ONLY CONNECT **Nicholas A Christakis**

Medicine may change our genes

The prospect of medical technology modifying genetic evolution is as amazing as it is troubling

A lot of hot air is around at the moment—and quite a bit of overselling—about advances in genetics, personalised genomics, and gene therapy. Only a small part of the variance in human illness is explained by genetics; most is explained by lifestyle, behaviour, and social factors such as poverty. Yet large sums are spent in a quixotic pursuit of the genetic basis for everything.

The hope—some say fear—is that we will be able to use advances in medical technology to reshape the genome of individual patients, curing ailments by changing somatic genes. Some even hope that we will be able to modify our species for the better by introducing changes into our germline.

Ethicists hotly debate this topic, arguing about the case for or against “perfection.” Do we have the right to develop technologies that would allow us to change the human genome? Some would say this is a duty. After all, if we could develop a genetically based treatment for patients with sickle cell disease, cystic fibrosis, or diabetes, who would not support that?

But overlooked in all this debate is the ways in which—just possibly—medical advances may already be changing our genes at the population level.

It used to be thought that our genes were historically immutable and that it was not possible to imagine a conversation between culture and genetics. It was thought that we as a species evolved over a timescale far too long to be influenced by human actions. But evidence has been mounting for the past decade that we as a species are evolving genetically in real time, under the pressure of discernable social and historical forces.

The best example so far is the evolution of lactose tolerance in adults. The ability of adults to digest lactose confers evolutionary

advantages only when a stable supply of milk is available, such as after milk producing animals (sheep, cattle, goats) were domesticated. The advantages are several, ranging from a source of valuable energy to a source of necessary hydration during times of water shortage or spoilage.

Amazingly, several adaptive mutations have occurred in widely separated populations in Africa and Europe just over the past 3000 to 9000 years, all conferring the ability to digest lactose. These mutations are principally seen in populations of people who are herders and not in nearby populations who have retained a hunter gatherer lifestyle. This trait is sufficiently advantageous that those with the trait have many more descendants than those without.

A similar story can be told about relatively recent mutations that confer advantages in terms of surviving epidemic diseases such as typhoid in Europe. As these diseases were made more likely when the density of human settlement increased and far flung trade became possible, here we have another example of how cultural change may affect our genes.

Of course, our biology and our culture have always been in conversation. For example, rising socioeconomic status with industrial development resulted in people becoming taller (a biological effect of a cultural development), and taller people required a change in architecture (a cultural effect of a biological development). Anyone marvelling at the small size of beds in medieval houses knows this at first hand. But it seems that it is also possible for genetic change to take place over relatively short time periods.

Why does this matter to medicine? Because many of the things we are already doing may be modifying our genes. Maybe we are all more myopic as a result of medieval lens grinders.

PAUL SCHWARTZ

“**Maybe we are all more myopic as a result of medieval lens grinders. Maybe our bones are weaker since we have had bone setting technology for thousands of years . . . Maybe the introduction of penicillin and childhood immunisation is changing our genes**

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Maybe our bones are weaker since we have had bone setting technology for thousands of years. Maybe the changes in survival of patients with all sorts of conditions that are wholly or partly attributable to single or multiple genes (ranging from sickle cell disease to type 1 diabetes) are resulting in changes in the human genome. Maybe the introduction of penicillin and childhood immunisation is changing our genes. Some have noted that the number of children with Down's syndrome is falling in many industrialised societies as a result of selective abortion. With the onset of personal genetics, it is not hard to imagine this being taken a step further. Medical technology might change our genes indeed.

Medicine is not the only thing doing this in ways relevant to health and wellbeing. There may be genetic variants that favour survival in cities, consumption of alcohol, or a preference for complicated social networks. There may be altruistic genetic variants that favour living in a democratic society. Maybe even the more complex world we live in nowadays really is making us smarter.

Unfortunately, this also means it may be the case that particular ways of living and particular medical technologies create advantages for some but not all members of our species. Certain groups may acquire (admittedly, over centuries) certain advantages. The idea that the application of medical technology modifies what kind of offspring we have is as amazing as it is troubling. However, it provides a way for us to begin to think about the inevitable genetic revolution in medicine that is around the corner.

