 2 presents frequencies for the five items regarding the importance of genetics. Taken together, respondents were most likely to regard genetic makeup as very important for physical illnesses and least likely to regard it as very important for success in life. Respondents were more likely to regard genetic makeup as very important for mental illness than for intelligence, and more likely for intelligence than for personality. The same ordering of items for the likelihood of regarding an attribute as very important was observed in reverse for the likelihood of regarding the attribute as not at all important, suggesting that none of these items elicit an obviously more polarized reaction than the others. Differences in relative frequencies between adjacent columns are each significant except for the difference between intelligence and personality. The pattern supports the cultural schema developed as Hypotheses 1 and 2. Additionally, the results emphasize the overall importance now granted to genetic causes in the United States: over 90 percent of all respondents regard genetic makeup as at least

[4] Alternative specifications of education yielded substantively the same result, although analyses using several dummy variables for education had lower statistical power, especially for subgroup analyses of blacks and Latinos.

Table 2. Responses to Items Asking How Important "Genetic Makeup" is for Different Life Outcomes (Percentages)

	Physical Illness	Mental Illness	Intelligence	Personality	Success in Life
Very Important	51.4	37.2	32.4	31.7	24.0
Somewhat Important	39.5	48.4	48.3	45.9	41.0
Not Very Important	6.8	10.3	11.7	14.4	22.2
Not At All Important	2.9	4.1	7.5	8.0	12.7
Mean/SD (4 = Very,	3.39	3.18	3.01	3.06	2.76
1 = Not At All)	(.72)	(.78)	(.88)	(.86)	(.96)
p for test of equality of adjacent columns	< .001	< .001	NS	< .001	
N	1,295	1,295	1,295	1,295	1,295

Significance test for equality of adjacent columns based on Goodman and Kruskal's gamma statistic for ordinal variables.

somewhat important for physical illness, and almost two-thirds do for success in life.

By conventional psychometric standards, one is justified in treating the five genetics causation items as comprising a single index. The lower-bound estimate of scale reliability (standardized Cronbach's alpha) for the items is .76, and iterated principal factors analysis resolves to only one factor with an eigenvalue greater than one. For the purposes of testing Hypotheses 3–5, therefore, we created an index of beliefs in genetic causation by standardizing the individual items, summing them, and standardizing this sum. Higher values on this index correspond to genetic makeup being more important for individual differences in the five attributes taken together. The loadings of items on the shared factor were quite similar, ranging from .50 (mental illness) to .67 (personality, intelligence). For this reason, the summated scale we use correlates extremely highly with one based on factor scores ($r > .99$) and yields virtually indistinguishable results.

Table 3 presents results of an ordinary least squares regression of the index of beliefs in genetic causation on age, sex, education, and political orientation. The first column presents results for all respondents and includes also race/ethnicity. The results contradict the proposition that those in positions of social disadvantage are more skeptical of genetic explanations. Instead, blacks, Latinos, and those who had not been to college all rated genetic makeup on average as more important for attributes than did whites and more educated individuals. Income is unrelated to ratings about genetic makeup net of other controls. In the remaining three columns of Table 3, we report results for separate regressions of whites, blacks, and Latinos. These reveal that education is not associated with beliefs in genetic causation for whites. Moreover, when we put results together, blacks and Latinos with at least some college education do not endorse genetic explanations any more than similarly educated whites. Instead, it is only among those with a high-school education or less that blacks and Latinos report greater belief than whites in the importance of genetic causes.[5]

If we look to political orientation, we see there is no tendency for the importance of genetic makeup to be endorsed more by either liberals or conservatives, relative to one another and to moderates. No significant relationships between political orientation and belief in genetic causation were observed when separate analyses were conducted by race/ethnicity. Instead, our results indicate that belief in the importance of genetic makeup appears independent of general political orientation, at least as measured by the simple self-identification measure included in the survey.

Although the genetic causation items are unidimensional by usual standards, we may still consider whether respondent characteristics are associated with a tendency to regard a given attribute as more or less strongly influenced by genetics than others. For example,

[5] This characterization of the result is supported by models in which education is measured just as a binary variable of whether the respondent has some college or not (not shown).

