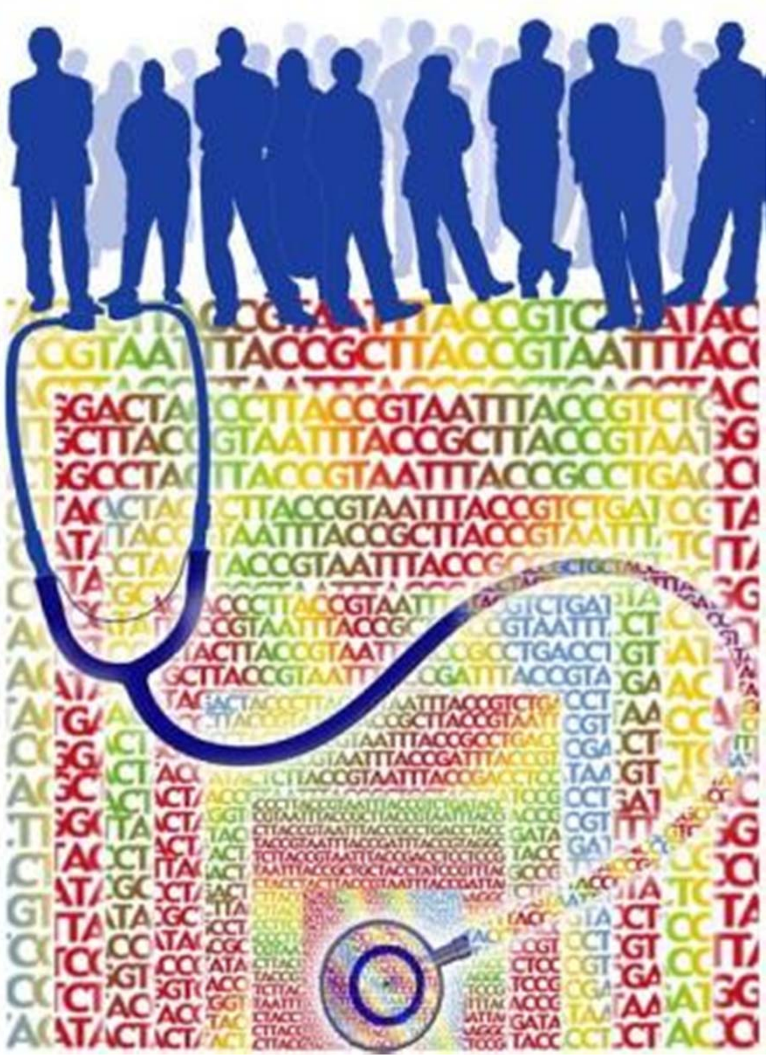
Etika in varnost podatkov

Maj 2014

Zaporedje prvega človeškega genoma je spodbudilo številne etične dileme. Danes je sekvenciranih že tisoče človeških genomov…..

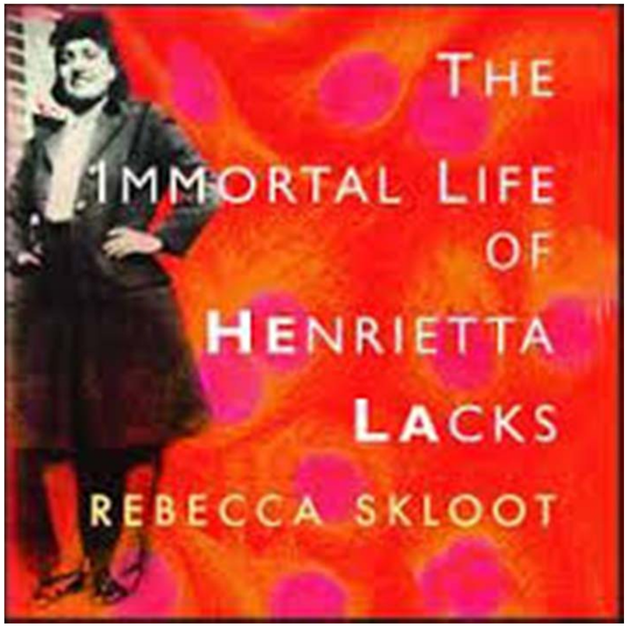


http://massgenomics.org/wp-content/uploads/2013/04/rare-variants-human-1000g.jpg

Nekatera etična vprašanja molekularne medicine

- Reproduktivna tehnologija
- Raziskave na zarodkih
- Genetski determinizem
- Genetska testiranja
- Genetsko rešetanje
- Privatnost genetskih informacij
- Varnost genetskih informacij

Her name was Henrietta Lacks, but scientists know her as HeLa. She was a poor black tobacco farmer whose cells—taken without her knowledge in 1951—became one of the most important tools in medicine, vital for developing the polio vaccine, cloning, gene mapping, in vitro fertilization, and more. Henrietta's cells have been bought and sold by the billions, yet she remains virtually unknown, and her family can't afford health insurance. Soon to be made into an HBO movie by Oprah Winfrey and Alan Ball, this *New York Times* bestseller takes readers on an extraordinary journey, from the "colored" ward of Johns Hopkins Hospital in the 1950s to stark white laboratories with freezers filled with HeLa cells, from Henrietta's small, dying hometown of Clover, Virginia, to East Baltimore today, where her children and grandchildren live and struggle with the legacy of her cells. *The Immortal Life of Henrietta Lacks* tells a riveting story of the collision between ethics, race, and medicine; of scientific discovery and faith healing; and of a daughter consumed with questions about the mother she never knew. It's a story inextricably connected to the dark history of experimentation on African Americans, the birth of bioethics, and the legal battles over whether we control the stuff we're made of.



Etična vprašanja in dileme……..

- Genetsko spreminjanje somatskih celic za zdravljenje bolezni je običajno etično sprejemljivo, ker gre za dobro zdravljenja in je terapiaj fokusirana na posameznega pacienta.
- Genetsko spreminjanje spolnih celic ima številne etične zadržke, ker se potencialna tveganja lahko prenašajo na naslednje generacije.
- Na voljo je vse več genetskih testov. Katere naj uporabimo pri vseh novorojenčkih?
- Kakšna bi morala biti vloga satršev pri odločanju o tem, kdaj naj se otroka genetso testira?
- Kaj storiti v primeru, če bolezen ni (lahko) ozdravljiva oz. če bo zahtevala velik finančni vložek staršev (ki lahko “investirajo” ali pa ne)?
- Kaj v primeru, če je geentski test pozitiven na bolezen, ki se bo pojavila šele v kasnejšem življenju (i. e. Hungtingtonova boleezn)?
- Kaj če test pokaže le verjetnost (in ne gotovost!), da bo otrok (ali odrasel) zbolel?
- Kaj če starši odklonijo testiranje, čeprav je to v najboljšem interesu za mladoletnega otroka?
- Kaj če se starši odločijo za genetske postopke, ki za otroka predstavljajo tveganje za nadaljnje življenje??

…………………………………………..

Nekaj mednarodnih zakonodajnih aktov na področju človeškega genoma in medicine

Human Genome, Medicine and Legislation

U.S.: H.R. 493 – Genetic Information Nondiscrimination Act.

