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GENETICS AND IDENTITY

FEATURES

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Sam Anderson

I grew up part Indian, like everyone else in rural Ohio. Had you walked into the hardware store in the little town of Fredericksburg, you would have thought our family trees were spotlessly, blandly European; but if you asked whether anyone had a Cherokee ancestor, most would raise their hand.

It may be a widespread American phenomenon, or it may be limited to states where freshly ploughed fields are still picked over for arrowheads, but when I was growing up everyone seemed to have some distant Indian ancestry. Usually it was Cherokee—probably because that was a tribe we had heard of, or because we just liked the sound of it—and often it was pinpointed to a single ancestor, as in "my grandma is one-sixteenth Cherokee" or "my great-great-great-grandpa was a Shawnee chief." When we had to pin a number on our own Indian-ness, it managed to remain unchanged from previous generations: if one of our grandparents was one-sixteenth Cherokee, so were we. When our oral tradition lacked such concrete figures, we were directly descended from a relative who "had some Indian in her."

Like many Americans, we took pride in being mutts, and we claimed as many ancestral connections as we could. We hadn't heard of the one-drop rule, but we turned it on its head. We had our own kind of hyperdescent: we only needed one drop to claim some country (this is how we categorized our ancestors - 'European' just wasn't interesting enough) as our own, and the more the better. But American Indian-ness was the most cherished of all our mottled ancestries. When we listed off our vast family origins, we saved it for last, the cherry on top of our ancestor sundae. "What are you?" we would ask one another, with straight faces. And we would answer at once, from memory: "German, Italian, Irish, Swedish, and one-sixteenth Cherokee."

We were too young to feel guilt that our cherished ancestors had co-opted this land, but we were not too young to know who had lived here first—or to want a share of that authenticity. We held it close, but we didn't flaunt it. There was a man on the school bus route who decorated his yard with a giant totem pole and a tepee; even as kids, we felt that was going too far. After all, his zeal was unnecessary: we were all one sixteenth Cherokee, just like our parents and our grandparents and our great-grandparents. We could put fifty totem poles in the front yard, but it wouldn't mean a thing: all of our Indian-ness was contained in that one mythical drop.

Featured artist

Sarah Kim *is a graduate of Massachusetts College of Art and Design who enjoys working on any and all kinds of illusration. You can see more of her work at* www.skimilkart.com. *This is Sarah's third* GeneWatch *cover.*

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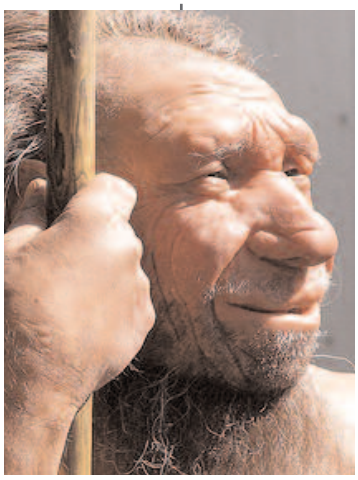

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The Council for Responsible Genetics has launched a new blog: *Genetic Watchdog*. Watch for regular news and commentary as recorded by CRG staff, board members, and friends, and join the discussion by leaving your own comments. You don't have to wait for the next GeneWatch to keep up with the latest events in biotechnology and ethics!

Genetic Watchdog
BECAUSE BIOTECHNOLOGY CAN'T WATCH ITSELF

The blog can be found at: http://www.councilforresponsiblegenetics.org/Blog.

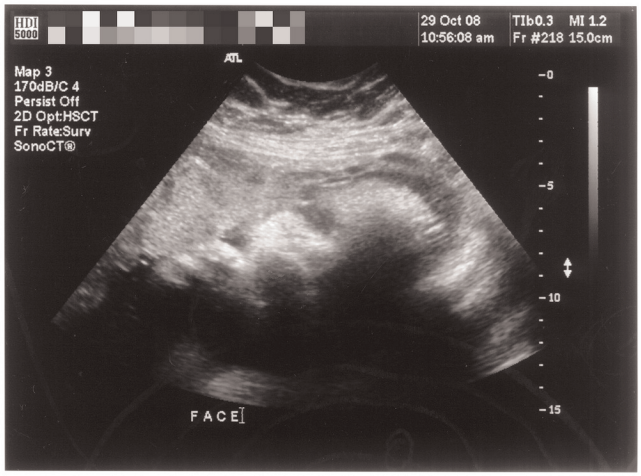
The Meaning of Genetics for Gay and Lesbian Identities

By Timothy F. Murphy

In written English, words are read from left to right, while Arabic words are read from right to left. In Japanese, the written language is read from the top to the bottom of the page, in columns that read from right to left. We normally see these variations as nothing more than a custom and don't go looking for biological explanations. Yet when men have sex with other men, and women have sex with other women, we are tempted to think that there must be more to the behavior than custom or simple choice alone. Since the late 1800s, friends and foes of homosexuality alike have tried to identify biological reasons why some people are homosexual. The German psychologist Richard von Krafft-Ebing (1840-1902) was among the first to speculate that some people - but not all - might be homosexual for genetic reasons. Since that time, many explanations of homosexuality have come and gone, especially psychological theories, but some researchers still look to genetics as an explanatory tool that can prevail where other explanations have failed.

But why do we care about the genetics of homosexuality at all? Since the early 1990s, biologist Ruth Hubbard has cautioned that this interest was driven by moral disapproval. How else to explain the overwhelming interest in this aspect of human sexuality but the yawning lack of interest in other dimensions of sexual behavior? One way to see how cultural standards play a role in scientific inquiry is to consider that most of the studies of homosexuality have looked at males, not females. What accounts for this imbalance? Is it the idea that the loss of anything to a male is always more important than the loss of the same thing to a female, heterosexuality included? Even if that's not the reason, it's hard to escape the conclusion that cultural worry has driven scientific interest in homosexuality, and not just innocent curiosity. It was no accident that many of the early studies of homosexuality were also looking for treatments and cures.

In part, cultural critics of sexual science have it right. Heterosexuality is so profoundly pervasive in human culture that it skews the very perception of homosexuality. Against a social background deeply saturated with sex between men and women, sex between men and sex between women looks unusual in a way that seems to demand explanation. This perception persists despite the fact that homosexuality is never far from the surface of most cultures. Across human history, both men and women have taken sexual partners of their own sex. Even so, we rarely think of homosexuality as emblematic of human nature itself, as something beyond the need for explanation.



The cultural motives that have spurred interest in the 'causes' of homosexuality have ironically thrown up cultural roadblocks to its study. For one thing, people are reluctant to disclose their homosexual behavior and interests if doing so puts them at risk of social mistreatment and stigmatization. Even when people are willing to be frank with researchers, the lines separating 'homosexuality' from 'heterosexuality' can be blurry. The Kinsey studies of 1948 and 1953 were the first to make a serious attempt at estimating the extent of homosexuality in the United States. These researchers quickly discovered that some people never engage in same-sex erotic behavior, some people never engage in opposite-sex behavior, while some men and women engage in same-sex erotic behavior for certain periods of times. Later studies conducted by sociologist Edward O. Laumann and his colleagues reported similar sorting difficulties, as they concluded that that approximately 2.8% of their overall male subjects and 1.4% of their overall female subjects identified themselves as having a homosexual or bisexual identity, while more people living in urban centers did so. But even some of these people had heterosexual sex, not to mention the much larger number of people who have had homosexual sex at some point without claiming a homosexual or bisexual identity. On this spectrum, who is 'homosexual' and who is not? Should researchers use a 'one drop' approach: anybody who engages in sexual activity with someone of the same sex is homosexual in some degree? Cultural habits of treating people as either homosexual or heterosexual may impose more sexual specificity than actually exists in human behavior. Even so, what some critics of genetic research of homosexuality don't get entirely right, I think, is that questions about the development of sexuality are amenable to scientific study even if cultural influences play a role. It is certainly meaningful to ask how - out of all possible sexual interests human beings can have - people come to the actual interests they have, and the answer to this question can incorporate cultural influences into pathways of sexual development as necessary.

Some people do not like biogenetic studies of sexual orientation not because they think it is conceptually confused but because it undercuts their cultural authority. In 2000, the Catholic Medical Association took pains to repudiate the idea that homosexuality could be genetic. Their statement, titled 'Homosexuality and Hope,' virtually says that homosexuals as such don't exist, only men, women, and adolescents in states of psychological conflict. But if some people are homosexually oriented for genetic reasons or any other reasons rooted in biology, that account fails as an explanation, and the Association's 'hope' of rescuing homosexual people from their confusion would falter. The North American Association for Reparative Homosexuality is no fan of sexual orientation genetics either. This group's denial that homosexuality is genetic enables them to champion their explanations of homosexuality; for example, they think male homosexuals suffer a psychic injury at the hands of their fathers as children. Genetic reasons for homosexuality would dissolve this explanation, and the 'therapies' that it authorizes.

By marked contrast to critics who deny a biogenetic basis for homosexuality, some gay men and lesbians welcome those kinds of explanations precisely because they shore up their identities. Homosexuality that is hard-wired - that is a genetic effect, for example - is homosexuality that doesn't lend itself to labels of psychological maladaptation or moral lapse. Genetic and other biological theories seem to read homosexuality into nature alongside heterosexuality, and some gay men and lesbians embrace those biogenetic accounts for that protective effect. They understand biological explanations as sympathetic to their own 'creation narratives' of who they are and how they come to be.

The benefits of genetic explanations for sexual identities do, however, come with a cost. An identified biogenetic trait for homosexuality might open the door to testing and treatment for adults, adolescents, children, and fetuses alike. In the worst case scenarios, some women might abort fetuses they believed likely to become homosexual children, and some adults and adolescents might be subjected to involuntary testing and treatment. When publishing their 1994 linkage study of male homosexuality, geneticist Dean Hamer and his colleagues took the highly unusual step of directly addressing these kinds of downstream effects of their work. At the end of their report in the journal *Science*, these researchers said: "We believe that it would be fundamentally unethical to use such information [about genetic linkages] to try to assess or alter a person's current or future sexual orientation, either heterosexual or homosexual, or other normal attributes of human behavior. Rather, scientists, educators, policy-makers, and the public should work together to ensure that such research is used to benefit all members of society." Other researchers have disputed the findings of the Hamer laboratory's 1994 report that male homosexuality is linked to a section of the X chromosome, and no study has ever offered direct evidence for a comparable linkage in lesbians. Even so, genetic and biological studies of homosexuality continue to come along, and the debate about their effect on the future of gay men and lesbians continues.

In this debate, some researchers and commentators overvalue the role biogenetic explanations of homosexuality can play in shaping favorable public attitudes toward homosexuality. No amount of genetics is likely to prevail against philosophical views that homosexuality is unnatural because of the inherent sterility of same-sex relationships, and genetics will not help at all with outright bigotry. By the same token, critics of this research tend to overstate the damage that research like this could do. The U.S. Supreme Court managed to strike down sodomy laws as unconstitutional, and some states have legalized same-sex marriage, no matter that biological studies of homosexuality in humans and animals have continued without a lull in the past two decades.

I plead agnostic to knowing whether or not homosexuality comes hard-wired in for some people, though some evidence seems to suggest as much. While only more research can answer that question definitively, sexual science would be lazy in the extreme if all we wanted to know is the biology of homosexuality and not the full array of human sexual interests and not either what role culture plays in the panoply of human sexual diversity. In the meantime, how do we understand the nature of gay and lesbian identities? There is no uniform answer to this question. In the absence of definitive explanations of homosexuality, some commentators try to de-legitimize those identities entirely. Yet other commentators welcome these studies - tentative though they might be - as a shield against hostile views that homosexuality is a psychological or moral failing. Other commentators worry that definitive explanations of homosexuality would empower tools to be used against gay men and lesbians. Conflicting views about the value of this science are possible because there is no single social meaning of science. So long as an interpretation of genetics does not contradict the observable facts, commentators are free to offer their interpretations about its meaning and value, the original intent of the investigators notwithstanding.

Ultimately, the value of gay and lesbian identities rests primarily with what they mean to the people who accept them and who identify themselves that way. Against the pervasive influence of heterosexual culture, one value of these identities lies in their oppositional effect in undercutting the presumption that men and women are only ever sexually attracted to one another and that society at large may proceed blithely in matters of law, religion, and culture as if there were no same-sex attraction and relationships. We don't need a specific biological grounding for political identities that work toward a better life for gay men and lesbians, but we also shouldn't condemn this science as conceptually impossible or prejudicial by its very nature.