Table 3. OLS Coefficents for Regression of Genetic Beliefs Composite on Age, Sex, Education, Political Orientation, by Race/Ethnicity

	All	Whites	Blacks	Latinos
Age	.007***	.008***	.007	.000
	(.002)	(.002)	(.005)	(.005)
Female	.196**	.237**	–.046	.253
	(.064)	(.073)	(.195)	(.187)
Education	–.061†	.004	–.181†‡	–.303**‡
	(.032)	(.037)	(.099)	(.105)
Family Income	–.007	.016	–.088	–.002
	(.027)	(.030)	(.091)	(.092)
Liberal	.051	.087	–.055	.014
	(.078)	(.087)	(.252)	(.243)
Conservative	.024	–.043	.151	.112
	(.070)	(.077)	(.220)	(.213)
Black	.192†			
	(.100)			
Latino	.452***			
	(.100)			
Other Race/Ethnicity	.018			
	(.142)			
N	1281	832	113	209

† $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$. ‡ indicates $p < .05$ difference from whites. Robust standard errors in parentheses. Reference groups for nominal independent variables are moderate (political orientation) and White (race/ethnicity).

those who are more politically conservative might be especially favorable to genetic explanations for success in life, or black respondents may be especially averse to genetic explanations for intelligence. To test this possibility, we estimate a rank-ordered logistic regression model for the five attributes. This model is substantively similar to the multinomial logit model for nominal outcomes, except that in the multinomial logit model one only has information about the most preferred alternative (or, by analogy, the attribute for which genetic makeup is regarded as most important), whereas in the rank-ordered logit model one has some information on preference among items beyond the most preferred (for model details see Allison and Christakis 1994; Long and Freese 2006). In its estimation, the model is equivalent to a Cox proportional hazards model for discrete-time survival-analysis data, in which respondents are strata and the attributes are observations within strata. Attributes ranked as more important are treated as observations with earlier mortality. The model includes (number of outcome categories – 1)(number of covariates + 1) parameters, for which sample sizes are too small to permit subgroup analyses by race/ethnicity. Cox models have an extensive literature on the handling of tied survival times, which in this study are two attributes for which respondents give the same response for the importance of genetic makeup; the model assumes outcomes can be ordered even though they are not and that the orderings are equally likely (Cleves, Gould, and Guitterez 2004). Methods for tied ranks implemented in the statistical software used (Stata 10.0) cannot accommodate weights and so unweighted results are presented.

Table 4 presents results from the rank-ordered logit model. Coefficients indicate expected change in the log odds of rating genetic makeup as more important (vs. less important) for an attribute than for physical illness; the differences between two columns indicate the expected change in log odds of rating genetic makeup as more important for the first attribute than for the second. Considering results for education first, the data contradict any supposition that individuals of lower status would be relatively more skeptical of genetic explanations for success in life. Instead, relative to the other outcomes, those with no college rated genetic makeup as relatively more important for success in life

Table 4. Rank-ordered Logistic Regression Coefficients for Regression of Beliefs about Genetic Etiology on Selected Explanatory Variables (N = 1,281)

	Mental illness	Personality	Intelligence	Success in Life
Age	.001[b,c,d]	.012**[a]	.014***[a]	.021***[a]
	(.004)	(.004)	(.004)	(.004)
Female	–.049[c,d]	–.077[d]	–.343*[a]	–.462**[a,b]
	(.144)	(.148)	(.146)	(.158)
Education	–.250**[d]	–.246**[d]	–.146†[d]	–.508***[a,b,c]
	(.077)	(.078)	(.077)	(.085)
Family Income	.025	–.004	.034	–.005
	(.025)	(.026)	(.025)	(.028)
Liberal	–.062	–.079	–.263	–.316
	(.182)	(.190)	(.187)	(.204)
Conservative	–.190[b]	.134[a,d]	–.026	–.223[b]
	(.160)	(.164)	(.162)	(.175)
Black	–.031	–.033	–.444†[d]	.229[c]
	(.252)	(.258)	(.263)	(.275)
Latino	.222	.081	.108	.481*
	(.209)	(.215)	(.213)	(.225)
Other Race/Ethnicity	.648**	.216	.504*	.508*
	(.230)	(.237)	(.231)	(.256)

† $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$. Standard errors in parentheses. Subscripted letters indicate $p < .05$ for contrast with (a) mental illness, (b) personality, (c) intelligence, (d) success in life. Reference groups for nominal independent variables are moderate (political orientation) and white (race/ethnicity).

than did respondents with some college. Similarly, blacks and Latinos were not more skeptical of genetic explanations for success in life, but rather both groups instead reported genetic makeup was relatively more important for success in life than the other outcomes (for Latinos, significantly so). However, blacks did report that genetic makeup was relatively less important for intelligence than did whites, which might reflect the particularly troubled history of discussions about genetics and the intelligence of blacks. This result was the only instance in our analyses in which a socially disadvantaged group evinced a pattern suggestive of greater aversion to genetic explanation. Apart from this, we find little evidence for either Hypothesis 3 or 4.