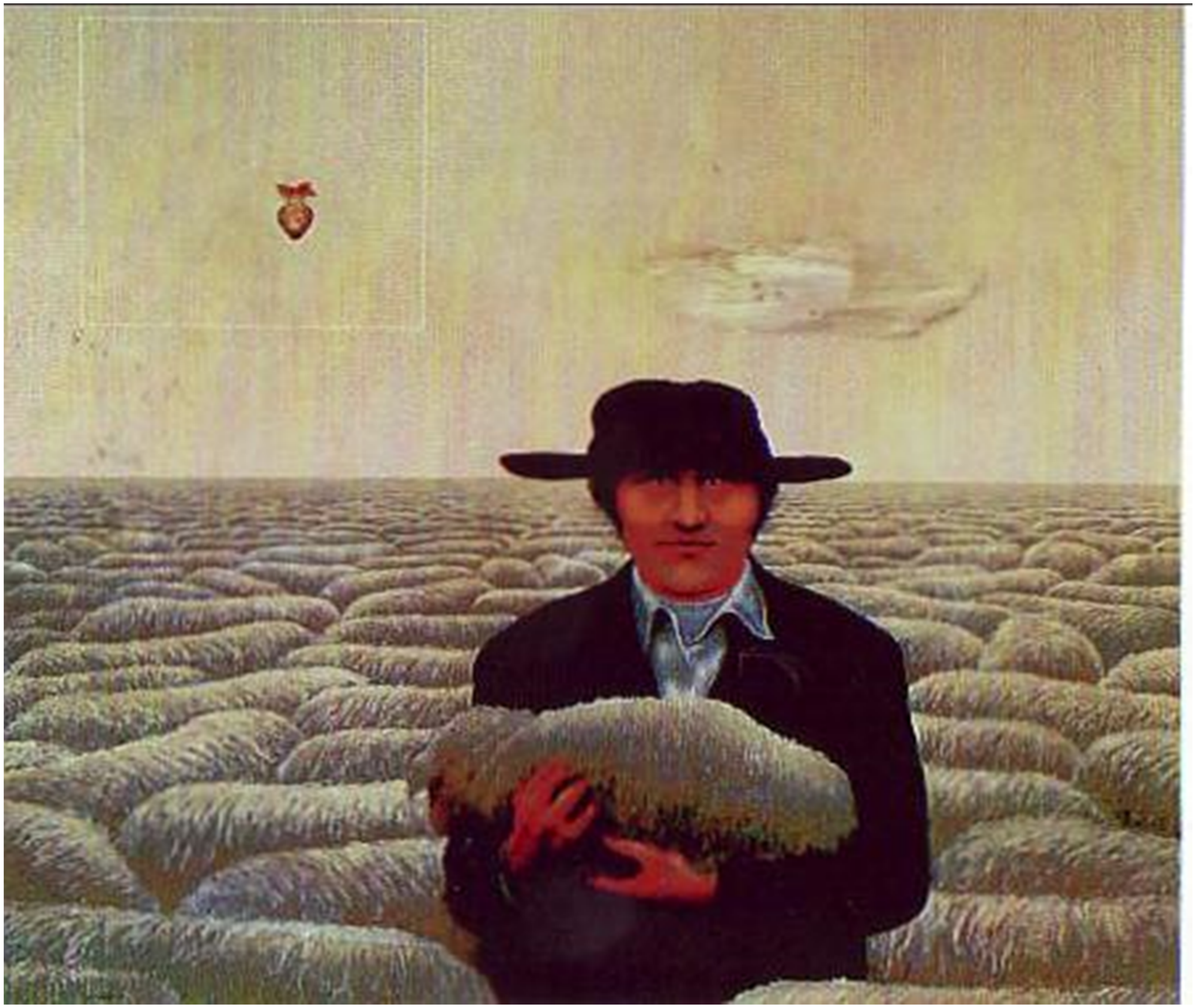
EC Convention for the protection of Human Rights and dignity of the human being with regard to the application of biology and medicine: Convention on Human Rights and Biomedicine.

United Nations Declaration on Human Cloning.

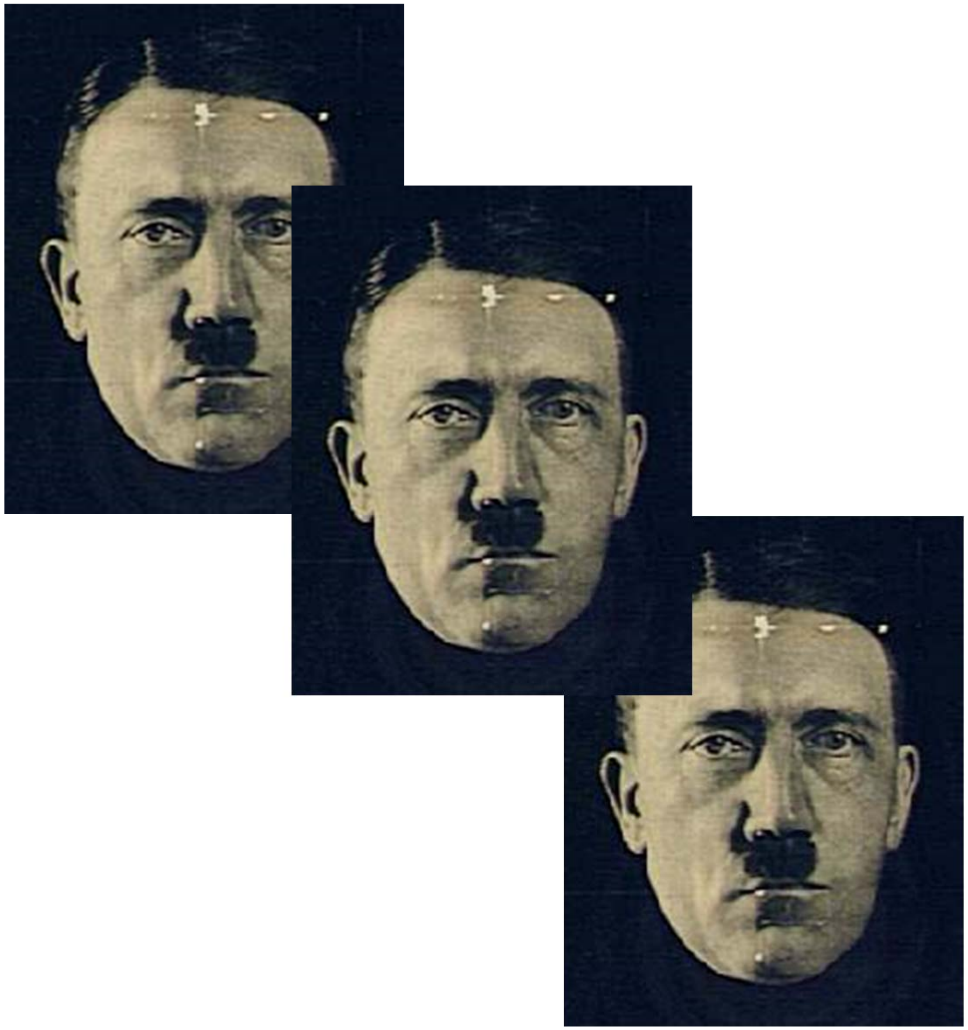
The Islamic Fiqh Academy issued a Fatwā stating that human cloning is prohibited by the faith.

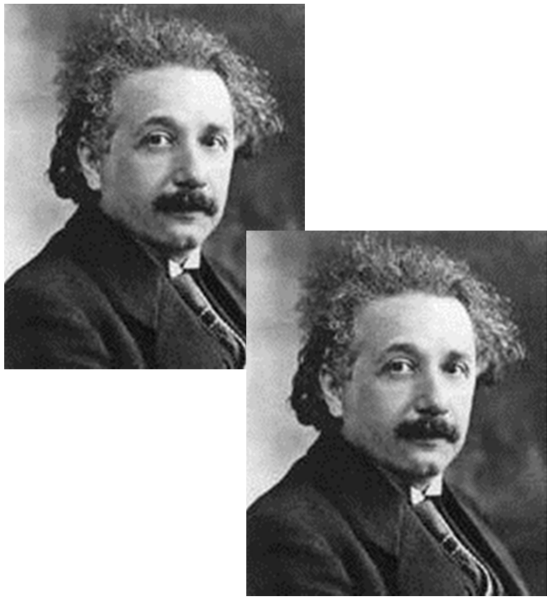
Prvi sesalec, kloniran iz somatskih celic….

Dolly, the sheep: 1996



Po somatskem kloniranju ovce Dolly so se takoj pojavila vprašanja, če je možno na ta način klonirati tudi človeka. Morda diktatorja ali pa genialca?





?

Je to v 21. stoletju realna nevarnost….????

"Went in for a simple blood test and got cloned by mistake."

Za vsako nadaljnjo uporabo pacientovih podatkov (genomskih in negenomskih) mora pacient (ali starši oz. skrbniki) podpisati privoljenje (angl. Informed consent)