Timothy F. Murphy *holds a doctorate in philosophy from Boston College and is Professor of Philosophy in the Biomedical Sciences at the University of Illinois College of Medicine at Chicago. He is the author of* Gay Science: The Ethics of Sexual Orientation Research *(Columbia University Press) and is writing a book called* Parents' Choices and the Future of Gay Men and Lesbians.

Genetics of the Jews: History and Identity

By Diana Muir Appelbaum and Paul S. Appelbaum

"Studies Show Jews' Genetic Similarity," announced a recent headline in the *New York Times.*[1] The two studies in question, each involving an international team of researchers, reported the results of genome-wide analyses of a variety of Jewish and non-Jewish population groups from around the world.[2] Despite using different samples and analytic techniques, the overall findings of the two groups were quite similar: almost all of the Jewish groups clustered fairly tightly on maps of genetic variation, overlapping considerably with some Middle Eastern groups (e.g., Druse and Cypriots), but showing much less consanguinity with populations from their host countries. The fact that these studies were reported in America's newspaper of record suggests significance beyond whatever scientific value the findings may have. What is that significance?

For observers who have followed the recent work on genetics of the Jews, the findings of the newer studies were not surprising. Previous research looking at markers of paternal lineage on the Y chromosome and maternal descent in mitochondrial DNA yielded similar results. The earlier studies had also turned up some less expected findings. Paternal Y chromosome markers among the Bene Israel Jews of India showed markers characteristic of other Jewish populations, but maternal mitochondrial markers were similar to those found in populations on the subcontinent. Ethiopian Jews are more similar genetically to other sub-Saharan African groups than to other Jews. And many Jewish populations appear to have had only a small number of maternal founders: one study demonstrated that 27% of Moroccan, 41.3% of Bene Israel and 51.4% of Georgian Jews are descended from a single female ancestor in each community.[3]

The question remains, however, what difference these data make. Perhaps the clearest answer relates to our understanding of Jewish history and the migration patterns of the Jews. Almost all Jewish groups (Ethiopian Jews being the major exception) show evidence of common descent from a Middle Eastern population, with major branch points corresponding to known historical events. Using techniques that estimate the time-course of divergence among populations, one of the recent studies, for example, estimated that Persian and Iraqi Jews separated from other Jewish groups about 2500 years ago—a period corresponding to the conquest of Judea by Nebuchadnezzar's army and the transfer of a significant proportion of the population to exile in Babylon.[4] In this case, the genetic data confirm the traditional view of the origin of these communities.

Other instances illustrate the potential of genetic studies to shed new light on historical understandings. Many scholars had assumed that far-flung Jewish communities were established by merchants who settled in distant lands and took local wives. In some cases, such as the Bene Israel of India, this narrative appears to be confirmed by mitochondrial DNA analyses. However, ancient Jewish women were more intrepid than historians thought. A study of the mitochondrial DNA of Ashkenazi (i.e., northern and central European) Jewish women reported that close to half (42%) were descended from one of just four matriarchs with distinctive haplotypes that most probably originated in the Levant.[5] Thus, it appears that the male founders of remote Jewish communities did not rely exclusively on marriage with local women, but were sometimes accompanied by their wives or sent home for brides.

Genetic data have also been useful for debunking myths of Jewish history. The best example is the Khazar hypothesis, popularized (though not originated) by the critic and novelist Arthur Koestler in the mid-twentieth century.[6] A people of the central Asian steppes, the Khazars founded a major kingdom north of the Caspian Sea in the seventh century, and between one and two hundred years later Khazar leaders and some undetermined proportion of the people converted to Judaism. After the 10th century, they disappeared from history. Koestler promoted the idea that Ashkenazi Jewry was largely descended from the Khazars, who he speculated had migrated into central Europe. Although the genetic data cannot exclude some introjection of Khazar genes into Ashkenazi gene pool—and there are even some data consistent with this possibility—it seems clear that this constitutes at most a minor contribution to Ashkenazi ancestry. Koestler's literary skills notwithstanding, the Jewish populations of European origins have clear Levantine roots.

More broadly, widespread assumptions that since Ashkenazi Jews are usually pale while Near Eastern Jews tend to be swarthy, the latter must be much more closely related to the peoples among whom their ancestors lived have been overturned. As would be expected from their appearance, Ashkenazi Jews have a higher admixture of European genes than do their Mizrachi cousins, but in both groups the genetic links to Levantine ancestry is strong.

Where genetic data have not been helpful—not surprisingly—have been at the individual and geopolitical levels. Whether Jewish identity is defined from a religious or ethno-national perspective, genetics have little to offer to the question of "Is this person a Jew?" The traditional religious view of Jewish identity is that a Jew is a person who was born to a Jewish mother or had a conversion according to Jewish law. (Reform Jews expanded the definition in the 1980s to include patrilineal descent.) Regardless of a person's genetic makeup, that remains true today. Indeed, the substantial percentages of genetic overlap between Jews and the host populations of their countries of long-term residence, as well as reports of mass conversions in the Hasmonean and Roman periods, suggest that in-migration of non-Jews to the Jewish religious community is not a recent phenomenon. Thus, although Jews as a group bear a

certain genetic distinctiveness compared with most other population groups, on an individual basis genetics are useless in determining religious identity.

A similar conclusion applies to what is probably the most highly publicized of the findings regarding the genetics of the Jews, namely the "Kohen modal haplotype." The Kohanim (plural form) are the hereditary Jewish priests, who had extensive ritual responsibilities before the destruction of the Temple in Jerusalem by the Romans, and who have retained some residual, if less crucial, ceremonial duties (and some behavioral restrictions under Jewish law) since. As described in the Book of Exodus, the priestly role was awarded to Moses' brother Aaron and his male descendants after him. In the 1990s, it occurred to an Israeli geneticist, himself a Kohen, that if the biblical story were accurate and if the tradition of kohanic descent had been reliably conveyed in the years since–both accounts having no shortage of skeptics–Kohanim should share common markers on their Y chromosomes. To the surprise of many people, such a haplotype, comprising 6 markers, was found in 45-61% of Ashkenazi Kohanim, 56%-69% of Sephardi Kohanim, and 10%-15% of other male Jews.[7] (Subsequent work applying a narrower definition of the haplotype, requiring the presence of additional markers, lowered the percentages somewhat.[8]) However, one's status as a Kohen according to Jewish law remains dependent on the possession of a family tradition: the presence of the Kohen modal haplotype does not confer priesthood on someone without such a tradition and its absence does not deprive a Kohen of that status. Once more, genetic data's historical value does not transfer to the level of individual identity.

Nor is the conclusion different in the ethno-national realm. Groups with long-standing identification with the Jewish people, generally including some degree of observance of traditional Jewish practices, have been accepted as Jews regardless of genetic findings. As early as the 16th century, for example, the black Jews of Ethiopia were recognized by major religious authorities as authentic Jews, despite their lack of physical resemblance to other Jewish populations. By the late 20th century, as noted, data were suggesting that genetic markers among Ethiopian Jews were unlike those of other Jewish groups, and much closer to surrounding African populations. These data, however, have been essentially irrelevant to the view that the Beta Israel, as they call themselves, are part of the Jewish people, and to the decision of the State of Israel to grant them citizenship.

At the geopolitical level, namely the struggle between Israelis and Palestinians over ownership of all or part of the land between the Jordan River and the Mediterranean, the impact of the genetic findings has not gotten much further–nor should it–although it may have precluded the introduction of some irrelevancies into the debate. Assertions that since Ashkenazi Jews are descendants of the Khazars they have no claim in the Middle East have now, thankfully, been put aside in the face of disconfirmatory genetic data. But all the national groups that have looked to genetics to support their claims to sovereignty over a particular land, as we have suggested elsewhere,[ix] are bound to be disappointed. Such arguments are usually made on the basis of one group having a closer genetic connection to the original inhabitants of the land than a competing population, so-called "historical primacy." Not only are such questions of historical relatedness difficult–and in many cases impossible–to resolve, but such chronological primacy is only one component that usually gets taken into account in determining who has the right to live in or control a land. Self-determination, corrective justice, efficient land use, and attachment to a territory are other factors that enter into these difficult assessments. Genetics has not and will not solve the conundrum in the Middle East.

Taken as a whole, the genetic studies of varied Jewish populations around the world illustrate the ability of modern laboratory techniques to contribute to a better understanding of historical phenomena, particularly when they involve the movement of populations. However, Jewishness is not a genetic trait, never was, and never will be.

Diana Muir Appelbaum *is a historian who is working on a book on nationalism.* ***Paul S. Appelbaum****, MD is the Dollard Professor of Psychiatry, Medicine and Law at Columbia, where he heads a center studying ethical, legal and social implications of findings in genetics. Together they have written for a variety of publications on the significance of genetics for national and individual identity.*

Information and Misinformation Already Had

DNA and Tribal Citizenship

By Jessica Bardill

Genomic science has been accelerating since the complete mapping of the human genome, vastly increasing the amount of data concerning both human and non-human genomes. Legislation and public policy have been working to catch up to these advances, including questioning how to protect the interests of the people being studied and how to use DNA to define identity. How indigenous peoples choose to use biotechnology for their own purposes, such as to prove citizenship, presents an important place to explore not only risks and benefits, rights and responsibilities, but also the narrative and understandings underlying these choices.

In short, ancestry testing analyzes sequences in relation to one another and which have clusters for certain population groups. Many of these sequences can be identified in peoples as common, in which case they can become Ancestry Informative Markers, or AIMs. In recent research, these markers have been shown to create clustering maps that mirror some national boundaries, supporting ideas of difference on both sides of these lines[1]. In famous examples of ancestry testing, Henry Louis Gates, Oprah, and Chris Rock have had their relationships to African tribes (and European ancestors) determined.[2]

While these concepts have been simplified, and while blood refers to more than biological ancestry but also stands in literally and metaphorically for other kinds of connections between kin, the movement to try to utilize an aspect of the literal substance to encode identity is worth analyzing. DNA testing has already become a possible tool for determining tribal identity and ancestry, and tribes have come down on both sides of the issue, for and against its use for helping to determine citizenship and recognition. This use predicates itself upon an unquestioned use over time of a story that relies on blood, whether metaphorical or physical, to conceive of identity– here, a determining blood narrative. Some tribes have embraced DNA, a rewriting of blooded connection, to help prove identities of members or of the group itself.[3] Other tribes have outright rejected the prospect of utilizing DNA to identify members[4]. The choice by a tribe to use or not use blood or DNA in determinations of tribal citizenship has at least these two sides. Many argue that blood as used in blood quantum is a kind of metaphor, as in the phrase "Indian by Blood" from various census rolls. However, DNA concretizes that idea and removes its ability to be a metaphor and only making it possible to mean the literal substance. This belief in a metaphorical or literal blood relation underpins a blood narrative and our understanding particularly of legal tribal belonging, and it is taken further when that identity is tied to genetics.

So what is behind this desire to use blood in the form of DNA to help standardize tribal citizenship? Most of the 564 federal tribes, as well as many of the state recognized and unrecognized tribes, utilize blood quantum or descendancy from a tribal particular roll to determine membership. For the federal tribes, blood quantum has a connection to the Federal recognition system and the certificate degree of Indian or Alaska Native blood (CDIB), which:

> ... certifies that an individual possesses a specific degree of Indian blood of a federally recognized Indian tribe(s). ...A CDIB does not establish membership in a federally recognized Indian tribe, and does not prevent an Indian tribe from making a separate and independent determination of blood degree for tribal purposes.[5]

Individual recognition of Indian peoples, here as determined by blood, is itself caught up in the Federal recognition process: only those whose Indian blood is from "a federally recognized Indian tribe" can have a CDIB, while others would be muted, becoming people who do not belong, at least to the system as set up by blood and knowing (again). In their constitutions, and as an aforementioned exception to CDIB, tribal nations can perform their own computations of blood degree for membership purposes. Of course, this blade can cut both ways and be either more inclusive or more restrictive in both the blood quantum rules and the recalculations, determining Native identity in the form of blood quanta. Census rolls, tabulated by the Federal government over time, serve as base membership rolls for many tribes, further involving the Federal government in tribal determinations of belonging. Many uses of DNA for tribes do not divine Native American ancestry per se, but DNA testing is utilized to

prove descendancy from a maternal or paternal line listed on the base roll. Understanding blood quantum and descendancy are important because these methods control understanding of identity before DNA, and are what DNA analysis builds upon for tribes, carrying forward the compounded problems of both concepts.