Looking to political orientation, conservatives are significantly more likely than moderates to regard genetic makeup as more important for personality than for mental illness or success in life. However, the difference between liberals and conservatives is not significant. Indeed, liberals and conservatives were not significantly different from one another for any attribute. Again, then, self-identified political orientation is not associated with differences in assessment of genetic causation, and thus we find no support for Hypothesis 5 in these data. Statistical power would appear not to be at issue, since the pertinent coefficients for liberals and conservatives are typically in the same direction when compared to moderates.

Although we did not hypothesize that gender or age would have specific effects on assessment of genetic causation, we note that women are more likely than men to endorse genetic explanations for personality, intelligence, and success in life, relative to their endorsement of such explanations for physical or mental illness. This suggests that, if something like the cultural schema posited above does exist, it has greater support among women than men. Younger respondents are more like women than are older respondents, insofar as they draw greater distinction between the genetic causes of illness and of either psychological characteristics or success in life. Whether the latter result is attributable to developments of aging or is a cohort difference cannot be determined by our data.

We sought also to assess whether the index of belief in genetic causation was relat-

Table 5. Ordered Logit Coefficients for Regression of Genetic Policy Variables on Genetic Beliefs and Other Explanatory Variables

	Human genome project is helpful not harmful	Require genetic test before marriage	Partner's family history of mental illness important to know
Genetic Attribution	.435***	.646***	.706***
	(.076)	(.068)	(.066)
Age	.001	.017***	.013***
	(.004)	(.004)	(.004)
Female	–.309*	.228†	.373**
	(.132)	(.130)	(.122)
Education	.109	–.323***	–.143*
	(.070)	(.072)	(.067)
Family Income	.086	–.112*	–.074
	(.056)	(.053)	(.047)
Liberal	.262	–.139	–.381*
	(.180)	(.164)	(.152)
Conservative	–.263†	.086	–.148
	(.149)	(.136)	(.138)
Black	–.295	.776***	.747***
	(.224)	(.202)	(.204)
Latino	.070	1.300***	–.234
	(.208)	(.182)	(.197)
Other Race/Ethnicity	.219	.356	.301
	(.275)	(.260)	(.260)
N	1176	1253	1266

† p <.10; * p < .05; ** p < .01; *** p < .001. Robust standard errors in parentheses. Reference groups for nominal independent variables are moderate (political orientation) and white (race/ethnicity).

ed to support for policies that may be premised on the importance of genetic causes. We considered three items; the first is "Overall, do you think the Human Genome Project and other research on human genetics is likely to be helpful or harmful?", with four response categories ranging from "very helpful" to "very harmful." The other two items have four categories ranging from "strongly disagree" to "strongly agree." These are: "Every person should be required to have a genetic screening test before he or she can get married," and "When thinking about choosing a marriage partner, it is important to know whether the person has a history of mental illness in the family."[6]

Table 5 presents results for ordered logit regressions of each of these items on the index of beliefs and the covariates used earlier. The ordered logit model assumes that a categorical outcome variable is the observed manifestation of an underlying latent continuous variable with a logistic distribution conditional on covariates (Long and Freese 2006). In each case, genetic beliefs are significantly related to the policy measure in the expected direction. While effects for other covariates are observed, they are inconsistent in their direction. For example, education is positively associated with enthusiasm for the Human Genome Project but negatively associated with using genetic information in marital or childbearing decisions. Moreover, belief in genetic causation is a stronger predictor of each of the policy outcomes than is general political orientation. These results indicate that understanding beliefs about genetic causation may be independently important for understanding attitudes toward policy questions related to genetics.

[6] We also looked at the item "If a couple has a one-out-of-four chance of having a child with a serious genetic defect, they should not give birth to any children of their own." This item takes genetic etiology as a premise. Nonetheless, beliefs about genetic causation were positively associated with agreement, suggesting the value of subsequent research on how genetic causation as an explicit premise affects responses to such items.

DISCUSSION

Many social scientists identify with liberal political positions (e.g., Rothman, Lichter, and Nevitte 2005), especially regarding policies toward helping the disadvantaged. Social scientists commonly perceive their work as standing against (as well as potentially threatened by) the recent surge of interest in genetics (Duster 2006). It might therefore be tempting to infer that laypersons who are politically more liberal or who belong to disadvantaged groups are likewise more broadly skeptical of the importance of genetics. That notion, however, is not supported in this study.