A BROKEN CONTRACT

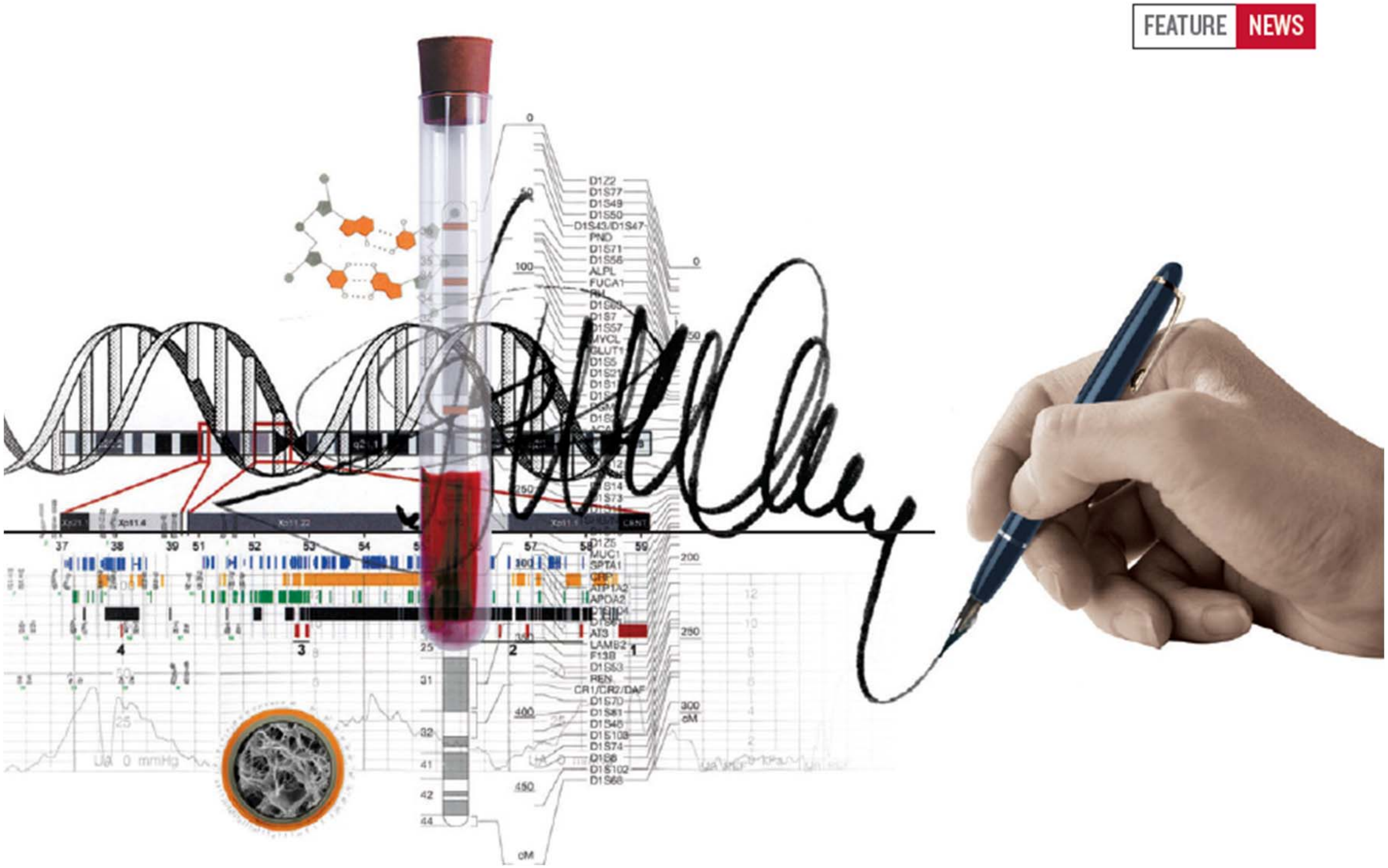
AS RESEARCHERS FIND MORE USES FOR DATA, INFORMED CONSENT HAS BECOME A SOURCE OF CONFUSION. SOMETHING HAS TO CHANGE.

BY ERIKA CHECK HAYDEN

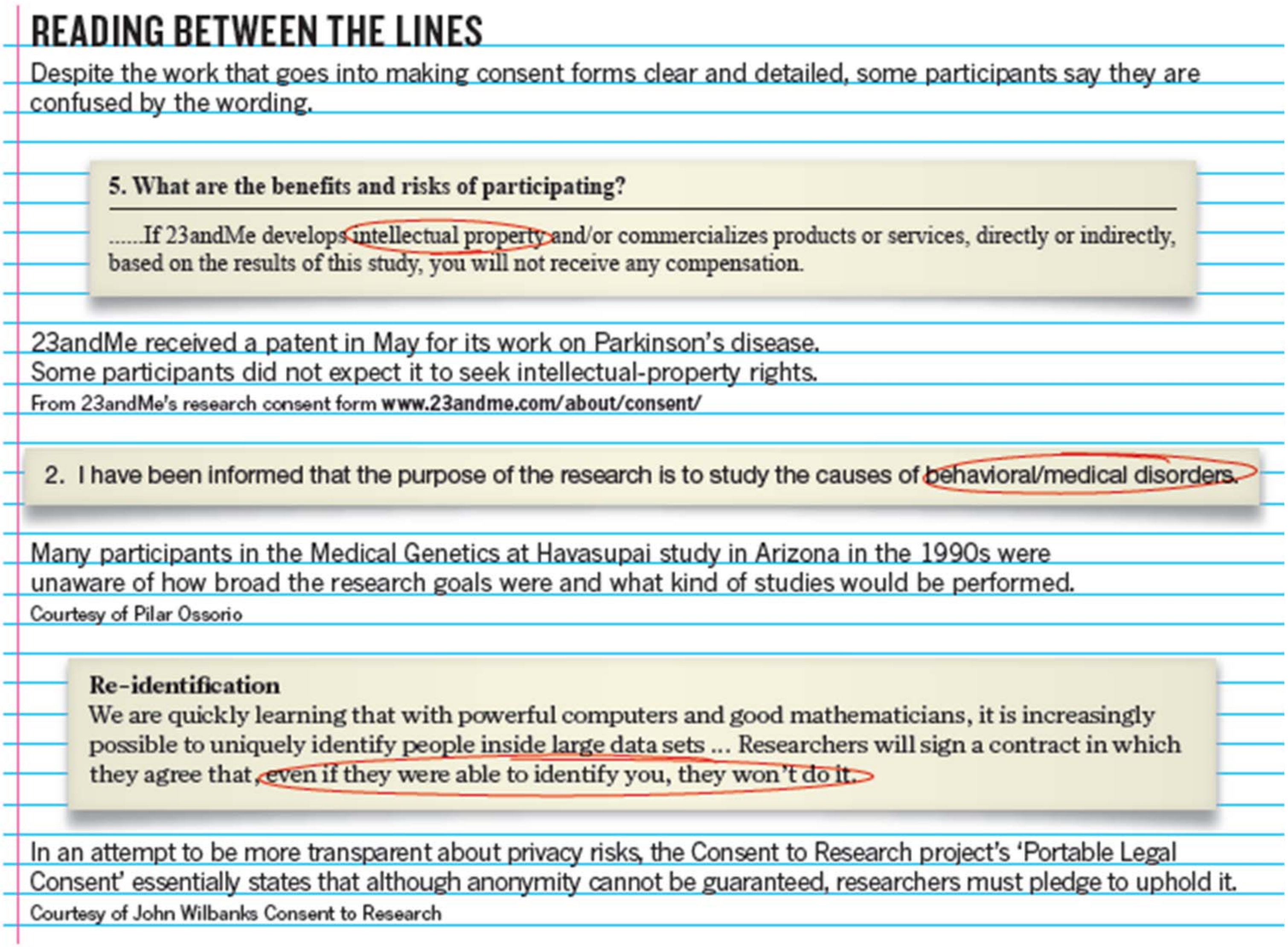
Late in May, the direct-to-consumer gene-testing company 23andMe proudly announced the impending award of its first patent. The firm's research on Parkinson's disease, which used data from several thousand customers, had led to a patent on gene sequences that contribute to risk for the disease and might be used to predict its course. Anne Wojcicki, co-founder of the company, which is based in Mountain View, California, wrote in a blog post that the patent would help to move the work "from the realm of academic

NATURE | VOL 486 | 21 JUNE 2012

Vse več je primerov, ko so pacienti podpisali dovoljenja za vključitev njihovih vzorcev v eno raziskavo, a so se ti brez njihovega privoljenja uporabili tudi za druge raziskave!!



Primer nejasnega formularja za privoljenje z razumevanjem enega od kmercialnih ponudnikov genetskih storitev



READING BETWEEN THE LINES

Despite the work that goes into making consent forms clear and detailed, some participants say they are confused by the wording.

5. What are the benefits and risks of participating?

......If 23andMe develops intellectual property and/or commercializes products or services, directly or indirectly, based on the results of this study, you will not receive any compensation.

23andMe received a patent in May for its work on Parkinson's disease.
Some participants did not expect it to seek intellectual-property rights.

From 23andMe's research consent form **www.23andme.com/about/consent/**

2. I have been informed that the purpose of the research is to study the causes of behavioral/medical disorders.

Many participants in the Medical Genetics at Havasupai study in Arizona in the 1990s were unaware of how broad the research goals were and what kind of studies would be performed.