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MEDICINE AND THE MEDIA

The soap opera that saves lives

A “public health” soap opera has such a large number of fans in South Africa that it is now being rolled out to neighbouring countries. **Jane Cassidy** reports

A soap opera on South African television that is run by public health activists is now to be screened across eight neighbouring countries, with the help of a £14m (€18m; \$27m) grant from the UK government. *Soul City* is watched by more than 34 million people in South Africa, over 70% of the population. In tackling a range of gritty health and social issues, from HIV and AIDS to rape, the drama doesn't pull its punches.

In a country where more than one in 10 people has HIV or AIDS, “edutainment” can play a big role in encouraging people to change their behaviour and in helping to save lives, says the UK Department for International Development, which has supported the shows for the past 13 years.

The *Soul City* phenomenon has spread from television to radio and spawned information booklets, advertising campaigns, and a young people's spin-off series called *Soul Buddyz*, with 3600 Soul Buddyz clubs nationwide. There is a Soul City Institute and a behaviour change communication campaign that sets targets for achieving safer sex practices, higher numbers of people going for an HIV test, greater awareness of management of tuberculosis and HIV, and reducing stigmatising attitudes.

A similar television series in the United Kingdom funded by the NHS, *Kismet Road*—a soap opera that aimed to promote public health issues to the UK's south Asian population—bombed when television companies refused to broadcast it (*BMJ* 2003;326:110). So why has *Soul City* succeeded where *Kismet Road* failed?

Doug Storey, associate director of the

Center for Communication Programs at Johns Hopkins Bloomberg School of Public Health in Baltimore, Maryland, says that *Soul City* is one of the best examples of entertainment education in the world. He said, “The strategy behind successful entertainment education programmes lies in bringing scientists and artists together so that they learn to speak each other's language. As a story script develops, it should be informed by science. *Soul City* does this beautifully; it has mastered the process.”

This synergy can produce results in developing and developed countries. Dr Storey worked on the Radio Community Project in Nepal, which had a big effect on family planning and was one of the first evaluations of an entertainment education project to show population level effects on behaviour.¹ He is also one of a team of researchers convened by the National Cancer Institute in the United States to study how narrative forms of communication are emerging as important tools for cancer prevention and control.²

The Health Communication Partnership at Johns Hopkins has worked with several South African research partners, including the Soul City Institute, to measure exposure to all major radio and television programming on HIV and AIDS to determine how the broadcasting has affected behaviour. A survey conducted by the partnership found that 87% of the 7006 men and women surveyed had some exposure to at least one of six main programmes. It found a relation between condom use and exposure to such programmes in the mass media, with condom use ranging

from 19% among those with no exposure to any programme to 70% among those with high levels of exposure.³

Soul City spokesman John Molefe described the painstaking research undertaken before filming starts to give the programme credibility. This involves teams of local researchers talking to people and grassroots groups about topical issues of concern to communities. Their results are fed back to scriptwriters, who produce storylines that are then tested on viewers to see whether they can relate to the characters, plots, and underlying health messages. The scripts are refined by the best talent from South Africa's television industry before filming starts. “We don't start out by saying we're TV producers,” said Molefe. “We aren't—we're public health activists. We wanted to use the media to impact on people's behaviour.”

Before a controversial topic is tackled, programme makers are careful to prepare for any potential public reaction. So in 1999, before a storyline on domestic violence was screened, *Soul City* worked with charities that support abused women, bracing themselves for a big response from women victims influenced by the drama. A helpline was set up, and training programmes were run for court officials and police to bring them up to speed with legislation that strengthened the right of women to take action against abusive partners. The Stop Women Abuse helpline received 180 000 calls while the programme was on air.

Conny Setjeo is perhaps the soap's most famous actor. After watching one episode before she joined the programme she went

On location in South Africa with *Soul City*, which pulls in a staggering 34 million viewers per episode

for an HIV test and found that she was HIV positive, infected by her former husband. She joined the series after asking programme makers why they were using actors instead of real people. Her experiences were dramatised in episodes screened in 2005 and 2006.