Instead, disadvantaged respondents, whether in terms of education or race/ethnicity, regard genetics as *more* important to the determination of life outcomes than members of advantaged groups. Moreover, the most disadvantaged respondents, in terms of education and ethnicity, regard genetics as most important. The only exception to this pattern is the lower importance given to genetic makeup for intelligence among blacks. Political orientation appears unrelated to assessments of the importance of genetics. While our study does not address the consequences of changes in beliefs, it does suggest that the idea of a natural affinity between belief in the importance of genetics and either social privilege or conservative politics should not be taken for granted. At the same time, our findings raise the possibility that belief in the importance of genetics may indeed be important for how genetics policy issues are evaluated in ways that crosscut traditional predictors of attitudes.

To be sure, arguments about genetic causation can be deployed to undermine support for programs that attempt to address existing health or social inequalities. In fact, respondents to our survey endorsed genetic causes of the specified health and social outcomes to a remarkable degree. Over 90 percent of all respondents regard genetic makeup as at least somewhat important for physical illness, and almost two-thirds do for success in life, the trait that received the *lowest* level of genetic attribution. Consequently, there is good reason to be concerned that essentialized ideologies would resonate strongly with the beliefs of substantial proportions of the US population, including those who historically have been harmed and disadvantaged by policies predicated on invidious assumptions about genes as causes of differences among individuals and groups.

Various explanations can be offered for why blacks and Latinos with lower levels of education may regard genetics as more important to explaining individual outcomes than whites and people with more education. One possible explanation is offered by the classic social psychological concept of *locus of control,* which is intended to reflect, among other dimensions, the extent to which individuals regard their fates as caused by their agency versus external circumstances and events. Genes are "inside" us but otherwise share characteristics of external attributions—they can be attributed to outcomes in ways that mitigate perceptions of the responsibility of individuals—and external locus of control has been consistently associated with social disadvantage (e.g., Shaw and Krause 2001; Bruce and Thornton 2004).

A second explanation is offered by system justification theory, which holds that "people are motivated to justify and rationalize the ways things are, so that existing social, economic, and political arrangements tend to be perceived as fair and legitimate" (Jost and Hunyady 2005:260; see also Della Fave 1986; Della Fave 1991). Studies have shown that endorsement of system justifications is associated with increasing positive affect and satisfaction with one's situation and reductions in moral outrage, guilt, and frustration, especially, though not exclusively, among the disadvantaged (Jost and Hunyady 2005: 262). Insofar as system-justifying ideologies serve a "palliative function," members of disadvantaged groups may be more likely to endorse them (Jost and Hunyady 2005). To date, ideologies that center on genetic and biological variation have not played a prominent role in the literature on system justification, though beliefs about genetics underlying group differences may be implicit in ideologies of social group dominance (Jost and Hunyady 2005). However, both the broad endorsement of genetics in our study population as a whole

and the exceptional endorsement of genes as the cause of individual "success in life" by African-American and Latino respondents, are consistent with the notion that genetic explanations for individual differences may function as a system justifying ideology, especially among socially disadvantaged groups.[7]

A third explanation emerges from our observation of a pattern by which those with less education, Latinos, and African Americans were less likely to endorse a pattern of belief in which broad physical conditions are perceived as more genetically based than more psychological conditions, which in turn are seen as more genetically based than social attainments (with the exception of attributions for intelligence by African Americans). If this pattern generally reflects a prevailing cultural script, the divergence in responses by less educated African American and Latino respondents may reflect their lower adherence to (and perhaps lower exposure to) this prevailing schema. We see some evidence for this explanation in our finding that income is not a significant predictor of genetic attributions, either independently or in interaction with race/ethnicity. This suggests that having less education, especially for African-Americans and Latinos, may be particularly consequential for beliefs about genes as causes of individual fates, precisely because institutions of higher education are central to the socialization of individuals to dominant cultural beliefs about the causes of individual health and social outcomes (c.f. Phelan et al. 1995).[8]

The above are neither exclusive nor exhaustive possibilities. Our findings may be interpreted as diverging from other work that indicates that genetic explanations for group differences can be associated with negative opinions of the subordinate group (Jayaratne et al. 2006; Schneider 2004). A commonly made point in discussions of genetic differences is that evidence of the heritability of individual differences does not imply that genetics are important for understanding group differences (e.g., Plomin et al. 2001; Fischer et al. 1996). However, available research indicates that individuals who use genetic explanations for individual differences are significantly more likely than others to use genes to explain perceived group differences for that same trait (Sternthal, Jayaratne, and Feldbaum, N.d.: 13).[9] Importantly, the items we considered neither ask about group differences nor explicitly invoke group identities. An implication of our work for those interested in combating prejudice is the importance of emphasizing the difference between causes of individual and group differences, especially as our data make clear that the public overall considers genetic makeup important across a range of broad individual life outcomes.