Courtesy of Pilar Ossorio

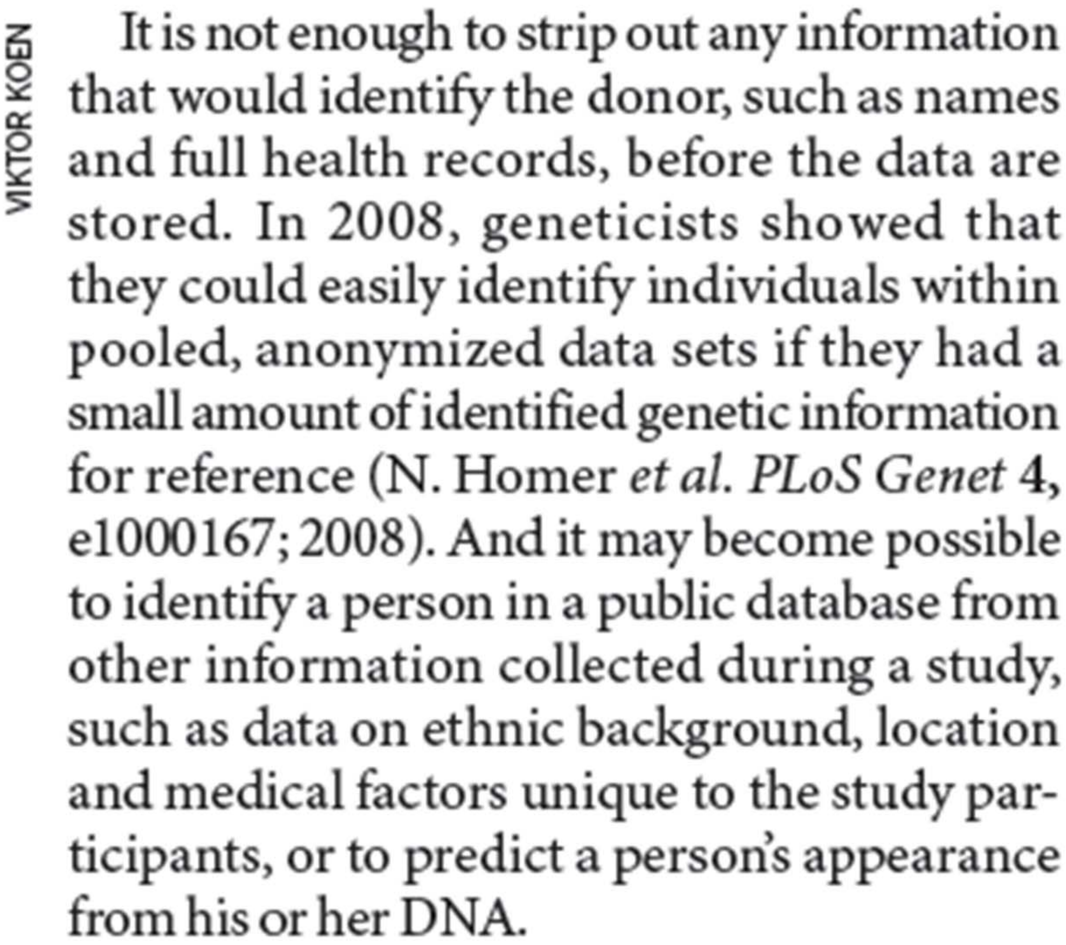
Re-identification

We are quickly learning that with powerful computers and good mathematicians, it is increasingly possible to uniquely identify people inside large data sets ... Researchers will sign a contract in which they agree that, even if they were able to identify you, they won't do it.

In an attempt to be more transparent about privacy risks, the Consent to Research project's 'Portable Legal Consent' essentially states that although anonymity cannot be guaranteed, researchers must pledge to uphold it.

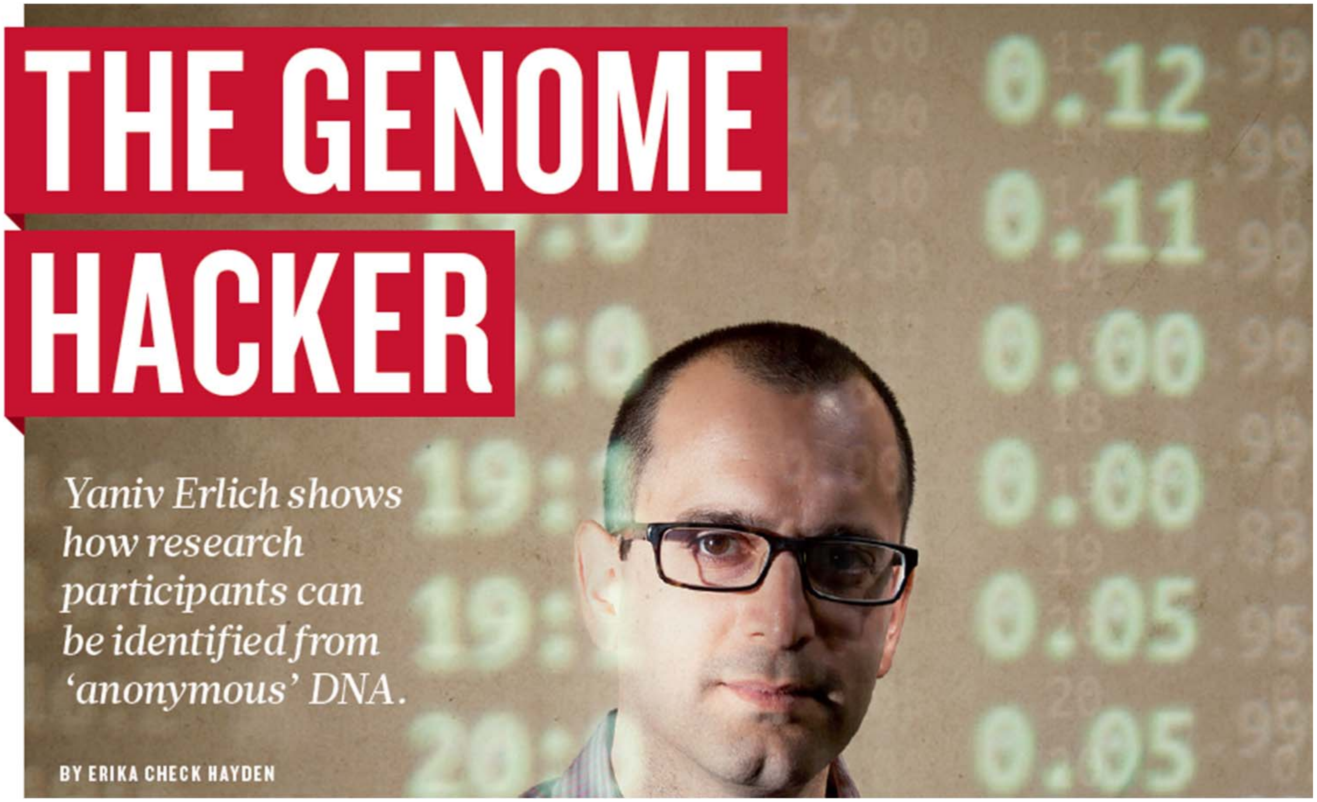
Courtesy of John Wilbanks Consent to Research

Iz genomskih podatkov zaporedij v javnih zbirkah je možno identificiarati, kateremu posamezniku pripadajo !!



VIKTOR KOEN

It is not enough to strip out any information that would identify the donor, such as names and full health records, before the data are stored. In 2008, geneticists showed that they could easily identify individuals within pooled, anonymized data sets if they had a small amount of identified genetic information for reference (N. Homer *et al. PLoS Genet* 4, e1000167; 2008). And it may become possible to identify a person in a public database from other information collected during a study, such as data on ethnic background, location and medical factors unique to the study participants, or to predict a person's appearance from his or her DNA.



THE GENOME HACKER

Yaniv Erlich shows how research participants can be identified from 'anonymous' DNA.

BY ERIKA CHECK HAYDEN

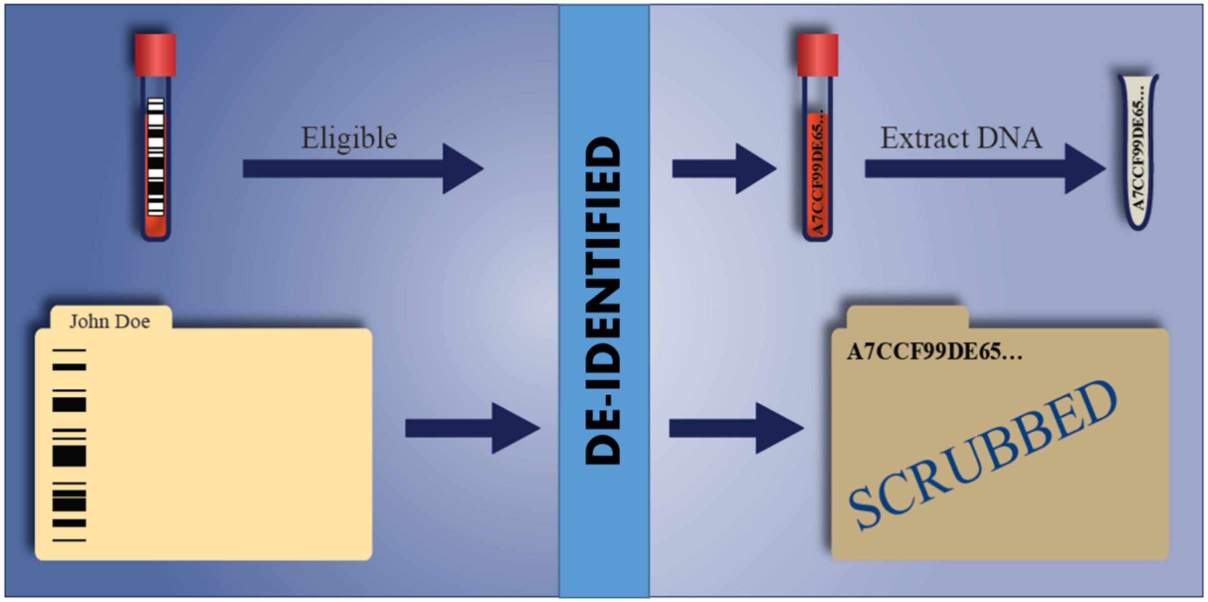
In 2011, as Erlich was setting up his first independent lab as a Whitehead Fellow, he met a Colorado-based woman, Wendy Kramer, whose son had managed to track down his father — an anonymous sperm donor — by searching a consumer-focused genetic-genealogy database for people with DNA similar to his own.