The tribes who utilize DNA believe it provides a scientific way to prove blood quantum or other relation to the tribe, thereby moving past the known errors of census rolls taken by the Federal government or blood quantum calculations. By this thinking, if you can prove blood through DNA, you are of the tribe. However, the whole use of blood is predicated upon a European notion of identity that does not conform to Indian notions of relations. While some tribes confirm maternity and others use DNA to claim relation to remains, such as in the case of the Kennewick Man, these uses of science and biotechnology to confirm knowledge already had belies a risk of that use: the loss of our own ways to determine relations, to determine belonging and tribal citizenship. Some tribal peoples determine their identity not on legal recognition of citizenship, but instead on belonging to the community; others claim that their tribal identity exists only because of citizenship. Tribal identities can exist inside and outside of the line of citizenship, but allowing science to draw that line is dangerous. Even keeping with the enemy we know, the errors of tribal census rolls and their command over identity provides limits, which can be both helpful and harmful, especially when DNA concretizes those relations. To better understand these concepts, I turn now to a current use of genetics to determine tribal identity, here confirming parentage to prove descent from a certain census roll.

Recently the Eastern Band of Cherokee Indians (EBCI) contracted the Falmouth Group "to determine the condition, status, completeness and accuracy of the enrollment records of the tribe."[6] This audit produced third-party evaluations of record maintenance but also evaluations of the basis of the enrollment records and recommendations for the future. A major finding of the report is that the Baker Roll, the foundation of EBCI membership and legal identity, has discrepancies throughout:

> Though the Baker Roll information is considered unimpeachable, there are a significant number of inconsistencies between the information found in the Baker Roll and the corresponding record information in the Enrollment Department's database. Most critically, a number of members indicated to be Baker Roll enrollees show a differing blood degree on the roll than in the Enrollment department data.[7]

By referencing "inconsistencies" the Group does not call these errors—as the Roll is "unimpeachable"—but does find a multitude of unverified information in the membership records. In attempts to remedy these concerns, the Group makes many recommendations to the tribe. One recommendation, intended to address inconsistencies in birth certificates (missing, multiple, incomplete) is that the tribe can try "requesting or accepting other corroborating documentation."[8] Throughout the whole report, this statement is as close as the Group comes to recommending DNA testing. Instead, the call for blood in the form of genetics comes from within the tribe as a way to find corroborating evidence of parentage.

Passed by the Tribal Council on June 3, 2010, Tribal Ordinance 277 requires members of the tribe whose eligibility is in question and particularly new applicants for membership to produce DNA tests, at their own expense, to prove their claims of both maternity and paternity. Specifically, within the enrollment application requirements, it now allows "results of a DNA test, from a lab acceptable to the Enrollment Committee, establishing the probability of paternity and/or maternity by the parent(s) through whom lineage is claimed for an applicant."[9] Further, this testing is required of all potential members, without exception: "DNA testing [is] required for all applicants, including adoptees."[10] This move essentializes identity into the genetics of maternity and paternity; even with adoptions, the biological parent's status as tribal member(s) or not comes into question and, of course, affects the fate of the child, regardless of the adopted parents' status. While this ancestry test does not divine a Native American identity, it does open the door to relying on genetics to determine tribal identity. Chief Michell Hicks has not yet signed the law yet, but was a major supporter of using DNA for reducing inconsistencies in the Rolls. While tribal members have stated that this move will cause skeletons to be let out of the closet[11], many still support the move. This "skeletons in the closet" concern should not be overlooked, as not only might that new knowledge change how a person understands his family, it will also change how he understands himself and his identity, genetic and otherwise.

The bigger concern here though is that a DNA test should be required of those seeking recognition from their tribe, and particularly the notion that DNA can determine tribal identity or not. If tribal nations are nations like others in the world, they have to have a way to allow for both immigration and change. I am not saying that tribal nations should start allowing anyone who wants to be Native in to the tribe; however, many tribes do have provisions for adopting outsiders, a move akin to immigration and naturalization as it emphasizes having cultural knowledge and respect, as well as a sponsoring family[12]. Change, in the form of exogamy as well as diaspora, has to be taken into account when determining who constitutes the citizenry of the nation, and who might identify as Indian without belonging to a nation. This latter change calls into question who can really determine one's identity: DNA tests, tribal governments, legislation, policy, community, or self?

Kimberly TallBear[13] has shown how ancestry analysis misses entire parts of one's lineage, but also how the use of blood as a stand in for "race" is problematic for American Indian nations, which are not racial constructs, and their claims to sovereignty, which are not based on race. In the case of American Indians, Rick Kittles proclaims that AIMs have not been identified for Native Americans, so that one would find it hard to test the blood of an individual and consider them ancestrally connected to American Indian tribes, and especially hard to pinpoint the political unit or tribe from which they may have come.[14] Further, it definitely cannot discern the total ancestral connections over time between an individual listed on a base roll and a current descendant. These problems help us to question the usefulness of biological genetic ancestry, or blood, for understanding cultural and political affiliations of individuals to tribes, or other forms of belonging.

Inherently, given the lack of evidence supporting the DNA testing, the proof of identity provided by ancestry testing should not be used by tribes to determine

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Interview: Kimberly TallBear

Kimberly TallBear is Assistant Professor of Environmental Science, Policy and Management at the University of California, Berkeley.

In studies involving human subjects who are potentially vulnerable in some way, do you see a difference in how researchers of different disciplines—say anthropologists versus geneticists—approach their ethical responsibilities?

The interesting thing about sociology, anthropology, and the humanities and social sciences in general, is that the history of their field is a core part of their canon. I don't think that's the case as often in the life sciences; they don't get that history of the mistakes and the failures in their field.

I do think that makes a difference in terms of being a little bit more critical about the hypotheses you put forward. Not to say that there aren't problems in biological anthropology—there are—but I think that in general, anthropologists are aware that when they're dealing with race as a scientific object, they need to be more careful with the language that they use and how they're linking race and genetics. They're aware that in the history of social science, the study of race in the early 20th century and late 19th century was aimed at justifying race hierarchies. Population geneticists in general don't have that history as part of their field.

I think it's very important to bring the history of genetics and race and the ethics of research more into the center of training for population geneticists, and to make sure that as genetics comes to the fore in biological anthropology that the lessons of cultural anthropology and bioethics don't get lost.

Right now, ethics tends to be an add-on. This is how you get what happened at Berkeley with the freshman DNA testing. Those of us in the social science faculty who work on genetics issues at Berkeley tried to address the ethical concerns of that project. It was like talking to a stone wall, trying to get the scientists involved in the freshman DNA project to understand that no, you don't just add an ethics panel at the end, after you've designed the whole program. Ethics don't come at the end; they come at the beginning, when you're conceptualizing. It's an inherent part of doing science right, not something you add on at the end.

Of course, everybody—whether you're coming out of a genetics department or an anthropology department—has to go through the institutional review board (IRB) at the university, so there's a baseline. But what IRBs require is a bare minimum of the standards that you have to meet to conduct ethical research. IRB approval doesn't constitute a thorough process.

Do you think that baseline can be made higher, or is it a general rule that IRBs only require the bare minimum?

IRBs vary from university to university, and some are much stricter than others. For example, the Arizona State University IRB is, after the Havasupai lawsuit, incredibly strict where tribes are concerned. If you're going to do research with native populations, whether it's biological research or even social science research, you have to get approval from the tribal council before the university will even look at your protocol. On the other hand, I'm doing a project at Berkeley where I'm interviewing both genetic scientists and tribal government people, and Berkeley didn't look twice at my interview with indigenous people. I asked if they require some sort of documentation that I got approval from the tribe, and they said, "No, no, no, that's not a problem." So there are differences between IRBs as well as between disciplines.

What do you suppose accounts for these differences in the strictness of IRBs?

I'm not an expert on IRBs, but I can speak from personal experience—I have worked at both Arizona State and Berkeley, so I have seen the huge differences in IRBs. In short, the difference is that ASU has been sued. Before the Havasupai suit, ASU was lax as well.

I was at ASU in 2006 and 2007. As a social scientist, I was interviewing a range of people—native people, scientists, regulators—and the IRB was very strict about allowing me to talk to tribes. I had interviewees at five or six tribes, which meant I would have had to go through each one of those tribes to get approval for those interview questions. So, in order to get approval for my science piece, I backed out of the Native American community member questions.

This was also really interesting: I study the culture and politics of genetic science, and I think they should have been more strict and careful about my research questions for scientists. In my work, scientists are potentially vulnerable subjects. Now, I don't actually think they are very vulnerable—I think they actually have a lot more cultural authority than I do in the broader world—but I'm a potential critic. While the native populations were seen as potentially vulnerable subjects, it didn't seem to have crossed the IRB's minds that scientists could be potentially vulnerable subjects, too.

It was the opposite at Berkeley, actually: they were much, much more concerned about my questions for scientists and protecting their confidentiality, and they seemed not at all concerned about my questions for indigenous people, at least from my perspective.

It seems that a researcher who belongs to the group being studied would be more concerned with their subjects' values; but I wonder if that is not as obvious an outcome as it seems, since the researcher's training also comes into play.

I think that's right, it's not just a natural outcome. Just because someone is,

say, Navajo, and they're researching the Navajo people, they would not necessarily do things very differently. If you have a PhD in genetics, you've been trained a certain way; you've been trained in a discipline that's not accustomed to thinking about this kind of knowledge the way that Navajo people might.

For my next research project, I'm interviewing indigenous geneticists and their collaborators—people who are actually committed to working in indigenous communities over the long term. That seems to be the key: you need to have an understanding that in these communities, you cannot just go in, get your sample, and never come back. If you want to work with native communities, because of the kinds of suspicions they have of this type of science and the particular historical relationships they've had with biomedical research, you have to make a commitment to be in it for the long haul. With increasing development of tribal research review boards, tribes are quickly getting very savvy to the fact that they have the right to review research, the right to reject certain research projects, and they have the right to review publications before they go out to make sure their confidentiality is maintained.

I think that the researchers working in Indian country are increasingly committed to being there over the long term. Those relationships take a long time to build—it's not easy to work with tribes at all, it's very difficult. Or you see people who have just decided they don't want to work with tribes, because they don't want to have to go through a tribal research review board, they don't want to let a tribal council or a tribal IRB have a say over whether they can publish something or not. I think that's a good thing. I would rather see more researchers who are committed to working with native people over the course of their career and really spending the time to do it right and build those relationships; and the rest of them who don't want to do that, that's fine. Go do something else!

Whether a researcher is native or not, what matters is their commitment to being involved over the long haul. I think the chances are that a native person who wants to do that work in their own community is going to be more committed to being there long term, but I also know other genetic scientists who are really committed to working with native people over the long term and doing collaborative research.

We can certainly think of researchers being eager to define a group of people in biological terms. I wonder if there are groups who are just as eager to *be* defined, especially in terms of ancestry. It seems like it might be an American phenomenon.

It's a very American phenomenon. You see that in the way that companies here all use the same four or five standard race categories that don't have the same salience in other parts of the world. You do have a couple of companies in Canada and a half dozen in the UK and ancestry testing is popular there. But really the majority of people who do this stuff are Americans. I said this in a meeting where there were a bunch of genetic ancestry testing company guys, how tilted toward the U.S. their race categories were and one company founder said, "That's not true! People globally are interested in this!" But it is not in fact a global phenomenon because whatever race categories you use, their relevance is specific to particular countries. The British companies, for example, use different ancestry categories—usually a greater number—than the four standard race categories that predominate in the American companies' tests.

Deborah Bolnick wrote a very interesting article—she's a biological anthropologist I work with in Texas—on the structure program, one of the main software programs used in AIMs (Ancestry Informative Markers) analyses which a lot of the ancestry companies do. It's AIMs that they're analyzing when they give you the results telling the different percentages of your ancestral background. She found that the program will basically break those markers down into whatever number of racial groups you put into the program. If you put in the standard five that make sense to us in the United States, it will spit back an analysis slotting the markers into one of those five racial categories; but if you put in twenty racial categories, it will break down markers at that level. There are some interesting ways in which our social ideas of race shape our technologies. It's not as easy as our technologies just confirming what we already thought existed.

Case in Point:

The Havasupai

In 1990, members of the Havasupai tribe, a small, isolated community living in the Grand Canyon, gave DNA samples to researchers from Arizona State University to contribute to research that could help determine the cause of the tribe's very high rate of diabetes. Nothing much came of the diabetes study, but over a decade later, the Havasupai discovered that over 20 academic articles had been published based on studies conducted at the university using Havasupai blood, studying an array of topics the tribe members never recalled agreeing to. One article found that the tribe's ancestors had crossed the Bering land bridge long ago, contradicting the tribe's oral history of having originated in the canyon; another article claimed the DNA samples showed a high degree of inbreeding among the Havasupai. Many of those who had given blood felt hurt and betrayed, and the tribe issued a "banishment order" against any Arizona State researchers attempting to enter the reservation.

