

Recreational genomics; what's in it for you?

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“But remember throughout that no external cause is efficient without a predisposition of the body itself. Otherwise, external causes which affect one would affect all . . .”—Galen, 129-200 CE.

Nearly two millennia ago Galen presciently introduced the concept of personalized medicine. Now, thanks to rapidly accelerating technology, the ability to live an examined life is at hand in a way that Socrates couldn't have dreamt of. Analyzing an individual's genome at 1,000,000 sites has become an afternoon's work and full genomic sequencing of the individual will soon be practical if the National Institutes of Health's "\$1000 genome project" is even marginally successful.¹ The resultant deluge of Genome-Wide Association studies in the medical literature promises to be a considerable boon to individualized medicine; allowing us to optimize disease screening, identify novel drug targets and illuminate the fundamental etiology of common diseases.²

But while the medical community is trying to figure out how to use this information to improve health, the private sector is rushing to satisfy our drive to know ourselves in this new way with a variety of boutique genotyping services. These offerings, widely publicized in the popular press, promise to analyze the consumer's genome for between \$1000 and \$2500, illuminating everything from their ancestry and ear-wax type to their risk for prostate cancer.³

Most of us view our genetic information as somehow special, in a way that our chest x-ray or electrolyte panel is not, and we thus (rightly or wrongly) accord it a special status; call it the "DNA R Us" attitude. As such potentially powerful information slips the bounds of the traditional academic or health care setting, it behooves us as physicians, patients, and consumers to ask what we are really likely to discover about ourselves with such individualized analyses. Broadly speaking, what are we likely to find out after having sent our DNA and credit card number to one of these new companies and received in return such a genetic report?

THINGS THAT ARE USEFUL TO KNOW

At least for now, useful results from such analyses with actionable implications will be rare. Many alleles that predispose

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Disclosure: The author declares no conflict of interest.

Submitted for publication July 3, 2008.

Accepted for publication July 3, 2008.

DOI: 10.1097/GIM.0b013e3181859959

to disease are identifiable but the overwhelming majority of them confer odds ratios of between 1 and 2.⁴ We have not the faintest idea of how to counsel a patient who has an odds ratio of 1.3 for prostate cancer. Moreover, the claim that such information will lead to favorable behavioral change is largely unsupported. And a concerning parallel reality is often overlooked: for everyone who is found to be at increased risk for some malady and thus might be persuaded to favorably modify their lifestyle, we will identify many more individuals who are not at increased risk. Will these individuals mistakenly feel genetically justified in pursuing unhealthy lifestyles? If our goal is really to improve the public's health, common sense advocacy of healthy habits is likely to be far more efficacious than overly simplistic and ill-informed "tailoring" of our advice through dubious genetic analyses.

THINGS WE ALREADY KNOW

One of the prominent commercial offerings currently available⁵ lets us know that their genetic profile of your DNA will inform you what color your eyes probably are. With apologies to Dave Barry, I'm not making this up. The chief scientific officer and narrator of the website's virtual tour helpfully informs us that his DNA analysis reveals that his "chance of having brown eyes is 67%!" I don't know about you, but I'd prefer the increased certainty and reduced cost of looking in the mirror to acquire such information. Likewise, learning that we are at risk for heart disease and that we should exercise and eat right is hardly new information for a US citizen if they glance at any available demographic table.

THINGS WE DON'T REALLY WANT TO KNOW

This is a potentially disturbing but very real category of information that we are sure to acquire from such analyses. Reasonably reliable genetic testing for predisposition to Alzheimer disease has been available commercially in the form of *ApoE* genotyping for many years now.⁶ Yet, the combination of the imperfect probabilistic nature of such information and the utter lack of validated means to alter that risk, make most individuals justifiably leery of acquiring such "information." Genetic predictions are only probabilities, and like roulette, must be approached with caution. Cashing in your retirement fund early because you are at an increased risk of Alzheimer Disease is a good way to end up destitute when you "luck out" and your predisposition to this disease fails to materialize. Medicine's ability to prognosticate always exceeds its ability to intervene and genetics only widens this gap. Individuals—whether pa-

tients or consumers—deserve a clear discussion of whether they actually want all the information that can be obtained.

THINGS THAT AREN'T TRUE

Given the high incidence of false positive results in Genome-Wide Association studies, some purported risks that are relayed to consumers will be nothing more than the predictable artifact of multiple testing on a grand scale and will never be replicated or validated.⁷ Moreover, even when a particular risk allele is validated in a given population (e.g., those of western European descent), there is little guarantee that such information can be reliably generalized to individuals who derive from ancestrally distinct populations.⁸ Thus, members of minority groups in the United States population who avail themselves of such offerings may receive results of even less utility than their counterparts who descend from more studied groups.

THINGS YOU DON'T WANT OTHERS TO KNOW

For good or for ill we accord our DNA a special status, which implies a desire to protect that information from commercialization or prying eyes. What assurances do you have in this digital age that when you send your cheek swab to a company that your genomic information will not be sold, shared, or simply inadequately protected?

THINGS THAT ARE FUN TO KNOW

This, finally, is what is likely (and understandably) driving much of the interest in boutique genetics. Such analyses are advertised as offering the ability to track one's ancestry and discover how much of your genome you share with friends, family and "famous scientists like Craig Venter."⁵ Such pursuits may be genetically naïve, but are arguably harmless and fun. However, in a more disturbing vein, a cofounder of one prominent venture, 23andMe, has declared "We envision a new type of community where people will come together around specific genotypes and these artificial barriers of country and race will start to break down."⁹ Frankly, I'm skeptical that humans really need more reasons to form mutually exclusive groups, this time based on what particular version of a genetic variant they possess. Haven't we been down that road before? Given the gut-level appeal of such nonsensical attitudes

about genetics, the rather frightening threat of yet a new "ism" . . . allelism, seems alive and well.

Breathtaking advances in genomic analysis hold great promise for our understanding of disease and could ultimately transform the practice and delivery of medicine.¹⁰ Moreover, there is nothing inherently problematic about the private sector entering the field. Indeed, one need look no further than the history of the human genome project to see how beneficial nonacademic entrepreneurial efforts are in accomplishing grand goals.

But uncritical enthusiasm for new genomic technologies seems to be driving the emerging phenomenon of recreational genetics, with the potential to misinform, divide and harm those who might be better off pursuing less expensive parlor games. We should take care not to confuse entertainment with useful medical information. Doctors and purveyors of this promising technology must seek to do more than turn a profit from poorly informed consumers; we must work to see that such information is thoroughly understood, applied appropriately and used for real benefit.

ACKNOWLEDGMENTS

The author was supported, in part, by the ELSI Research Program of the National Human Genome Research Institute of the National Institutes of Health, Grant Number P50HG004488.

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