Primer iz ZDA: Univerza Vanderbilt in program BioVU

Imajo 2 ločeni podatkovni zbirki, eno z imeni in drugo ze podatki pacientov (podatki so anonimizirani). Nekatere podatke naključno izbrišejo, da so možnosti zlorabe manjše. Povezava podatkov do imen bolnikov je tao zapleten proces. Vključenih je že 200 000 pacientov – v svetovnem merilu verjento največja zbirka povezave genetskih in ostalih zdravtvenih podatkov.

Pacienti morajo odkljukati točko, kjer jih vprašajo, če želijo, da njihovi vzorci NISO shranjeni za nadaljnje raziskave…..

Številni pacienti ali starši se šele kasneje zavedajo, kaj so odkljukali in se želijo naknadno izključiti…….



The FDA is overcautious on consumer genomics

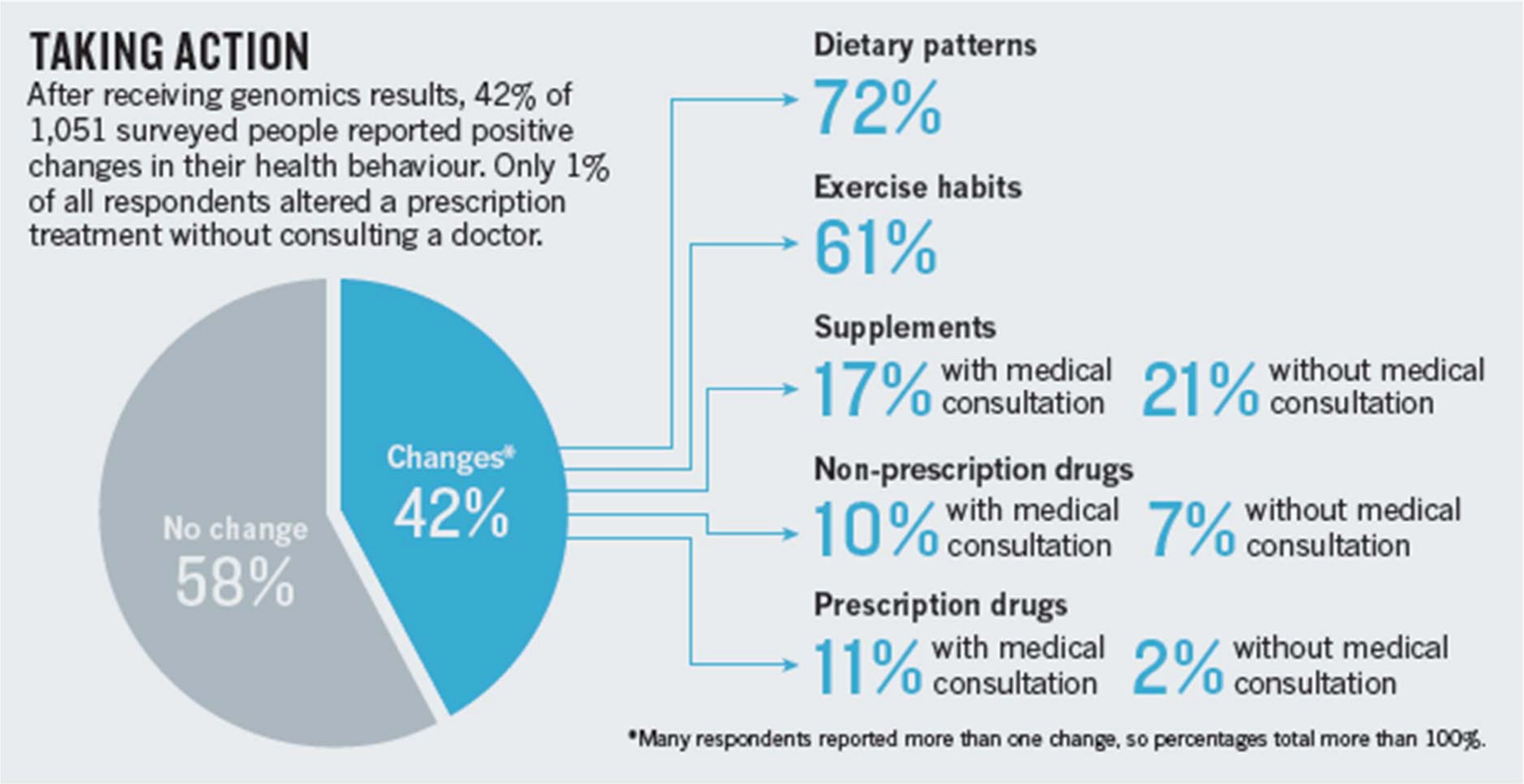
A US drug-agency clampdown is unwarranted without evidence of harm, say **Robert C. Green** and **Nita A. Farahany**.


A lab technician scans a consumer gene-testing kit.

On 22 November last year, the company that has performed the bulk of these tests received a letter from the US Food and Drug Administration (FDA). The FDA ordered 23andMe, based in Mountain View, California, to "immediately discontinue marketing" its testing kit and personal genome services, which the agency says offer medical advice and so require regulatory approval.

NATURE | VOL 505 | 16 JANUARY 2014

Glavne spremembe obnašanja po rezultatih genetskega testiranja



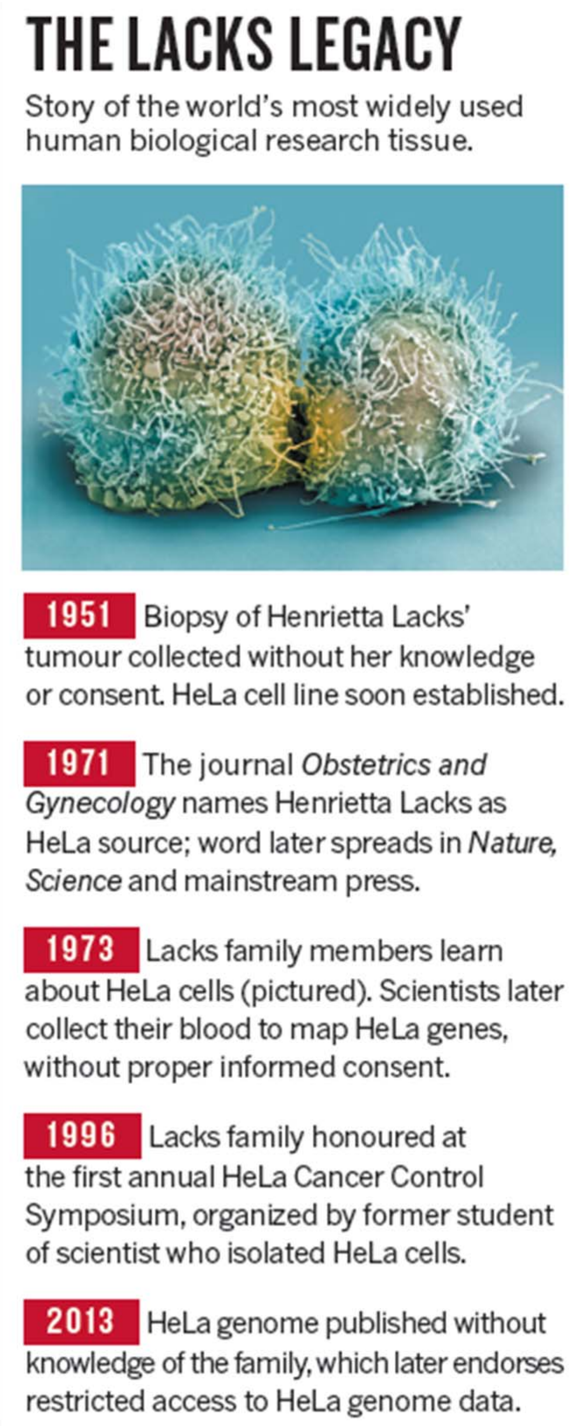
TAKING ACTION

After receiving genomics results, 42% of 1,051 surveyed people reported positive changes in their health behaviour. Only 1% of all respondents altered a prescription treatment without consulting a doctor.

*Many respondents reported more than one change, so percentages total more than 100%.

Pacienti z rezultatom mutacije v genih BRCA so test večinoma ponovili in če je bil pozitiven, pozvali k testiranju še ožje sorodnike – v primeru te medicinsko relevantne mutacije je bila reakcija ljudi po komercialnem testu in testu znotraj medicinske ustanove ppodobna

Zapoznele etične dileme nesmrtnih celic HeLa



THE LACKS LEGACY

Story of the world's most widely used human biological research tissue.