So, why should the UK government help finance the roll-out of the *Soul City* package across countries in the region, including Mozambique, Namibia, Zimbabwe, Lesotho, Botswana, Malawi, Zambia, and Swaziland? A study on achieving the millennium development goals for health, funded by the World Health Organization, concluded that the “best buys” in HIV prevention included mass media campaigns.⁴ South Africa’s Department of Health last year reported a fall in the number of under 20s infected with HIV, from 16.1% in 2004 to 13.7% in 2006, and a similar fall occurred among 20-24 year olds, indicating that a sustained change in behaviour is taking place among younger people with regard to safer sex practices.⁵

Melinda Simmons, head of the UK Department for International Development’s office for Southern Africa, says that the show works because it’s realistic: “It’s not preachy, unlike a lot of initiatives around HIV/AIDS and health. *Soul City* doesn’t draw any conclusions, it simply tells people’s stories really well.”

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- 1 Storey D, Boulay M, Karki Y, Heckert K, Karmacharya DM. Impact of the integrated Radio Communication Project in Nepal, 1994-1997. *J Health Commun* 1999;4:271-94.
- 2 Kreuter MW, Green MC, Cappella JN, Slater MD, Wise ME, Storey D, et al. Narrative communication in cancer prevention and control: a framework to guide research and application. *Ann Behav Med* 2007;33:221-35.
- 3 South African national HIV and AIDS communication survey 2006: overall impact of 14 AIDS communication programmes. www.jhuccp.org/pressroom/2006/11-06.pdf.
- 4 Hogan DR, Baltussen R, Hayashi C, Lauer JA, Salomon JA. Cost effectiveness analysis of strategies to combat HIV/AIDS in developing countries. *BMJ* 2005;331:1431-7.
- 5 Department of Health, South Africa. National HIV and syphilis prevalence survey, South Africa 2006.

WHAT'S NEW ON BMJ.COM

On the blogs

From the other side

Anna Donald, in her From the other side blog, is confronted with a young friend’s death and muses that more life is just more—“And how much more do you need?” but finds that “it really, really matters how you live. Making meaning in the now, for the now—probably the only life insurance policy I’m able to have. It’ll do me just fine.”

Read Anna’s blog entries and the comments they’re getting (well over 80 at the time of writing)

<http://blogs.bmj.com/bmj/category/from-the-other-side/>

Life before death

Meanwhile, providing a different perspective on the same topic, Julian Sheather is moved by photographs at the Wellcome Trust’s exhibition “Life Before Death” in London and wonders whether, in spite of increasing calls in medicine and society more widely for a more honest and open approach to death, our secular culture retains the resources honestly to confront such a topic: Death is... notoriously difficult to think about head-on. Something in us shies away from it...

<http://blogs.bmj.com/bmj/2008/05/09/julian-sheather-on-the-wellcome-exhibition-life-before-death/>

Reflections on rationing

Helen Barratt faces up to the harsh reality of making rationing decisions about medical treatment: “But next time you read a story about a patient being refused a treatment, stop and think about the decision—what would you have done, given the same budget constraints? How would you justify your decision?” We’d welcome your comments.

<http://blogs.bmj.com/bmj/2008/05/09/helen-barratt-counting-the-cost/#more-433>

Last bmj.com poll

We asked:

Does it matter that medical graduates don’t get jobs as doctors?

You replied:

YES 1025 (81%)

NO 246 (19%)

From brain to nuts

The editor of bmj.com, David Payne, reflects on students’ information sharing habits after attending HighWire’s publishers’ meeting in Stanford, California (<http://blogs.bmj.com/bmj/2008/05/08/david-payne-the-demise-of-the-email/>).

And *BMJ* features editor Deborah Cohen attended the Periodical Publishers Association Awards but found that style seems to matter rather more than content. In spite of this (or is it because of this?) *BMJ* columnist Iona Heath and freelance writer Jonathan Gornall were both highly commended in the writer of the year category, business media. Debbie’s conclusion? “Readers, the march from *Brain* to *Nuts* starts here.”

<http://blogs.bmj.com/bmj/2008/05/09/deborah-cohen-attends-the-periodical-publishers-association-awards/>

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