The results also diverge from those of the study most comparable to ours. In their analysis of data from the 1996 General Social Survey (GSS), Schnittker and colleagues (2000) found that blacks endorsed genetic explanations of mental illness significantly less than did whites, while we found no such association. The reason for the discrepant findings is not clear. One methodological difference between the studies is that we asked respondents a simple question about the importance of genetic factors in causing "serious mental illness." In contrast, respondents in the 1996 GSS were asked about the importance of genetic factors in response to a vignette that described a person with symptoms of schizophrenia, major depression, drug

[7] How to extend system justification theory to the domain of health is an intriguing question, as system justification theorists generally have focused on "control of the physical and social environment" through possession of "wealth, institutional power, and status" (Della Fave 1991).

[8] An interesting hypothesis suggested by an anonymous reviewer is specifically that majoring in a science in college contributes to greater endorsement of dominant cultural beliefs about genetic causation. The same reviewer suggested that among those with less education, sensationalist media coverage of genetic research (Conrad 1997) may be more persuasive. The data for this analysis contain no information about college major or apprehension of media coverage, however these possibilities should be evaluated in future research.

[9] In Sternthal et al. (N.d.), endorsement of at least some genetic influence on individual differences in intelligence or personality increased the odds of doing so for race differences by approximately 80 percent.

addiction, or alcohol dependence. One possible explanation for the discrepant finding, then, is that the interpretation of the term "serious mental illness" and its correspondence to the four disorders presented by Schnittker et al. differs according to race.

Our study has several important limitations that we hope can be addressed in subsequent research. First, while we think it a virtue of the study that questions about genetic causation are not asked in a forced-choice format against an alternative (e.g., genetics or environment), asking about environmental causes in a parallel format would allow more information on how endorsement of genetic causes are related to beliefs regarding other causes, and it would offer a useful check about the issue of differences in respondent's thresholds for, e.g., "very important" versus "somewhat important." Second, although broad questions about political orientation are widely used, they also have known limitations (Conover and Feldman 1981), and full assessment of the relationship between political orientation and beliefs about genetics would benefit from considering a range of attitudes that distinguish liberals and conservatives and differences within the two broad orientations. Third, more extensive measures of income and wealth—rather than just one five-category question about family income—might clarify whether financial resources truly are as irrelevant for beliefs about genetic causation as this study indicates. Fourth, asking a broad array of genetics-related policy questions—and more questions that involve trade-offs rather than the increasingly criticized agree/disagree format (Krosnick 1999)—might allow stronger inferences about the role of beliefs about genetic causation in shaping these attitudes. Finally, while available data do not demonstrate a consistent relationship between genetic knowledge and attitudes towards genetics (Condit 2001), we anticipate that questions about genetic knowledge would augment our understanding of the underlying informedness of different profiles of answers to questions about the importance of genetics. For example, questions about genetic knowledge could help to elaborate respondents' beliefs regarding precisely what genes are (Lanie et al. 2004) and how they act in ways that may contribute to variations in individual health and social outcomes. Likewise, such questions could allow us to better ascertain respondents' apprehension of contemporary genetics research, including the HGP, and its applications.

We have every reason to imagine that genetic and other research will continue to produce new knowledge claims about humans at a rapid rate. We also expect the merits and implications of these claims will continue to be much debated in academia, with many competing interpretations offered to the broader public. Prevailing public interpretations, in turn, may have implications for funding priorities and regulation of research, creating an open-ended co-evolution of genetic inquiry, science discourse, and public opinion. Social scientists have ample historical warrant for fears that belief in the importance of genes for life outcomes can be used to justify inequalities and pessimism about the possibilities of social change. We hope social science will maintain its vigilant voice against oversimplified or deterministic views of the influence of genes. However, one common expression of concern—the idea that belief in the importance of genes is more appealing to privileged groups or to those with more conservative political orientations—is not supported by our data. Broader understanding of variation in individual beliefs about the importance of genes awaits future research. Moreover, how such beliefs will be affected by developments in genetic science is perhaps every bit as unknown as is what those developments will be. Genetics may thus be expected to be another exemplification of Hacking's (1999:108) conclusion that "When we get to the future, we will renegotiate our concepts as best we may, in ways we cannot predict."

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