1951 Biopsy of Henrietta Lacks' tumour collected without her knowledge or consent. HeLa cell line soon established.

1971 The journal *Obstetrics and Gynecology* names Henrietta Lacks as HeLa source; word later spreads in *Nature*, *Science* and mainstream press.

1973 Lacks family members learn about HeLa cells (pictured). Scientists later collect their blood to map HeLa genes, without proper informed consent.

1996 Lacks family honoured at the first annual HeLa Cancer Control Symposium, organized by former student of scientist who isolated HeLa cells.

2013 HeLa genome published without knowledge of the family, which later endorses restricted access to HeLa genome data.

Henrietta Lacks with her husband David.

ETHICS

Deal done over HeLa cell line

Family of Henrietta Lacks agrees to release of genomic data.

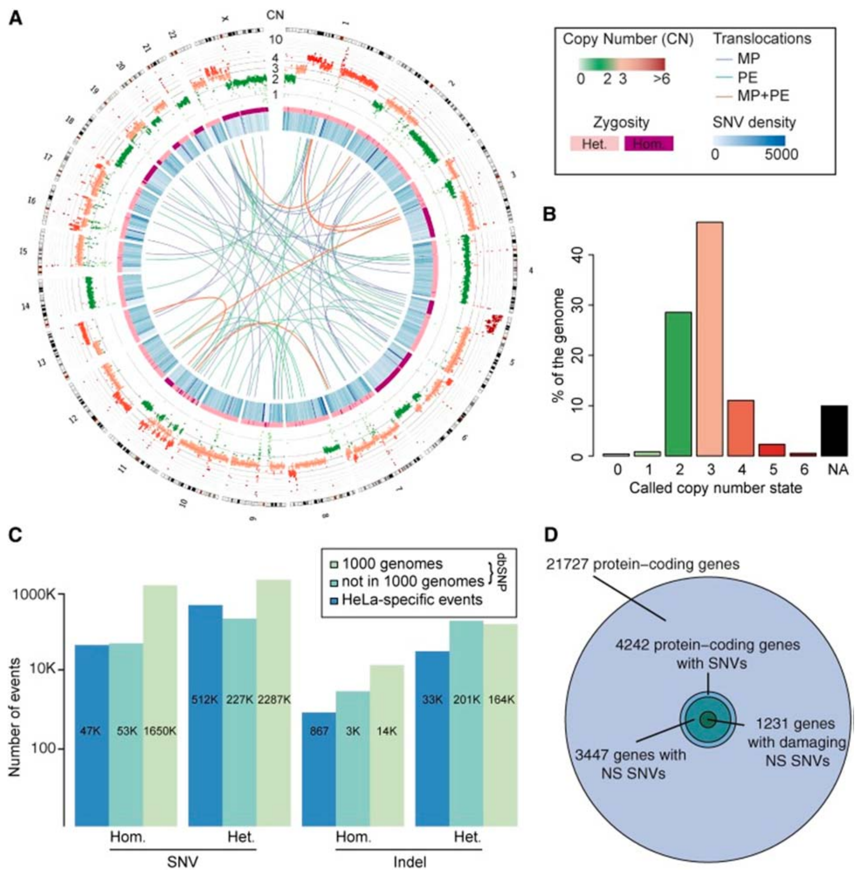
BY EWEN CALLAWAY

Institutes of Health (NIH), Francis Collins, is

G3·Genes | Genomes | Genetics
Information for Authors Editorial Board Submit a Manuscript

G3 (Bethesda). Aug 2013; 3(8): 1213–1224.
Published online Mar 11, 2013. doi: 10.1534/g3.113.005777
PMCID: PMC3737162

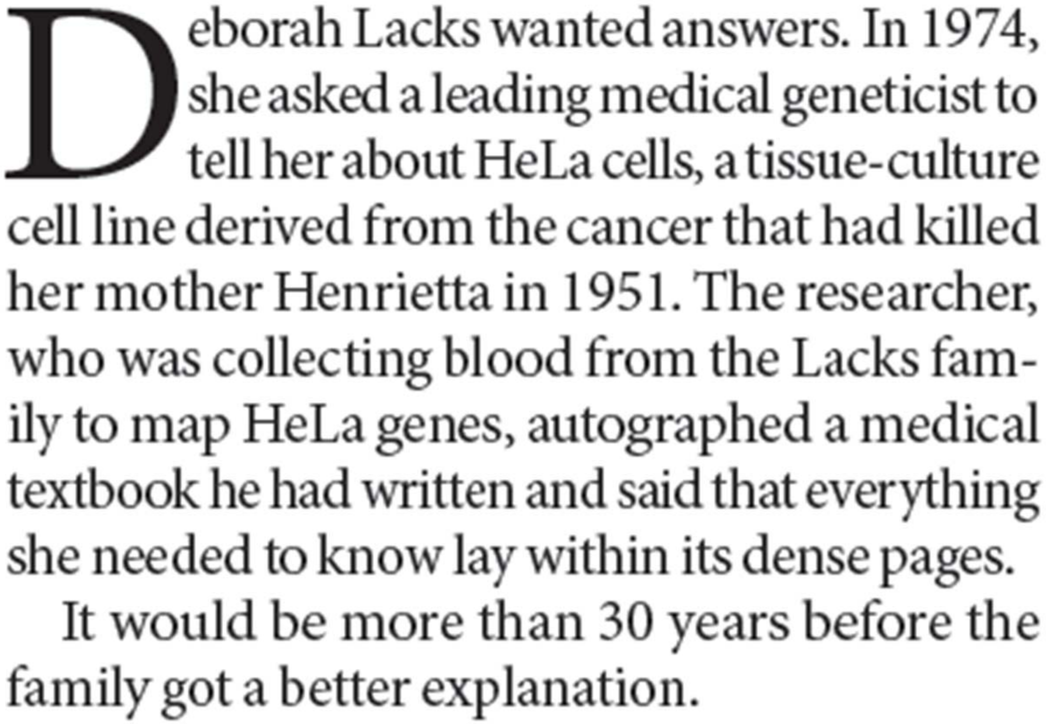
The Genomic and Transcriptomic Landscape of a HeLa Cell Line



Članek je bil objavljen brez vednosti družinskih članov, ki so za to izvedeli iz uvodnikov dnevnega časopisja. Izrazili so veliko nezadovoljstvo……

Se sploh zavedamo, da imajo mnoge nesmrtne celične liniije svojega donorja? So njihove družine seznanjene s tem, kaj se dogaja s temi celicami?

Skorajda 40 let čakanja na odgovor, zakaj je umrla g. Henrietta Lacks



Deborah Lacks wanted answers. In 1974, she asked a leading medical geneticist to tell her about HeLa cells, a tissue-culture cell line derived from the cancer that had killed her mother Henrietta in 1951. The researcher, who was collecting blood from the Lacks family to map HeLa genes, autographed a medical textbook he had written and said that everything she needed to know lay within its dense pages.

It would be more than 30 years before the family got a better explanation.

Francis Collins (direktor NIH) je posredoval pri družini Lacks, da bi dovolila objavo natančnejšega zaporedja DNA celic HeLa. S tem bi družina dobila tudi odgovor, zakaj je g. HeLa umrla. Družina je dovolila, da se informacija sprosti na podlagi prošenj, ki jih bi obravnavala strokovna komisija ob prisotnosti članov družine Lacks.

LACKS FAMILY/VIRGINIA DEPT HISTORIC RESOURCES

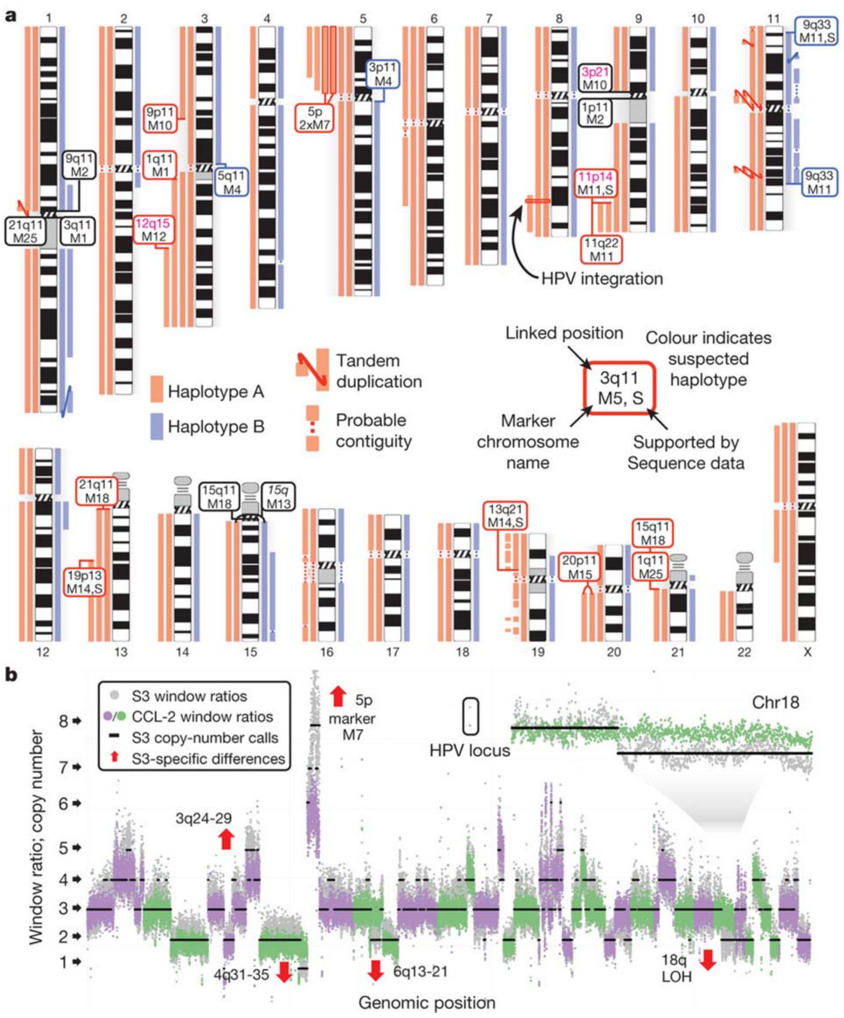
Henrietta Lacks' family gather around a historical marker dedicated to her in Virginia in 2011.