Over the course of a decade, without the tribe's knowledge, degrees and grants had been awarded based on these studies; now, after years in court, the university will pay the tribe $700,000. The remaining blood samples were destroyed this spring. Arizona State has adopted much stricter requirements for researchers working with tribes - and the Havasupai and other tribes will be watching.

Ethics, Identity, Genetics, Patrimony and Power in the Harvesting of DNA from Africa

By Shomarka Keita with James Stewart

The Human Genome Diversity Project (HGDP) is commonly thought to have been "stopped" by the actions of "indigenous peoples" who were not interested in being memorialized in laboratories. This concern about memorialization is not hyperbole since many of the investigators involved—who almost never were from any of the targeted groups—were clear that they wanted the DNA from indigenous populations that were "disappearing" (as well as others). The representatives of the targeted bioethnic entities wanted to know why the investigators were not helping them survive instead of worrying about generating hypotheses and constructing narratives based on their DNA. They were also concerned about the interpretation and misuse of these data, and its commercialization. Native Americans and certain indigenous groups in Asia were the most vocal in their opposition. Africans were nearly deafeningly silent. The HGDP was not stopped, only stalled, and in the case of Africa it is not clear that it was even stalled, based on the number of publications on African populations.

Some scientists were apparently taken aback or shocked that anyone should question them. A limited review of various sources indicates that at least some scientists were determined to carry out this project no matter what anyone said, with the implication that they had some kind of *right* to this information and to somehow lay claim to be representing all humankind in a quest for knowledge. There was, and has been, no discussion of the *ethics of curiosity*, nor of the ranking of ethical responsibilities to other communities, if we count scientists as a community apart. Science and scientists exist in social, political and historical contexts. The claim that there were no potential financial motivations for the HGDP's DNA collection does not hold water; there have been numerous attempts at gene patenting, and there are other examples of the exploitation of biological materials without any rewards going to the donors or their families. The best example is the well known HeLa cell line: used nearly sixty years in countless laboratories, by thousands of researchers, generating money in a myriad number of ways. The HeLa cell line came from Mrs. Henrietta Lacks, of Middle Passage African descent, who died in 1951 in Baltimore, Maryland. Her family has *not* benefitted economically or socially from the cell line and indeed do not have adequate healthcare at this time. This is a true irony.

Not all compensation is in salaries; some is in obtaining degrees, fame, prizes, and claims of original knowledge creation or exploration. The so-called Tuskegee study, better called the US Public Health Service study *in* Tuskegee, was couched in terms of gathering data for "science"; tragically some Middle Passage Descendant Americans even bought into this construct. Curiosity in the context of unequal power relationships has many rewards for those who are allowed to act on it, but is highly questionable.

One can demonstrate the persistence of problematic models, practices, terms, constructs, and differential control over research and discourse. The caption under Archbishop Tutu's photo in an article in Nature mentioning his participation in a genome study might be said to illustrate this. It reads: "*Archbishop Desmond Tutu's genome was chosen to represent the Bantu peoples of southern Africa*." Whose voice is this in the caption? 'Was chosen' by whom: his clan elders, the Swazi king, the Zulu king, a committee of Bantu speakers officially elected for this purpose, the ANC, the African Union? Could his DNA actually represent all Bantu speakers—in what model of science? Archbishop Tutu's name is not on the paper that presents him as a "representative" of "the Bantu", a dubious taxon and connotation in a country where 'Bantu' was a descriptor on identity cards and viewed as a negative. Did Archbishop Tutu *accept* being called "*Bantu* Desmond Tutu" in the apartheid era, which has not really ended in all domains of socioeconomic life? No. But ironically he is now reduced to Bantu Desmond Tutu in a genome database. Notably, there are no "Bantu" names in the authorship of the paper—nearly twenty years after the "fall" of apartheid.

There are many other questions. Was Archbishop Tutu clear on the issues related to a lack of African representation in the ranks of geneticists and ethicists as well as the lingering problems with racial thinking in the taxonomy of African peoples and in scientific work? From bioethical and political perspectives *was his consent truly informed*? Did he understand that the completion of "Khoisan" and "Bantu" genomes in some sense fits the racist Carleton Coon's misconception of human variation as race? How does Tutu's DNA sequence advance the freedom of Africans in the townships of South Africa or the Gabonese rainforest from fear, want and need? It cannot be shown that Western DNA research will fix their current public health needs, or add to a sense of self-determination which is compromised in a global system of research which objectifies them. The freedom fighters who gave their lives in the anti-colonial struggles from Algeria to Zimbabwe were fighting against all

forms of domination.

It is not clear if there was a strong statement from the Organization of African Unity (OAU) or its successor the African Union (AU) about the taking of biological materials from African peoples (from Cairo to the Cape). Some countries most certainly do/did *in theory* have some restrictions on research, but genetics may have been overlooked. The EU has stronger guidelines about various research issues. The AU officials, apparently, did not develop an oversight commission on the question of the rights of Africans with regards to their full patrimony: biological, geological, cultural, and other materials (including fossils). Nor did the OAU/AU fully address the issue of the full content of foreign aid, which should include the building of the capacity for African peoples, nations, and universities to "fish" for and develop the treasure of Africa which includes the data from its people, flora and fauna, and reap the full benefits, which include any economic and downstream scientific derivatives, degrees, fame, and others. Much has been taken from Africa with inadequate or no compensation over the last 500 years; the accumulation of money and wealth by the West, measured in this case by genetic data, continues apace.

A word on one diasporic group is in order. Within the USA, none of the major community or rights organizations of Middle Passage Descendant (MPD) Americans made official statements about the harvesting of DNA from this population. The demands for opportunities to redress past injustices did not include one for funds to build community institutional capacity in human sciences which have a history of spawning ideologies used against minorities. While there has been some voiced concern about increasing "minority" participation by the training of individuals, it does not seem that there has been as much concern for developing the capacity of under-represented institutions *as institutions*. There is/was no public and absolute push for the development of capacity for genetics research and global participation within institutions that have traditionally served the MPD community. It is not known to what degree the leadership of these institutions demanded inclusion, a notion of distributive justice covers this matter. The trans-generational impacts of colonialism and racism will not be solved by a little "inclusion." It can be argued that it is a human right to be able to study one's community, especially in the cases where past practices have been laden with theoretical and other abuses.

A range of ethical issues were and can be raised about the HGDP, with major focus being placed on *informed consent*—a tricky issue since it has multiple components and dimensions. Obtaining consent for the *act* of drawing blood must be distinguished from consent for the purpose to which that blood will be used, and there are other things as well. The attestations of informed consent in Africa are not convincing as to whether there was full understanding on the part of the "participants", "subjects" or "objects" as to the range of purposes of that DNA. We must never forget that a culturally relevant consent informed by an explanation rooted in Geertz's concept of "thick description" is the only kind of consent that would be morally (and politically) acceptable. Vanessa Gamble's call for a critical race bioethics is relevant here. It must also be remembered that consent given for blood drawing and cheek swabbing in situations of asymmetrical power relationships is ethically problematic when not simply wrong. Not only must individuals and communities not be misled, but the context must not be coercive, deceptive, or threatening.

In ethical terms the concept of autonomy, or as is now said *respect for autonomy*, covers these situations, and it could be asserted that these must be related to self determination at the level of nations, communities, and micronations, to borrow a term from Wangari Maathai. Respect for autonomy means respect for self determination. True autonomy implies real understanding and control over the circumstances of consent. At the community level the issue is one of self determination: does a community understand to what uses the DNA will be put, and who would gain in the short or long terms the most benefit? There is a justice issue here as well in terms of bioethics. Naive utilitarianism can have no role since there was no obvious benefit to all (the human community, the local community) at the time that most of these samples were collected and even now as we write. Large sums of money are being spent essentially in the name of curiosity. Does the burden of proof of morality lie with the educated financiers or those who are requested to be subjects/participants? The hope of future rewards when peoples are on the verge of starvation, infant mortality is high, and cultures are being destroyed is a hollow promise that deserves a comment from the keepers of virtues and morality in the "developed" world. The bioethics concepts of beneficience and non-maleficence are useful guides to right action in these issues. They are little mentioned in studies which discuss the genetics of African peoples.

Some other ethical issues are rarely reviewed. For example, little has been written about the *ethics of curiosity* with reference to genomic, genetic and other human biological studies in Africa. Sandar Sarukkai points out that much of science "is often seen to be independent of ethics," and suggests that curiosity as a concept has been used by scientists to keep ethics "at bay." The argument is that science is about "facts," "transcendental truths," and that ethics is about values which emanate from the human experience. From this point of view only "applied science" is subject to ethical considerations, because basic science—in its purest sense—is presented as an attempt to simply discover truths, no matter the consequences. Sarukkai suggests that curiosity itself is value laden and culturally mediated, and that scientists must consider constraining curiosity itself, not just avoid working on projects regarded by many as currently unjust or unpopular. He states that scientists seem unwilling to take this step, citing literature from the past decade in which the idea of constraining curiosity is clearly rejected.

A more fundamental question is in order. Where do the *rights* to be curious and act on curiosity originate? What about the boundaries of curiosity? Does one have a right to be curious, and to act on that curiosity about anything, especially in the context of recent global history? "Who has the right to interrogate—whether it is other humans or nature?" Some researchers apparently believe that it is their right to have unbridled curiosity (and act on it) when it comes to certain domains in exploratory (versus clearly experimental) science. According to Sarukkai scientists resist "constraining their curiosity per se." This position ignores the contexts of history, privilege and power. What gives any one the *right* to obtain, analyze and interpret Kalenjin DNA, and what would those Nandi soldiers who forced the British to negotiate have to say about this (or King Hassan V, Nelson Mandela, Gamal Nasser, Jomo Kenyatta or Patrice Lumumba for that

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Neanderthal Genes, Religion, and the Unique Identity of Modern Humans

By Terence Keel

The recent discovery by the Neanderthal Genome Project that present day Europeans and Asians might be the only two populations in possession of Neanderthal DNA forces us to yet again ponder the relationship between genetics and human identity. Who we think we are has much to do with the questions we ask. And for *Homo sapiens* there are perhaps no greater questions of ultimate concern than "where do we come from" and "what makes a human, *human*?" Increasingly genetics offers tools to trace our roots, and the genetic ancestry industry has flourished due to growing public interest in what has been packaged as "racial" diversity (what geneticists call "admixture") within our DNA.[1] So far, genetic identity testing technologies have been able to trace human origins back to the continental regions where ancestors of modern humans left Africa somewhere between 50,000 and 100,000 years ago and branched into the various populations often thought of as "races." But lately, figuring out what makes us human appears to be a moving target.

Recent news that on average "Europeans" and "Asians" may possess up to 4% Neanderthal DNA not only reveals previously unknown genetic admixture, it pushes us to reframe the distinction between non-human and human descent. Geneticist Svante Pääbo, from the Neanderthal Genome Project, seemed to suggest this as he was reported saying, "Neanderthals are not totally extinct; they live on in some of us."[2] With this new information the quest for the genetic "admixture" of modern humans has now formally extended beyond racially "mixed" family trees and into the "pre-historic" age. Some of our perceptions about the purity of our inherited genetic legacy will be altered now that many of us might be related to hominids from the *Land of the Lost*.

In the U.S., we have largely come to believe that science and religion (or specifically evolutionary biology and Christianity) offer strikingly different answers to the question of our beginnings. This is no doubt true if the conversation solely concerns whether humans were the direct and instantaneous creation of God or evolved precariously from a lowly anthropoid ancestor. The lines between religion and science on the issue of human origins become blurred, however, when the question is framed in terms of what essential attributes make us "human." That is, what are the specific physical and intellectual traits that decisively demarcate modern humans from non-human species?

For centuries Christian philosophers like St. Augustine and Thomas Aquinas turned to the human capacity for reason and moral responsibility to illustrate "Man's" uniqueness. Likewise, within the legacy of modern science, natural historians and anthropologists compared the cranial structures, social behavior, and linguistic abilities of humans with those of primates to demonstrate the gulf between us and the animal world. More recently, population geneticists have sought proof of our biological uniqueness by deciphering human gene expressions involved in language, reasoning and brain development not found in other primates.[3] If we think about the search for evidence of interbreeding between modern humans and Neanderthals with this history in mind, then it appears that Western scientists and Christian thinkers have shared a commitment to pursuing and detailing the "traits" that corroborate our cultured belief in the uniqueness of our species.

In order to determine what "traits" humans and Neanderthals have in common, the Neanderthal Genome Project used full genome sequencing technology that entailed scanning 60% of the Neanderthal genome.[4] They also took up a comparative study of autosomal regions (SNPs)—a technique used in admixture testing—of five people from China, France, Papua New Guinea, South Africa and West Africa with that of the Neanderthal.[5] By comparing segments of DNA where SNPs occur at high frequencies in different populations, geneticists were able to discover that Europeans and Asians share up to 4% of their DNA with cavewomen found in Croatia (the fossil samples used in the study were from female Neanderthals). With this geneticists had announced that the line between the human and non-human—crucial to religious and scientific beliefs about the novelty of our species—was in fact more porous than we thought.