Family matters

Kathy L. Hudson and **Francis S. Collins** discuss how and why the US National Institutes of Health worked with the family of Henrietta Lacks, the unwitting source of the HeLa cell line, to craft an agreement for access to HeLa genome data.

The haplotype-resolved genome and epigenome of the aneuploid HeLa cancer cell line

Andrew Adey et al, Nature 500, 207–211 (08 August 2013)



Celice iz agresivnega raka materničnega vratu (cervical cancer).

HeLa celice navedene v več kot 750 000 PubMed povzetkih!!

Velike prerazporeditve na kromosomu 8q24.21 – značilno za to vrsto raka in asociacija s papilloma virsno infekcijo.

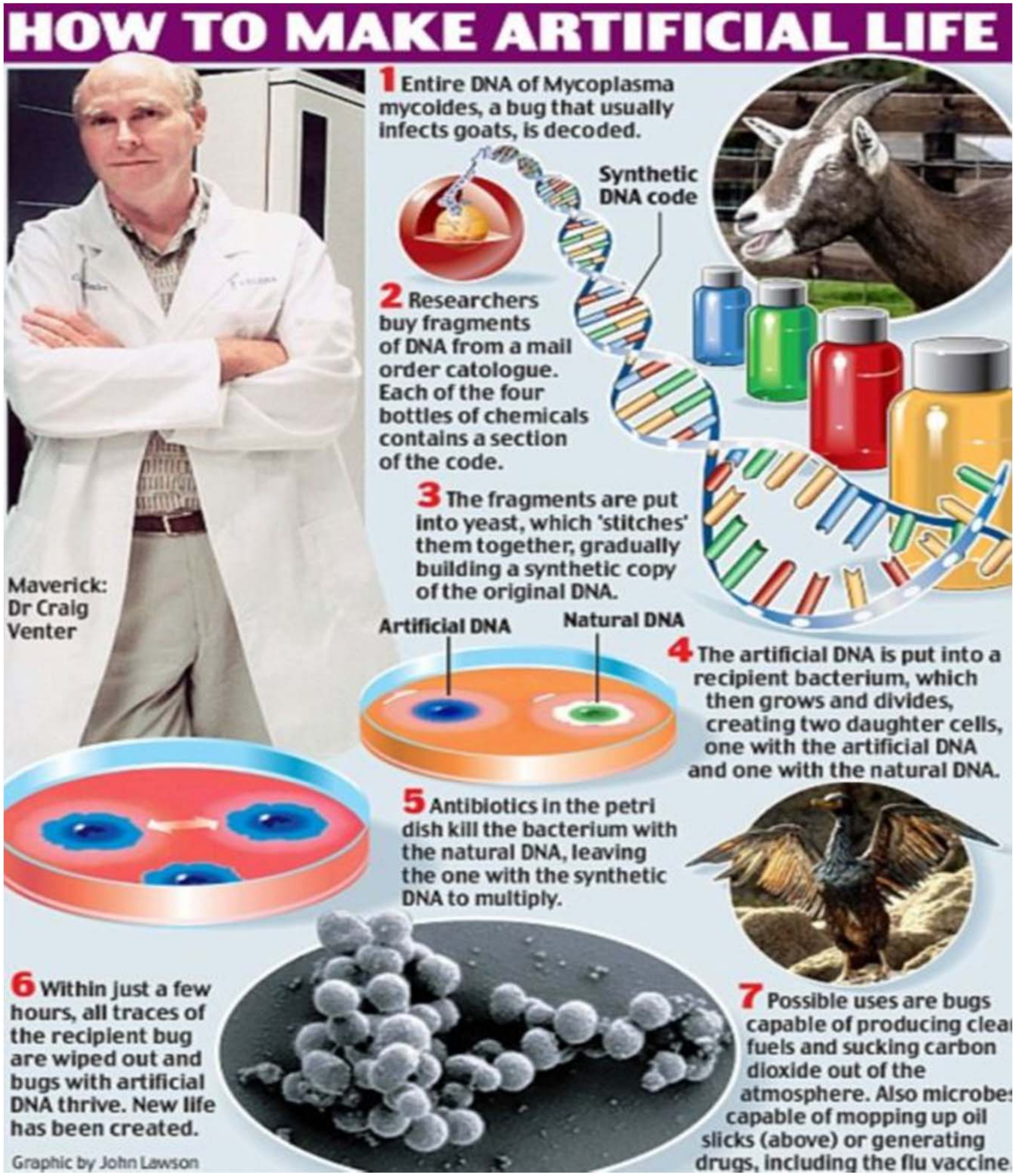
Po vzporeditvi s podatkovno zbirko ENCODE in epigenomskimi podatki so ugotovili, da je bil aktiviran proto-onkogen MYC.

Do aktivacije je prišlo zaradi integracije HPV-18 v genom cca 500 kb navzgor.

Človeštvo

- Sočasno unikatno in raznoliko
- Radovedno in kreativno

May 2010



HOW TO MAKE ARTIFICIAL LIFE

1 Entire DNA of Mycoplasma mycoides, a bug that usually infects goats, is decoded.

2 Researchers buy fragments of DNA from a mail order catologue. Each of the four bottles of chemicals contains a section of the code.

3 The fragments are put into yeast, which 'stitches' them together, gradually building a synthetic copy of the original DNA.

4 The artificial DNA is put into a recipient bacterium, which then grows and divides, creating two daughter cells, one with the artificial DNA and one with the natural DNA.

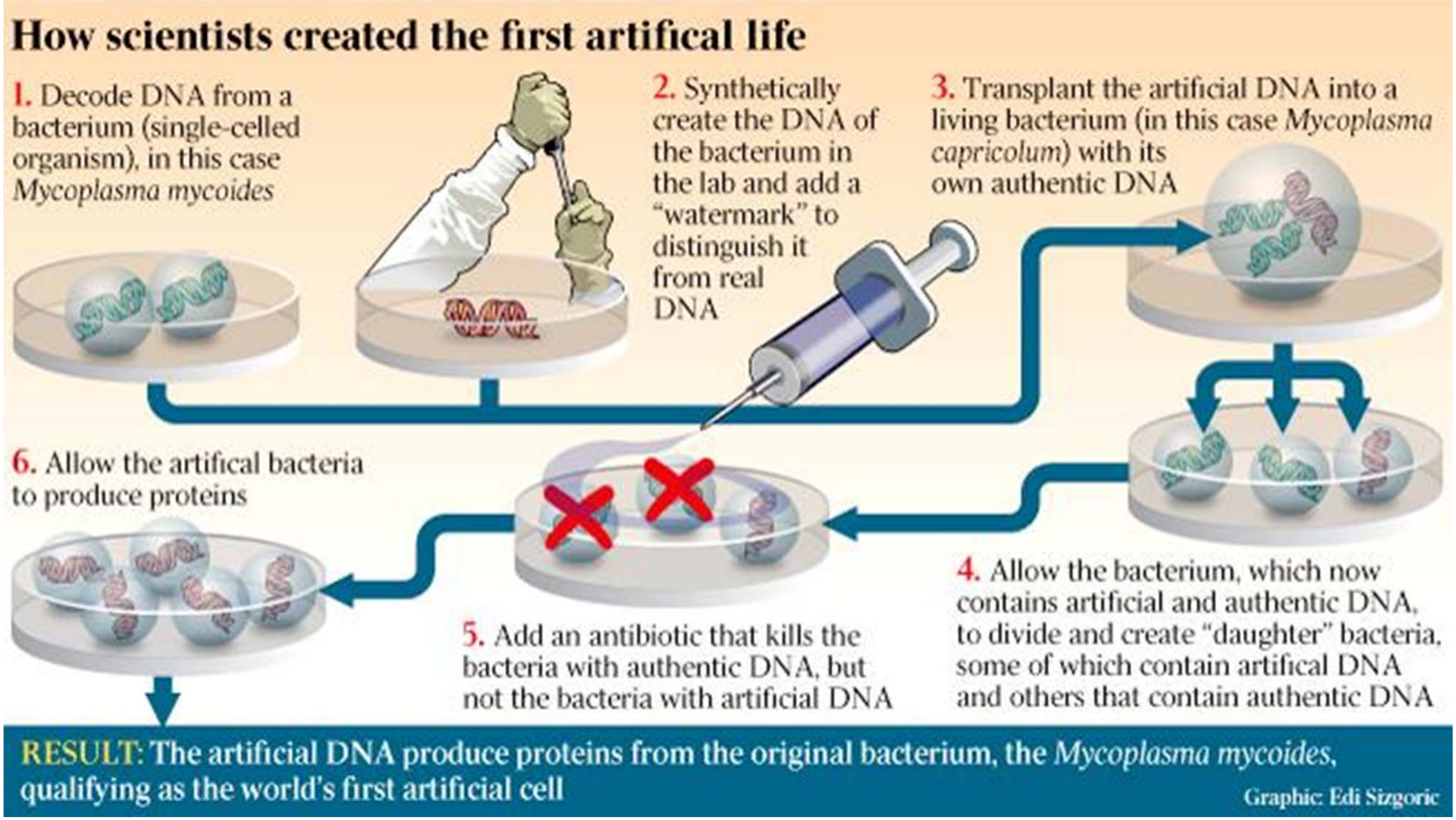
5 Antibiotics in the petri dish kill the bacterium with the natural DNA, leaving the one with the synthetic DNA to multiply.

6 Within just a few hours, all traces of the recipient bug are wiped out and bugs with artificial DNA thrive. New life has been created.

7 Possible uses are bugs capable of producing clea fuels and sucking carbon dioxide out of the atmosphere. Also microbe capable of mopping up oil slicks (above) or generating drugs, including the flu vaccine

Maverick: Dr Craig Venter

Graphic by John Lawson



How scientists created the first artifical life

1. Decode DNA from a bacterium (single-celled organism), in this case *Mycoplasma mycoides*

2. Synthetically create the DNA of the bacterium in the lab and add a "watermark" to distinguish it from real DNA

3. Transplant the artificial DNA into a living bacterium (in this case *Mycoplasma capricolum*) with its own authentic DNA

4. Allow the bacterium, which now contains artificial and authentic DNA, to divide and create "daughter" bacteria, some of which contain artifical DNA and others that contain authentic DNA

5. Add an antibiotic that kills the bacteria with authentic DNA, but not the bacteria with artificial DNA

6. Allow the artifical bacteria to produce proteins

RESULT: The artificial DNA produce proteins from the original bacterium, the *Mycoplasma mycoides*, qualifying as the world's first artificial cell

Graphic: Edi Sizgoric

nucelotide sequence databases

DNA synthesis platforms

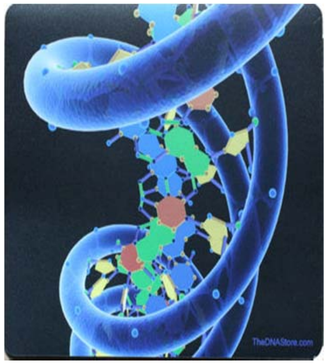
PUBLIC DATABASES

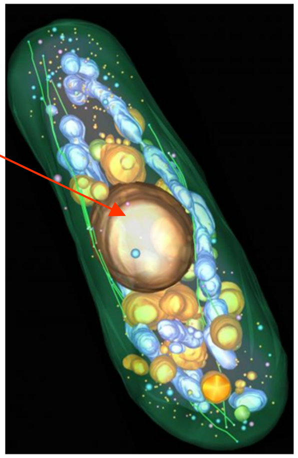
INTERNET

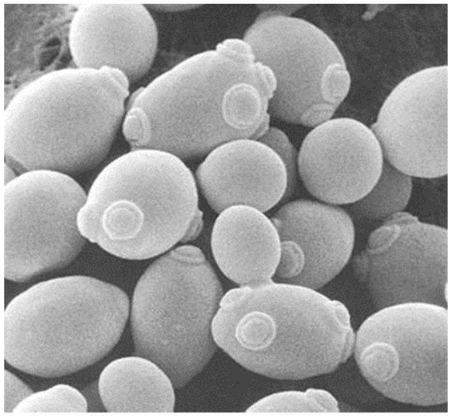
INFORMATION

DNA SYNTHESIS

ARTIFICIAL GENOME







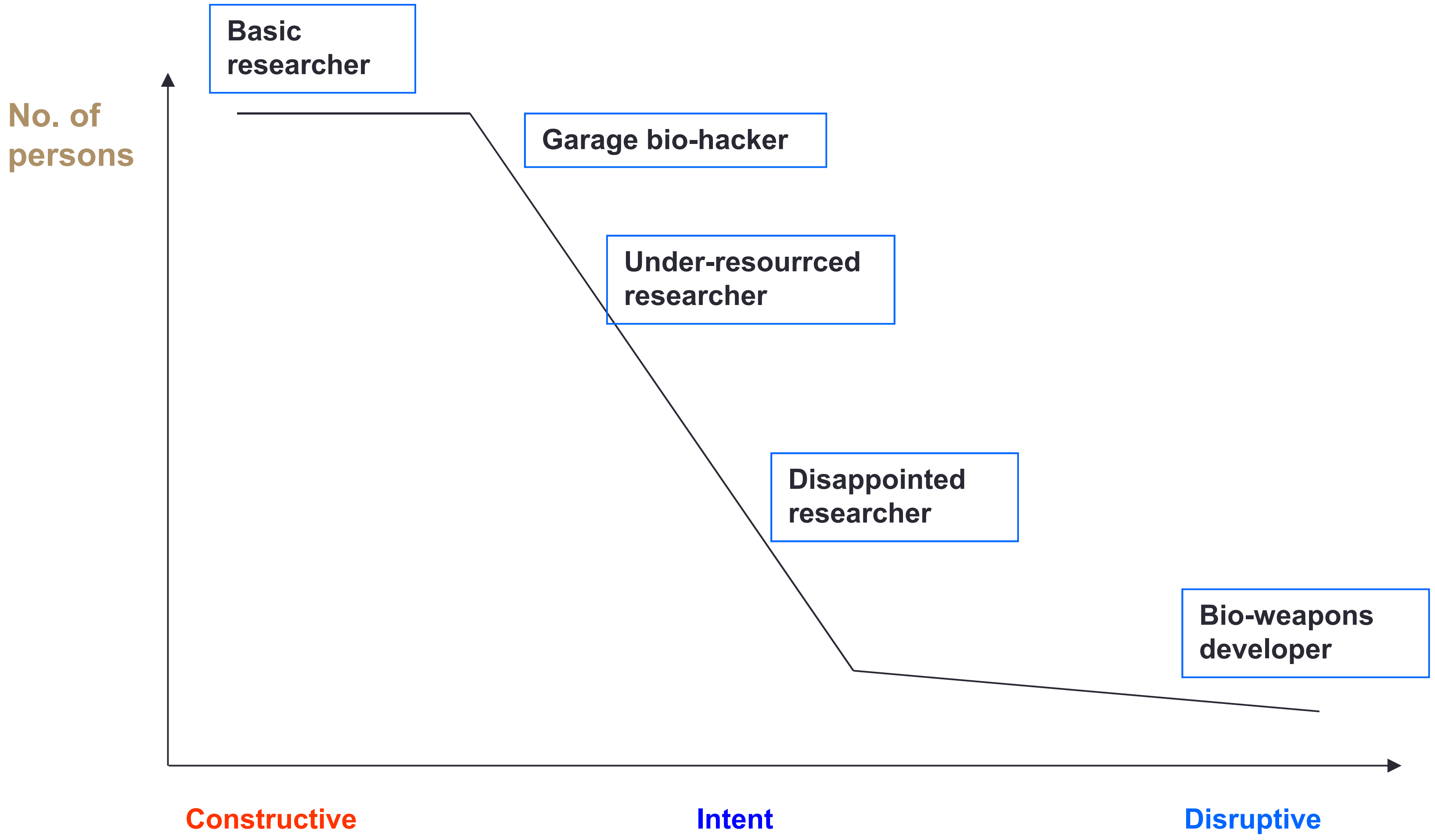
Kaj definira “resnično” in kaj “umetno” življenje?

Kakšne bodo posledice noveh zmogljivih tehnologij na človeško družbo in okolje?


Alamy/SPL

Kakšne so nevarnosti zlorabe znanosti?

Večina ljudi noče uničiti sveta …to bi bilo dolgočasno, saj bi šlo za enkraten dogodek…..



Hvala lepa za pozornosti !