Of course this is not the first time that scientific investigations into human descent disrupted the line between human and non-human ancestry, and with it belief in the uniqueness of our species. In the mid 19th century, before Darwin challenged the world to consider humans had descended from primates, a significant debate developed over whether or not present day humans were the offspring of a shared ancestor (monogenesis) or whether the various "races" possessed their own exclusive forbearers (polygenesis). Out of this debate emerged an idea called "pre-Adamite theory" which claimed that Africans, Asians, and Native American populations were "pre-humanoid forms" created separately from Europeans and with no ties to "Adam's" ancestral linage—thought to be the exclusive inheritance of whites.[6] For people in the mid-19th century it was a foregone conclusion that Adam was the "original man," but this belief had to be squared with 19th century geological discoveries that increased the age of the earth and challenged the account of creation found in the Christian bible. It also had to be reconciled with data from American ethnologists like Samuel Morton and Josiah C. Nott who claimed that "the races" were utterly different human types. Pre-Adamite theory thus became a useful strategy to account for the perceived intellectual, cranial, linguistic, and moral discrepancies between European and non-European populations, while also maintaining the veracity of biblical knowledge. Moreover, it proved effective for drawing the line between which populations were or were not truly "human." The theory gained increased currency among scientific and religious notables of the day with figures such as the Swiss naturalist Louis Agassiz and Christian mod-

ernists Isabelle Duncan and James Gall.

If much of this sounds absurdly distant to modern readers it is because the gradual acceptance of Darwinian biology during the early 20th century and, later, the development of the "Out of Africa" hypothesis put a moratorium on most pre-Adamite ideas. Yet the synthesis of Darwinian biology and evolutionary genetics did not entirely bring an end to the debate between monogenists and polygenists over the shared ancestry of all modern day humans. During the late 1980's, a group of geneticists led by Milford H. Wolpoff proposed a "multiregional hypothesis" as an alternative explanation to the "Out of Africa" theory.[7] This multiregional model suggested that modern day humans did not evolve solely from the group of early humans who migrated out of Africa between 50,000 and 100,000 years ago. Wolpoff's group wanted to say that humans might have also evolved from other ancestral hominids living in regions outside of Africa already.[8]

Recent blogosphere and public reactions to the discovery of Neanderthal admixture in some humans but not others has potentially brought new life to old debates over the multiple origins of the various races that echo concerns voiced by 19th century proponents of pre-Adamite theory.

Some Creationists appeared to have embraced this recent discovery, largely because they have always claimed that the Neanderthals were human.[9] Flat out rejecting the evolutionary account of human development, many Creationists have contended that paleontologists have fabricated the very idea of the Neanderthal, deliberately mixing the fossil remains of an ancient human with primates in order to justify the evolutionary belief in a creature not quite animal nor fully human.[10] Creationists have also insisted that our recent genetic ties to the Neanderthal should force us to abandon scientific theories that claim humans have genetic material that make them a "new" and separate species from this ancestral hominid.[11]

A number of social conservatives have played up the fact that Europeans, rather than Africans, possess Neanderthal DNA. Just days after the discovery of the Neanderthal genome a majority of bloggers on the white supremacist website Stormfront.org congratulated themselves for their genetic uniqueness and claimed Neanderthal DNA was responsible for the "intellectual supremacy" and "physical prowess" of Europeans. Several even shared the sentiment conveyed by an anonymous blogger who suggested that:

> "[As] Neanderthal genes become more inundated with other racial mixes we have been evolving back wards [*sic*]. It may be that in a few hundred years so little will remain of these genes that we will be inseparable from the lower form of human (i.e. blacks)."[12]

Interestingly, white supremacists have understood their genetic bond with the evolutionarily primitive Neanderthal as a mark of lauded genetic distinction and biological superiority.

Listeners' reaction to NPR's coverage of the Neanderthal Genome Project was a bit more measured, but inevitably concerns similar to those expressed by the Creationists and Stormfront bloggers were peppered throughout the discussion.[13] One anonymous listener was concerned by the lack of attention given to "the six day creation model and how it better answers the questions of our origin than evolution." Others shared his reaction that pro-evolutionists have "the political power" to "suppress any discussion of an alternative model." Creative efforts were also made to rethink the Genesis creation story in light of this new finding, as one listener suggested that perhaps

> "Adam and Eve were the first cognizant humans, their two offshoots-offspring were Neandethal son Abel and Modern or Cro Magnan son Cain. Abel the hunter, Cain the planter. And Cain killed off his brother Abel. It's a terrible story of why there are no Neanderthals today."

Several listeners speculated that the Neanderthal genome was possibly responsible for the "red hair", "blue eyes" "stocky stature, long torso" and other phenotypes expressed exclusively by "whites." Another listener interested in the implications this discovery has for thinking about racial differences claimed that:

> "[The fact that] Neanderthal genes are distributed globally yet not much among African people hints at the possibility of a genetic explanation for racism ,,, Perhaps over time, Neanderthal genes made their carriers wary and fearful of hominids who looked unlike them and shared fewer of those genes. After all, it seems that anti-black feelings run deepest in Eurasia and Asia, where the Neanderthal carriers ended up."

Continuing in the spirit of pondering what the Neanderthal genome means for thinking about race, one listener raised

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Inside the Human Genome: A Case for Non-Intelligent Design
by John C. Avise. Oxford University Press, 240 pp., $19.95

Signature in the Cell: DNA and the Evidence for Intelligent Design
by Stephen C. Meyers. HarperOne, 624 pp, $19.99 (paper)

At the bottom of both John C. Avise's **Inside the Human Genome** and Stephen C. Meyers's **Signature in the Cell** is the same, straightforward question: is the human genome evidence of design or evidence of evolution? Through his discussion of the "inherent design flaws" in human DNA, Avise finds proof of "nonsentient" evolution. Meyers reaches the opposite conclusion, finding confirmation of design in the genetic "information" he describes as encoded in our genes. Ultimately, Meyers is undone by the same factors that secure Avise's success: logic and evidence.

The "signature" Meyers alludes to in his title is the "information" represented by the so-called genetic code: the four-letter "alphabet" and three-letter "words" that mediate the processing of DNA into functional proteins. Exemplifying the idiom of information theory ubiquitous in microbiology today, Meyers's book is partially a protracted review of the basic tenets of modern genetics. The four nucleotide bases of DNA—adenine (A), guanine (G), cytosine (C), and thymine (T)—encode "information [and] function as alphabetic characters." These "characters" combine in three-nucleotide combinations—or "words"—called codons. In turn, each codon specifies a particular nucleic acid. Gene expression is the mediation of the "instructions" represented in our DNA converted by a host of intercellular machinery to become proteins—the "chemical building blocks of life."

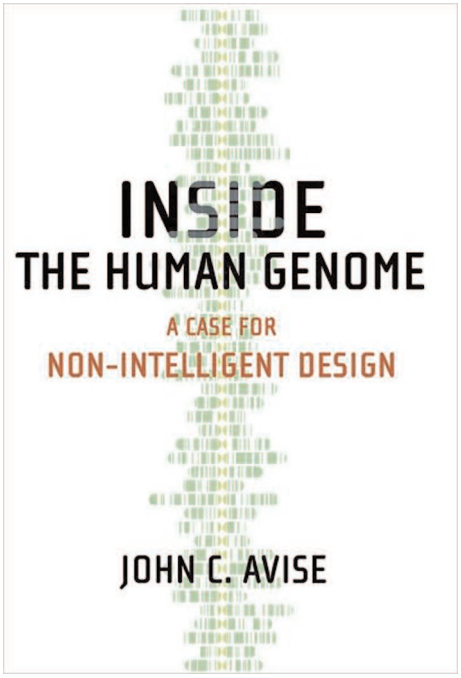
To Meyers, this aspect of DNA—that it contains "functionally specified information"—is "profoundly mysterious." "Apart from the molecules comprising the gene-expression system," he argues, "sequences or structures exhibiting such specified complexity or specified information are not found anywhere in the natural—that is, the nonhuman—world." Describing what he calls the "DNA enigma"—"the mystery of the origin of the information needed to build the first living organism"—Meyers stakes his central claim: that an intelligent designer is required to explain the human genome. While his theory does not identify the intelligence responsible for the informational content of DNA, "it does affirm that the ultimate cause of life is personal . . . [meaning] a self-conscious, deliberative mind in possession of thoughts, will, and intentions."

Although Meyers's invocation of the "mysteries" at the core of his argument foreshadows the theological nature of his claim, he nevertheless defends intelligent design as a legitimate scientific hypothesis, amenable to legitimate scientific scrutiny. "Logically," Meyers posits, "one can infer the past existence of a cause from its effect, when the cause is known to be necessary to produce the effect in question." "[U]niform experience," he reasons, "affirms that specified information—whether inscribed in hieroglyphics, written in a book, encoded in a radio signal, or produced in a simulation experiment—always arises from an intelligent source, from a mind and not a strictly material process." Thus the "strictly material process" of evolution is inadequate to answer the "DNA enigma." Rather, Meyers infers the necessary existence of a designing mind to explain the ultimate source of genetic "information."

Despite over six hundred pages of eloquent prose, Meyers's argument ultimately fails for at least two principal reasons. First, his logic is flawed. Second, he confuses the metaphoric for the literal in his analysis of so-called genetic "information." His reasoning, though formally valid, truncates at an arbitrary point in a chain of necessary inferences. Put syllogistically, his argument is essentially as follows:

- Intelligence is necessary to the occurrence of "information."
- DNA carries "information."
- Therefore, intelligence is the necessary antecedent to DNA.

The problem with this argument is that it stops here, when its underlying logic compels that it continue. By definition, any intelligence capable of creating the "information" in DNA must itself possess *at least* the same amount of information. Because, as Meyers claims, intelligence is a necessary antecedent of "information," it follows that another intelligent designer must have designed the intelligent designer. Each step back in the inferential chain necessitates yet a further step *ad infinitum.* Meyers meekly confronts this issue by appealing to the



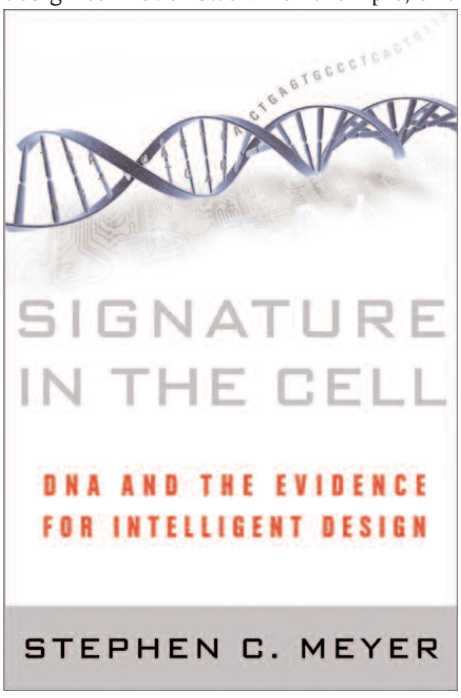
claim that "[i]n every worldview or metaphysical system of thought something stands as the ultimate or prime reality, the thing from which everything else comes." Thus Meyers gladly relies on causation when it suits his argument, then denies its logical force when he finds its demands less palatable. Moreover, even if we grant his latter claim that there can be an unmoved mover, this admission vitiates his argument relying on the causal connection between intelligence and "information." On this point, Meyers refutes himself.

Secondly, Meyers's use of the concept of "information" to describe the workings of molecular biology—though the near-universal idiom of that field—is problematic because it conflates the metaphoric with the literal meaning of the term. While it serves certain explanatory and pedagogical aims to speak as if DNA were "written" in a "language," these are merely metaphors for what are fundamentally causal, bimolecular relationships. To say that DNA carries information about proteins is like saying that smoke carries information about fire. While this may be true in a very weak sense, it would be absurd to claim that fire transmits information about itself via smoke. Because there is no true "information" in DNA—merely a set of biochemical affinities and molecular mechanisms—Meyers's argument falters yet again. Thus, only by way of a fundamental misunderstanding of the human

genome can Meyers conclude that DNA offers evidence of intelligent design.

In **Inside the Human Genome**, John C. Avise offers a different perspective on the (non)workings of human DNA. Observing that "most [genetic] mutations range from neutral to highly deleterious for human health . . . leav[ing] in their wake countless shattered bodies and destroyed lives," he suggests that "[t]hese are probably not the kinds of biological outcomes that one would wish to attribute to the direct hand of an all-powerful and loving God." Genetic malfunctions, and their consequent diseases, are legion—ranging from the mild to the gruesome. Trimethylaminuria, for example, is an incurable genetic disorder that inhibits proper metabolism of trimethylamine (a by-product of digestion). While it carries no serious health effects, trimethylaminuria's one notable symptom is that it can cause those afflicted to smell like rotten fish. Another, more horrific example is Lesch-Nyhan syndrome. Resulting from the mutational substitution of a single nucleotide among some three billion, Lesch-Nyhan syndrome causes severe neurological dysfunction as well as compulsive vomiting and self-mutilation. Affecting mostly children, it is not uncommon for the afflicted to chew off their lips and their fingers.

At the end of the day, the strength of Avise's argument is its focus on evolution's ability to explain phenomena—namely, systematic flaws in the human genome—that the theory of intelligent design cannot answer. For example, one curious inhabitant of the intracellular world is the mitochondrion. Known as "powerhouses" of the cell, these organelles oxidize hydrogen to produce adenosine triphosphate (ATP), "a cell's biochemical equivalent of electrical power." Unique among their cytoplasmic fellows, mitochondria house their own DNA (mtDNA), comprised of 16,596 nucleotide base-pairs that encode thirty seven genes. Curiously, these 37 genes translate to only a portion of the proteins necessary for proper mitochondrial functioning. The remaining critical proteins are encoded in the cell's nuclear DNA. In other words, mtDNA "is just a tiny snippet of DNA that by itself would be absolutely helpless, to itself and to the organism in which it is housed."



Like nuclear DNA, mtDNA is also subject to mutations that compromise molecular operation. What's more, in quintessentially baroque fashion, nuclear DNA and mtDNA are incompatible in such a way as to require a parallel system of gene transcription for each. The complexity of this strange arrangement opens the door to numerous opportunities for genetic error. Abundant metabolic disorders derive from faulty nuclear-mitochondrial interaction. In fact, "[a]n emerging paradigm is that many of the degenerative diseases of aging have their etiologies in mitochondria, either as deleterious mutations in the populations of mtDNA molecules themselves or as operational flaws in nuclear-mitochondrial interaction."

"The serious health problems that arise from mitochondrial mutations," Avise argues, "immediately challenge any claim for omnipotent perfection in mitochondrial design." The energy-producing function of mitochondria is essential to cellular metabolism. "[W]hy in the world," Avise rhetorically asks, "would an intelligent designer have entrusted so much of the production process to a mitochondrion, given the outrageous molecular features this organelle possesses?" Why would a wise creator engineer mtDNA and mtDNA expression in a manner so fundamentally different from that of their nuclear counterparts? This arrangement simply "make[s] no (theo)logical sense."

In contrast to intelligent design's inability to explain this mtDNA enigma, the endosymbiotic theory of mitochondrial evolution offers a straightforward explanation of mitochondrial origin and function. This evolutionary hypothesis posits that some two billion year ago, proto-mitochondria—ancestral analogs to bacteria—somehow took up residence in primitive eukaryotic cells. At first, the proto-mitochondrial genome carried all the genes needed for its own survival. As time passed and the symbiotic relationship drew closer, however, the majority of these genes were shifted to the host genome. Thus the divergent molecular processes required to transcribe mtDNA and cellular DNA reflects mitochondria's extracellular origin.

The enigma of mtDNA offers a clear example of Avise's central thesis. "From scientific evidence gathered during the last century, and especially within recent decades," he explains, "we now understand that the human genome and the metabolic processes it underwrites are riddled with structural and operational deficiencies." "These defects register not only as deleterious mutational departures from some hypothetical genomic ideal," Avise observes, "but also as universal architectural flaws in the standard genomes themselves." Intelligent design cannot explain these features of the human genome. Indeed, these "universal architectural flaws" offer strong evidence against the possibility of *intelligent* design. Moreover, what intelligent design theory is incapable of illuminating, evolutionary processes neatly explain. In Avise's words: "[e]xactly how a Fall from Grace in the Garden of Eden might have become translated into these molecular defects is mechanistically unclear." "By contrast," he concludes, "how such genomic flaws arise and persist poses no insuperable mystery from the scientific perspective of evolutionary genetics."

Ultimately, Avise's slim tome carries far more weight than Meyers's opus. Both authors set out to make a scientific case in support of their argument. Avise succeeds in his task by pointing to the powerful explanatory force of evolution—its ability to make sense of the otherwise baffling, haphazard nature of the human genome. Granting Meyers the benefit of the doubt, his arguments fall prey to fatal logical flaws and a deeply confused concept of "information" and the role it plays in genetics. In the end, intelligent design cannot meet the rigorous demands of scientific proof, whereas evolution is again affirmed as the predominant illuminating force in molecular biology.

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matter)? Any notion that there is an automatic right to roam the Sahara, the Congolese rain forest, the Atlas mountains, Nile Valley and basin, or the east African savanna in search of DNA founders on a polluted reef. The pollution involves, but is not limited to, the denial of patrimonial rights in the context of recent history, arrogance, vulgar power and scientific racism in the neocolonial context.

Identity bears a basic relationship to patrimony, and it is fair to say that much of the work on the genetics of non-Western peoples has not been concerned with the issue of patrimony and the autonomy or respect for autonomy of those peoples. Little has been written about sharing the technology and knowledge so that research can be done by insiders. Less has been done to actually help create the necessary infrastructures. It is also likely that Africans have not vociferously demanded this, which could also be viewed as an ethical and political lapse. Who has first rights to collect the data and study the human biology of Africa for any reason?

Western scientists often seem to speak as a class with ascribed privilege and the right to study anyone they want, thus continuing an obvious tradition from the colonial period, itself perhaps the result a change in the value placed on curiosity—and the right to explore coupled with a right to conquer. The irony is that much of the wealth (invested over and over) that allows so much science to be done has its roots in the exploitation of colonies and free slave labor. Edmund Pellegrino, formally head of the Presidential Commission for the Study of Bioethical Issues, advocates for ethics and virtue, and urges physicians to seek and practice a virtues-based ethics, i.e. to be virtuous. The patient is not to be an anonymous deracinated object of analysis, under the care of an instrument wielding analyst called a doctor. Ancient non-Western, specifically Egyptian conceptions of Maat are also helpful in this regard. Karenga notes this declaration of Kheti:

> I have done what people love and divinities praise.
> I gave bread to the hungry, clothes to the naked.
> I listened to the appeal of the widow.
> I gave a home to the orphan.
> I turned my back on the lover of lies.
> And I did not judge the blameless by his (i.e the liar's) word.
> I answered evil with good.
> And I did not seek after wickedness,
> So that I might endure on earth
> And achieve worthiness.

Remembering recent history these kinds of acts for people should take precedence over curiosity and putative claims about human genetic diversity research.

One can argue for a virtues based ethics for exploratory human biologists, including population geneticists interested in the goals of the HGDP. A virtuous scientist would address the putative future general benefit in which the key research participants currently have no say in developing the interpretation of these data, and who in fact lose control and ownership in the current system of arrangements. (Indeed one should ask who owns Archbishop Tutu's DNA, or the right to study it, the right to be empowered to study it?) A virtues-based ethics would require the researchers to change the scientist-"subject" arrangements, assure the survival of the communities, their self-determination, and work to their total betterment before taking and interpreting their DNA.

Patrimony also implies something about interpretation. One of us was once told by a geneticist in a spirited exchange that the data of science was truth/facts, but interpretation was more heat and subjective, implying it (whether wrong or right) to be of little concern. This position is interesting, and fits in with Sarukkai's observations. However, interpretation does have a value and can have a cost. It was pointed out that the wrong interpretation of the *fact* of abdominal pain and tenderness in the emergency room can lead to an unacceptable cost (the loss of life).

Some few themes related to genetic studies of Africans and one diasporic group have been addressed. There is an ongoing issue about the ethics of the context of this work, related to patrimony and respect for autonomy as well as other principles. The *ethics of curiosity* have serious implications for work in Africa in light of the colonial past, neocolonialist relationships, the effects of past and present exploitation and ongoing biased and callous attitudes. A concern for justice is very important. Any future African human genomics and diversity project must, as with its Asian counterpart, be under the auspices of Africans who are the primary investigators. The virtuous position on this is not the cynical version of the Golden Rule: "He who has the gold makes the rules." There is something else: a just foreign aid and virtuous science would make sure that concern about the overall well-being of people ranked far above the curiosity of non-Africans and Africans. Aid to help the development of the capacity of Africans to do their own and most relevant research first would also reflect a virtuous respect for peoples, and should rank secondary to data collection and analysis by outsiders. Organizations like the Gates Foundation and moral wealthy individuals from all continents could greatly serve humanity by helping in this sort of foundational project. Africans must also develop policy that demands this level of respect, which means ending a lot of 'bakshish' and prosecuting those guilty of it. Hopefully no one will think it is acceptable to merely collect data for a HGDP type project from vulnerable African populations—people poisoned by the oil spills in the Niger Delta, gunned down in Darfur, politically disenfranchised in other regions, denied full participation in societies in a number of places, and subject to the exploitation of others from the East and West—because they are "disappearing."

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University of California, Berkeley Adopts Controversial Genetic Testing Program

By Jeremy Gruber

Instead of the usual summer reading, the University of California, Berkeley recently announced that it will be sending incoming freshman a cotton swab with which to send in a DNA sample. These DNA samples will be tested for three genes that help regulate the ability to metabolize alcohol, lactose and folates as part of a program for the class of 2014 that will focus on genetics and personalized medicine.

Berkeley's program is the first mass genetic testing by a university and quickly brought national attention and an outcry from professors and public interest groups, including the Council for Responsible Genetics. The program's proponents, including Dean of Biological Sciences at the University Mark Schissel, have claimed that the testing will be voluntary and anonymous, that sufficient safeguards are in place to protect the privacy of the information, and that subsequent forums would be available to students to build an understanding of such information and put it in context.

Critics have countered that by offering voluntary educational forums only after the DNA sample has been collected, students will be unable to make informed decisions regarding participation in the program and the utility of these genetic tests, that the structure of the program is inherently coercive and that the program is likely to exaggerate the role of genetic information in medicine.

In an open letter to the University, the Council for Responsible Genetics decried the lack of ethical considerations prior to adopting the program and argued that many of the suppositions behind the program including the statement by the University that "(T)he information Berkeley students will glean from their genetic analysis can only lead to positive outcomes" were "woefully naïve" as to the many opportunities for and documented instances of the misuse of genetic and other medical information and the security of de-identification techniques. The letter further noted that:

> "[T]he American Medical Association, the American Society for Human Genetics and the American Clinical Laboratory Association have all issued strong statements against direct to consumer genetic testing and recommended that a genetics expert be involved in ordering and interpreting genetic tests, consumers be made fully aware of the capabilities of genetic tests, the scientific evidence on which tests are based be available and stated so that the consumer can understand it, the laboratories conducting the tests be accredited, and consumers be made aware of privacy issues associated with genetic testing. It is particularly troubling that the announcement of this program should come just days after the Food and Drug Administration (FDA) forced Path-way Genomics to pull its genetic testing kits off Walgreens pharmacy shelves for being unapproved and making unvalidated claims and the House of Representatives Energy and Commerce Committee began an investigation of the claims made by these companies."

In an analysis of the program in the *Chronicle of Higher Education*,[1] Berkeley Professor Troy Duster argued:

> Might a Berkeley freshman get a false understanding of his or her reaction to alcohol, or intolerance for milk, or need for kale? Well, possibly, but that is not the main point. Rather, the substantial intellectual risk is that they'll be institutionally introduced into misunderstanding the precision, interpretation, and historically problematic execution of such research, and the subtle, unexamined undercurrent of coercion in their participation. Until students have a firm comprehension of all those aspects, such projects shouldn't be planned.

Critics additionally attacked the lack of an open process in adopting the program and the seemingly blatant conflict of interest and absence of academic independence in the program's inclusion of a contest with a prize of a full genetic screening by the direct-to-consumer genetic testing company 23andMe, a company on whose Board of Directors one of the faculty sits.

The University has since decided to eliminate the contest but they have failed to properly address the serious concerns of many over the close commercial biotech connections of the professor leading the University's genetic testing program, Jasper Rine. Professor Rine is the founder of several commercial biotech companies (and has served as a consultant for others), including founding his own genetic testing company (Vita Path Genetics) less than a year ago. Indeed, Professor Rine was on a tenure committee that denied tenure to a scientist (Ignacio Chapel) who was critical of a deal several years ago between Berkeley and Novartis and Rine (who was a vocal critic of Chapel) was heavily criticized for having a conflict of interest because of his biotech ties. Furthermore the University has attempted to quell concerns over the funding of the program by claiming the funds will not come from existing University funds but has raised new concerns since these private donations are apparently anonymous.

Despite all the criticism, Berkeley has decided not to cancel the program, or even delay it with further consideration, but continue the program without delay. Writing in *Inside Higher Ed*,[2] Vanderbilt University Professor Jane Robbins finds that:

> Minding my teaching that we should not make assumptions, particularly about motive (although we can often unpack motive from evidence)…at the very least, it seemed that UC Berkeley did not think this through. That alone is a failure of ethical responsibility, and one of the lessons about how ethics failures occur.

Perhaps that can be the topic of next year's program for the class of 2015.

***Jeremy Gruber**, J.D., is President and Executive Director of the Council for*

Supreme Court Lifts Ban on GM Alfalfa

By Magdalina Gugucheva

In *Monsanto v. Geertson,* the Supreme Court of the United States removed a nation-wide ban on the continued sale and cultivation of Roundup Ready alfalfa, a Monsanto-developed genetically modified (GM) crop. The ban was originally implemented by a lower court in response to environmental concerns voiced by a coalition of plaintiffs. These groups included the Center for Food Safety, environmental activists, and farmers of conventional and organic alfalfa. While statements declaring victory have been issued by parties from both sides of the lawsuit, the Supreme Court opinion itself says actually very little about the future of biotech crop regulation. However, the decision is highly protective of the U.S. Department of Agriculture's discretion and authority to make major regulatory decisions governing GM crops. Given the USDA's history of ignoring environmental concerns and poorly enforcing existing environmental laws, biotech firms are likely to end up the biggest winners in this protracted litigation.

Facts & History

Roundup Ready crops are genetically modified (GM) to express a gene that allows the plant to survive exposure to the herbicide glyphosate ("Roundup").

Glyphosate was introduced to the United States in the 1970s, and has been the most used herbicide in this country since at least 1980. The chemical is incredibly potent, capable of killing almost any plant sprayed. In addition to its potency, Glyphosate's popularity primarily comes from how environmentally friendly it is compared to other pesticides. However, glyphosate can also be deadly to the crops it is sprayed on, usually requiring that it be used only at certain times during the growing cycle, and forcing farmers to use other, more harmful pesticides during the rest of the year.

Monsanto solved this problem by genetically engineering crops to include a gene from bacteria that makes the plants immune to Roundup's toxic effects. Starting with soybeans in 1996, Monsanto's list of Roundup Ready crops has grown to include cotton, canola, sugar beets and alfalfa, with wheat still in development.

Overview of Laws Regulating GM Crops

APHIS, an agency within the U.S. Department of Agriculture (USDA), has assumed authority to regulate GM crops, including Roundup Ready crops, by classifying them as "plant pests." Under the Plant Protection Act (PPA), plants pests are considered "regulated articles," and therefore any entity proposing to release these organisms into the environment must obtain a permit first. Obtaining a permit is difficult, however, and so long as GM strains remain regulated few farmers can actually plant them. The period when such permits are issued is called a "regulated release."

After a regulated release, APHIS will usually accept petitions to grant the GM crop de-regulated status. Deregulation means firms and farmers can freely sell, plant and cultivate that GM crop. Or, APHIS can choose to de-regulate only in part, permitting more wide-spread planting and distribution without a permit while still requiring that farmers and handlers comply with containment protocols.

In making these de-regulation decisions APHIS is required to comply with the National Environmental Policy Act of 1969. This law mandates that federal agencies prepare an environmental impact statement (EIS) prior to undertaking any "major Federal action[n] significantly affecting the quality of the human environment." What constitutes "major" can be open to interpretation, however, and often agencies like APHIS will complete less rigorous and time-consuming "environmental assessments" (EAs) first. If an EA results in a "Finding of No Significant Impact," an EIS is not required in order for the agency to implement the proposed decision – in this case, a decision to de-regulate a GM crop.

Current Roundup Ready Regulation & Controversy

Thus far, Roundup Ready crops de-regulated by APHIS include cotton, corn, canola, and sugar beet. In other words, the agency has found that these GM crops are environmentally safe. On the basis of findings from EIS reports prepared for these previous de-regulation decisions, APHIS determined that no EIS was necessary for Roundup Ready alfalfa. APHIS made a similar determination for Roundup Ready sugar beets on the basis of only an EA, a decision still being litigated in a San Francisco federal district court. Since the agency had determined Roundup Ready corn and cotton were environmentally safe, it reasoned that alfalfa should be, too.

Scientists and environmental rights activists disagreed. Aside from concerns that heavy glyphosate use may affect human endocrine function and interfere

with reproduction, these groups cited two main environmental concerns with glyphosate usage. First, they were concerned that "gene flow" might occur, where the seeds or pollen from the genetically modified crop would spread and interbreed accidentally with wild, conventional or organic alfalfa strains. Once contaminated with the transgene, it can be extremely difficult and very costly, if not impossible, for organic and conventional farmers to restore their unmodified crop. Because many of these crops are sold or exported to buyers who refuse to purchase genetically modified foods, transgene contamination can be devastating to farmers.

The second, and arguably greater, concern over Roundup Ready crops is that the vastly increased use of glyphosate has encouraged the development and proliferation of Roundup-resistant weeds. Therefore, while APHIS may have assessed correctly that the introduction of a small number of Roundup Ready crops may not significantly harm the environment, as Roundup use expands to include a wider range of crops, its environmental impact is dramatically exacerbated. As more resistant weeds develop and proliferate, use of harsher and more toxic herbicides becomes necessary. As a result, any environmental benefits of Roundup use are lost.

Current Lawsuit

The Center for Food Safety, along with conventional alfalfa seed farms and other environmental groups, filed a lawsuit in 2007 claiming that APHIS's EA did not adequately address environmental consequences stemming from gene flow and glyphosate-resistant weeds. Judge Breyer of the Northern District of California agreed, ruling that APHIS had violated federal law in fully de-regulating Roundup Ready alfalfa. Instead, the agency should have completed a thorough investigation of the crop's potential environmental impact. Ordering APHIS to execute an EIS, the Court prohibited the agency from issuing *any* deregulation – even a partial one – until this comprehensive report was complete. The District Court also banned all sale and planting of GM alfalfa pending EIS completion. The Court did allow for the harvesting of any Roundup Ready alfalfa already planted in the U.S., not wanting to unfairly burden farmers who had originally relied on APHIS's deregulation decision and purchased or planted seed. However, the Court did specify strict containment procedures for these crops.

Monsanto appealed, but the 9th Circuit agreed with Judge Breyer and upheld the order. The Supreme Court, however, disagreed with these previous decisions. Writing for the majority, Justice Alito said Judge Breyer's bans exceeded the measures necessary to protect the environment. While upholding the District Court's first order, which returned GM alfalfa to regulated status, the Supreme Court reversed the last three orders. It reasoned that APHIS should still be able to issue a partial, rather than whole, deregulation of GM alfalfa if it found no significant environmental impact would result. In other words, while a total deregulation might require an EIS, a partial deregulation – allowing widespread planting subject to containment restrictions – might not pose an environmental risk requiring a rigorous and time-consuming EIS. APHIS should be free to explore in a less intensive environmental assessment whether partial deregulation would pose a significant environmental impact.

Implications of the Supreme Court Decision

So what does this mean for the future of GM alfalfa? It's hard to say just yet. In his dissent, Justice Stevens points out that the District Court's opinion is itself a bit confusing. Perhaps, he argues, Judge Breyer does not purport to issue such broad restrictions on APHIS's ability to partially deregulate, but only tries to specifically prohibit APHIS's proposed deregulation. Justice Stevens explains that maybe Judge Breyer meant to allow more limited deregulation to go forward with only an EA. Thus, it's possible that on remand Breyer will merely clarify this order, rather than making any changes.

The Supreme Court opinion does not leave much other room for Breyer to maneuver, however. Therefore, it is likely that when the case goes back to the District Court, he will only be able to issue an order preventing complete deregulation without an EIS. Any decision will likely leave it to APHIS to decide, subject to federal rulemaking protocol, whether and how much of a partial deregulation is appropriate. Furthermore, the Court's decision will likely constrain the upcoming ruling on whether GM sugar beets can be planted while an EIS is pending for that crop.

In other words, the Supreme Court opinion defers most of the decision regarding GM alfalfa regulation to APHIS. And, according to Justice Alito, APHIS will likely issue a partial deregulation that closely mirrors the proposed order the agency gave Judge Breyer in 2007. This rule would allow a large expansion in the amount of Roundup Ready alfalfa planted nationwide, greatly exacerbating the potential problems of gene flow and herbicide resistance. Furthermore, APHIS's limited resources make it unlikely the agency will able to inspect and enforce any containment rules it does implement. The agency has done a poor job of encouraging compliance among farmers and distributors in the past – even in the first two years of alfalfa de-regulation (before the lawsuit was filed), there was already evidence of gene flow to neighboring hay fields. Therefore, partial de-regulation might just amount to "full de-regulation subject to [unenforced] certain restrictions."

Nevertheless, Justice Alito points out that environmental groups can file a separate lawsuit to challenge any future decision by APHIS to fully or partially deregulate. If they do file another suit alleging NEPA violations, environmental groups and farmers can request that the court issue a preliminary injunction – a temporary order halting the deregulation process until the lawsuit is resolved. This may happen; but again, it's only a stop-gap on the road to what APHIS's previous decisions suggest will be full deregulation. And while the Supreme Court's decision in this case only explicitly addresses procedural issues – mostly about when and how courts can issue injunctions – the opinion does hint at the Court's likely allegiances with respect to GM crops, biotech and environmental concerns more broadly. Thus, when future battles over GM regulation hinge on the actual merits of deregulation decisions, rather than procedure, it seems unlikely that today's Court will be very sympathetic to concerns about the environmental impacts of these novel crops.

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In Vitro In Vivo In Venter

Craig and Synthia's Big Day Out

By Jim Thomas

There's a new version of an old joke going around: A recently deceased geneticist is being shown around the labs in heaven by St. Peter when he happens to look through a window and sees Craig Venter working away at the celestial lab bench. "I didn't know Craig Venter had died," says the geneticist. "He hasn't," replies St Peter. "That's God - he's just playing at being Craig Venter."

For those who hadn't previously heard of gene tycoon J. Craig Venter, the near saturation media reporting attending his latest lab experiment would have briefly given this niche joke a pretty wide audience. On the 20th of May 2010, the journal *Science* published a paper which included Venter among the authors, describing the 'creation of a bacterial cell controlled by a chemically synthesized genome'. A team of scientists bankrolled by Venter's private commercial company, Synthetic Genomics Inc, had built the world's longest strand of manmade DNA and inserted it into a bacterial cell which in turn had assumed the identity of the synthesized genome (a goat bacteria called mycoplasma mycoides) going on to reproduce as such. "This is the equivalent of changing a Macintosh computer to a PC by inserting a new piece of software," as Dr Venter likes to explain. Unusually for a genetics project the software, the DNA, was entirely manmade—all million base pairs of it. ETC Group nicknamed the new organism Synthia—a name which got widely picked up in the press, especially the UK press—much to Venter's irritation, it seems.

Venter, whose mastery of public relations outpaces even his scientific skill, had spent several years priming the press for exactly this paper and missed no opportunity to play up the importance of Synthia in front of the public and investors alike. Within 24 hours, Google News recorded over 1,000 different news stories on the topic and Venter himself was doing the rounds of news stations: CNN, BBC, Fox, Al Jazeera. The UK's Channel 4 news declared it "the biggest scientific story in history" while veteran inventor Freeman Dyson declared the news "a turning point in the history of our species and our planet." Meanwhile, veteran geneticists were less impressed. "Craig has somewhat overplayed the importance of this," said David Baltimore of Caltech. Others pointed out that the Venter team had merely copied an existing genome and added it to existing cellular machinery, mimicking life but not creating it. "Printing out a copy of an ancient text isn't the same as understanding the language," admonished George Church, arguably the leading pioneer of DNA synthesis.

Was Venter playing God? One transhumanist ethicist at Oxford, Julian Savulescu, said he might be, so all the press duly quoted him. Spokespeople for world religions, including the Vatican, chose wisely to hold their fire on judging the meaning of Venter's experiment until after the smoke from the theatrical launch had cleared. Others noted that synthetic biology of this sort allows for creation of dangerous bioweapons and environmentally damaging biofuels – which it does and did even before Synthia hit the scene. However, much more practical commentary on the 'meaning' and significance of this particular breakthrough did find its way into broader discussion.

For a start, Venter's announcement meant a lot more money for Craig Venter. Already touting his $600 million deal with Exxon to make synthetic algae for biofuels and his undisclosed deal with BP to turn coal into natural gas using microbes, Venter went on to unveil a new deal with pharmaceutical giant Novartis to use Synthetic Biology to produce next season's influenza vaccine. Instrument maker Life Technologies, Inc., who had kindly donated half a million dollars to Venter's supposedly not-for-profit outfit The J Craig Venter

DNA and Tribal Citizenship,
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membership. However, the desire to use DNA is telling and reinforces a blood narrative of identity utilized in blood quantum determinations and reliance on descendancy. JoAnne Barker, Eric Beckenhauer, and Kimberly TallBear[15] have all pointed out the inadequacy of using notions of race and population to understand indigenous peoples, but what other alternatives do we have than continuing down the rabbit hole of blood? If our kinship connection is biological, what ideas do we have that are not blood or DNA to understand identity and belonging? Culture is arguably environmental, and in the classic nature versus nurture argument, both contribute to individual and tribal identity. Even given that race is not biological, but a social construct, tribes need to construct a type of belonging that honors ancestry but also adapts to changing contexts, including nationalism.

In truth, our identities are not determined by our genetics, but both genetics and culture/environment play parts in how we develop identities. This legislation by the EBCI halts the natural evolution of identity and represses those who do not have a connection to an inconsistent census roll, the Baker Roll of 1924 in this case. The identities of the people and community are caught up in one another, and altering the understanding of a person invariably alters the community identity. While each tribe maintains the sovereign right to determine citizenship, the use of genetics should be thought out thoroughly before its limitations are applied. In this case, using genetics and altering the understanding reproduces acts perpetrated on Natives for centuries: acculturation, termination, essentialization, blood quantum rules and eligibility restrictions. Except now, we are doing it to ourselves.

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Neanderthal DNA and Human Identity
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an important question regarding the distribution of Neanderthal DNA in a racially intermixed country like America. The question was:

> "If Neanderthals mated with non-Africans, but throughout history Non-Africans have been mating with Africans esp [*sic*] in America, would this mean that only Africans who are in Africa whose ancestors had no contact or mated with only other Africans would only have there [*sic*] genomes be pure from Neanderthals' DNA? As opposed to ones who have white ancestor in them?"

What does this discovery mean for populations with partial European ancestry? Might these groups also possess Neanderthal DNA? Interestingly, ancestry-testing specialists estimate that, on average, African Americans posses 18.5 % European DNA.[14] This potentially means that if you were to compare the full genomes of African-Americans with the Neanderthal it is likely that many would also have genetic ties to this ancestral hominid.

Given these public reactions it seems that knowledge of the interbreeding between humans and Neanderthals has shaken up what many believe constitutes the modern human and has also provided new data for thinking about the novelty of our species. It also appears to be the case that discussions about the Neanderthal genome inevitably animate concerns about racial difference and religious claims about human origins. It is as though science, religious belief, and ideas about race share a deep and unspoken bond made explicit when knowledge about the uniqueness of our species is called into question. Yet, in an interesting way, the Neanderthal genome presents us with a telling reversal of history where having "pre-Adamite" relatives might just be a mark of distinction rather than inferiority.

But before labs start direct-to-consumer testing for Neanderthal DNA we have to keep a couple of things in mind. Additional genomic sequences to verify the findings of the Neanderthal Genome Project have yet to be made, and the Project claims only to have constructed a "draft" of the Neanderthal genome. Nevertheless, these limitations haven't prevented excitement around this discovery, as it appears that the Neanderthal DNA within present day humans was positively selected.[15] This is to say that the DNA acquired from Neanderthals once provided functional advantages to our human ancestors. Large bodies, big brains, and plenty of aggression were surely valuable attributes in pre-historic times. However, geneticists have also discovered that Neanderthal DNA within present day humans seems associated with metabolic and cognitive functions that cause diabetes, Down Syndrome, Autism and Schizophrenia.[16] Clearly these are not "positive" traits to be lauded.

Geneticists still have not ruled out whether African populations also possess ancestral hominid DNA—much like the Neanderthal discovered in Croatia—hidden somewhere between the 3 billion DNA base pairs that make up their genetic identity. Humans could have mated with ancient hominids prior to the "Out of Africa" event and we just haven't found their fossil remains. Nor is it clear if blacks with European ancestry in the Caribbean, South America or other parts of the African Diaspora also posses Neanderthal DNA.

Ultimately, the presence of Neanderthal DNA—or any other ancestral hominid—within a living person today merely offers us a new lens for an ever-broadening understanding of our genetic diversity and our species identity. This should ultimately be embraced as yet another testament to the *collective* uniqueness of the human race.

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Educating Emerging Leaders in Biotechnology and Medicine

BY MAGDALINA GUGUCHEVA

"To educate a man in mind and not in morals is to educate a menace to society."
- T. Roosevelt

I stopped scribbling. Sinking back into my cool seat, I let my gaze drift away from the fluorescent power point projection and out into the calm darkness of the lecture hall. Class was nearly over.

"And . . ." Almost as an afterthought, the professor continued: "... these techniques aren't just valuable when we want to create transgenic mice. The cool thing is that they are applicable in human genetics as well – for example, couples with a family history of cystic fibrosis can use the same procedure to select for healthy embryos when they go to have kids. Pretty soon, when we have a better understanding of human genetics, we'll be able to select for a wide range of traits in our offspring..." RING. Class dismissed.

Hundreds of aspiring physicians and future biologists rose, slowly herding out of the lecture hall. I remember remaining in my seat. It was my first semester of college; I was eighteen years old, newly arrived in New York City's Greenwich Village, and I was taking my first molecular biology class. Like the students around me, I was an eager and aspiring young scientist, enraptured with the marvels of human genetics. But that day's lecture – maybe halfway through my first semester – gave me pause. *How could the professor end a lecture like that? How could he be so cavalier – so naively optimistic – about a technology with such broad social and ethical implications? Wasn't there more to say, to question, to discuss?*

I remember looking at the faces moving around me – faces of future leaders in genetics and medicine – and not one appeared disturbed or puzzled. If we had the power, the technological know-how, to intervene and improve the human condition – why, of course we would do it. But what does it mean to improve? What potential adverse consequences might await patients who choose to undergo these procedures—or those who *don't* choose, but will live in a society where these practices are commonplace? Why was no one asking about this in my class? Why didn't the professor acknowledge these questions and *get his students to start asking*?

Three and a half years later, I finished my undergraduate education in molecular biology without once encountering these debates in a biology classroom, despite the many technologies I learned about that would have merited such a discussion. Had I not developed an interest in bioethics on my own, I would have walked away under the impression that advances in genetics were undoubtedly the future of medicine, that genes and disruptions at the molecular level were the primary cause and treatment target for disease, and that every technological development in genetics held tremendous, unbridled benefits. I furthermore would have left my undergraduate education without any account of the dark history of the field of genetics. I would have never learned about the eugenics movement and its deep institutional ties to today's research. I would have never questioned the method or virtue behind the allocation of money that was funding my professors' research, and therefore the social value of their research. I would have never wondered whether real lives were being saved with those grant dollars, or whether limited government funds might better serve social goals if channeled elsewhere. These are not questions I purport to answer, but they are questions that deserve asking. And they deserve to be asked by and of those who are key players in technological advancement. Addressing ethical and social concerns is essential for training future leaders of any technological innovation, but it is especially critical in one so integral to human health and identity.

Given the current controversy over Berkeley's genetic testing of incoming freshmen, I think the time has come to start examining the ways we educate future leaders in medicine and biotechnology. While bioethicists have heavily criticized Berkeley's project "Bring Your Genes to Cal," accounts from students who will likely subject themselves to the University's testing program tell a different tale. These statements strike a tone of eager enthusiasm toward emerging technologies on the one hand that is paired with ambivalence and dismissal of ethical concerns on the other. One rising freshman quoted in *The Daily Californian*, Berkeley's undergraduate newspaper, stated: "I'm totally for it. No one is forcing me to do it, and there's no real downside I can see."[1] Like many students endorsing the project, he dismissed any privacy or coercion concerns. Instead, his statement exemplifies an excitement among members of his cohort that is utterly lacking in necessary apprehension or critique. Contrast this student's position to the outspoken criticism from bioethicists. Are such polarized positions a product of fundamental ethical disagreements? Probably not. Rather, they demonstrate highly incongruent perspectives in education – where those on one side of the debate have been trained to ask an entirely different set of questions than those on the other.

Comments made by Dean Mark Schlissel, head of Berkeley's Biology Department and one of the leaders behind "Bring Your Genes to Cal," further illustrate this broad gap between science education and social and ethical policy education. In his response to backlash against the genetic testing program, he states that the "rapidity and energy" behind bioethicists' reac-

tion took him "by surprise."[2] No doubt it did – he's not a bioethicist, he doesn't spend his days questioning social implications of genetics research. When his statements met further reactions from faculty on campus who pointed out that he should have consulted more bioethicists in crafting a less ethically questionable project, he responded that Berkeley does "not organize educational programs by inviting all 1,500 professors to participate in the design."[3] In other words, how was he to know he should even seek out input on a program he didn't have a clue would spark a debate? A trained scientist, he may have had little exposure to social concerns associated with emerging technologies. Yet he and his students will be in a position to make similar decisions – decisions about implementing new technologies, initiating novel studies, endorsing changes in medicine and healthcare – without ever thinking to seek ethical input, social policy input, or democratic input. Schlissel's failure to spot and address ethical issues in this program highlights a major gap in the current mode of educating future scientists.

Wondering whether I was really right—whether part of the problem in the polarized debates over regulation of new technologies was merely an issue of exposure in education—I undertook a short survey of biology-related undergraduate curriculum at the top twenty-five national universities in the U.S.[4] Of those twenty-five, only ten universities offered majors in subjects that explored the relationship between science, technology and society (STS) and/or bioethics. Three more schools offered only minors in bioethics-related subjects. Just six colleges required at least one course in bioethics or STS-related subjects of some biology-related majors – but not one school required such coursework of all students majoring in the biological sciences. Furthermore, nine of the top twenty-five undergraduate universities did not even offer a single STS or bioethics-related course – not one – as at least an *elective* that would count toward any biological science major.

To be fair, bioethics courses at these schools might be offered through other departments. Such courses can always be sought out by students who already have an interest in bioethics or STS, and they can always be taken as a general elective. That's what I did in undergrad. But I also had to jump through quite a few hoops: the two courses I took were offered as sociology department seminars available to majors only, and so I had to persuade professors to let me enroll even though I was not majoring in sociology. In other words, I had to have a pre-developed interest strong enough to individually pursue exposure to bioethics and STS issues.

But the point of educating future researchers in ethics is not to help them explore issues they already have questions or concerns about; it's about expanding students' understanding of their field, their assumptions and the values they take for granted. Students should be shown how to question and scrutinize the premises of their work. That reflection, paired with a broader understanding of one's role in a society – beyond that the immediate professional role in the narrow context of one's career and his immediate peers – this is what liberal arts education should be about. Yet while colleges in the United States have largely expanded science and math education, requiring humanities majors to complete more math and science courses, they have utterly failed to provide that same breadth of perspective to future scientists. In a world increasingly shaped by genetics research and technology, might this gap not bring potentially disastrous consequences?

Look at business and finance. In the wake of the financial crisis, business schools have scrambled to expand their ethics curricula. It might have taken an economic disaster, but educators realized that ethics education is critical to training future leaders – leaders who will undoubtedly wield tremendous power and make decisions carrying broad social consequences. Yet, when the novel financial instruments many blame for the financial meltdown were being innovated, no one was thinking about educating business students in corporate and social responsibility. Ethics was for the policymaker and the regulator, not the innovator. Innovation, however, has always raced ahead of regulation. At least in business, educators realized this meant an internal check was needed.

The parallels between finance and biotech are not hard to see. As education in these technical and complex fields becomes more specialized, and as expertise and segmentation within the profession grow, more and more ethical decisions simply evade regulatory oversight. Self-regulation becomes the only feasible way to put a check on questionable new technologies. Those whom we might require to self-regulate, however, are so energized and excited – intoxicated – with the progress of their fields that we can't reasonably expect them to remember to hit the brakes. The problem is not unlike the intoxicating profits reaped by the banks when they innovated new ways to move money around, with no one motivated to question the ethics.

Does that mean, then, that we ought to wait for our own major crisis – perhaps an environmental disaster spawned by GM crops, or a major privacy and security breach from DNA databanks, or a health crisis relating to overzealous application of novel genetic therapies – before we can reexamine how we train the future leaders of bioscience?

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