



Genetic data – privacy and surveillance

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Centre for Policy Futures



You can find me: [@DrCaitlinCurtis](https://twitter.com/DrCaitlinCurtis) 

DNA is the code to make us

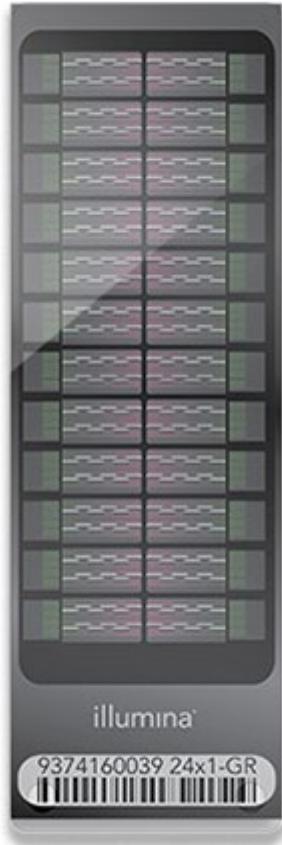


Machines for DNA data: faster and cheaper



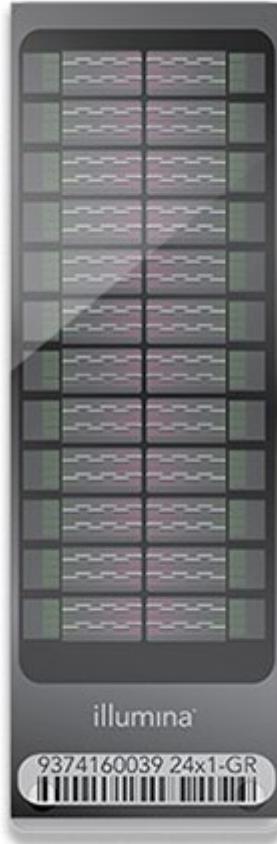
Illumina DNA sequencing technology
www.illumina.com

SNP chip



Illumina Omni Express Sequencing Array
www.illumina.com

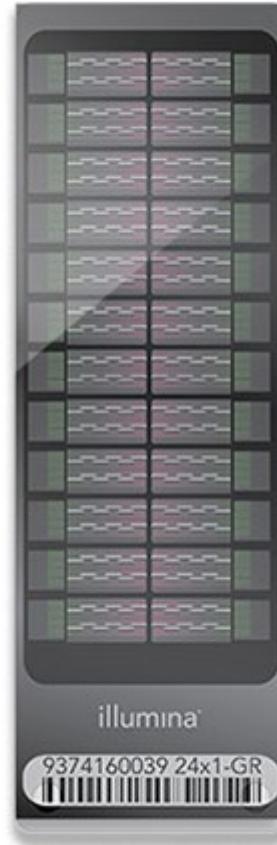
SNP chip



~700,000 variable
data points

700,000 letter PIN code

SNP chip



~700,000 variable
data points



Illumina Omni Express Sequencing Array
www.illumina.com

This code reveals things about us





Caitlin Curtis

Honorary Research Fellow, The University of Queensland



James Hereward

PostDoc Ecological and Evolutionary Genetics, The University of Queensland



DNA facial prediction could make protecting your privacy more difficult

May 2, 2018 5.05pm AEST

Snapshot Prediction Results

Composite Profile



#BCSO-TX-16000440-Snapshot

PNL Document #17K16059-AJ5Y4GEN



Actual Photo

Predicted (■) & Excluded (☒) Phenotypes

Skin Color 8.9

Fair / Very Fair (79.6% confidence)

NOT Brown / Dk Brown (99.3% confidence)

Eye Color 10.5

Blue / Green (91.8% confidence)

NOT Hazel / Brown / Black (91.8% confidence)

Hair Color 21.9

Brown / Blond (97.9% confidence)

NOT Black (97.9% confidence)

Freckles 67.1

Few / Some (33.2% confidence)

NOT Zero (95.8% confidence)

Sex: Male ♂

Age: Unknown

(Composite shown at age 25)

Body Mass: Unknown

(Composite shown at BMI 22)

Ancestry: Northern European



This code reveals things about us

Physical traits

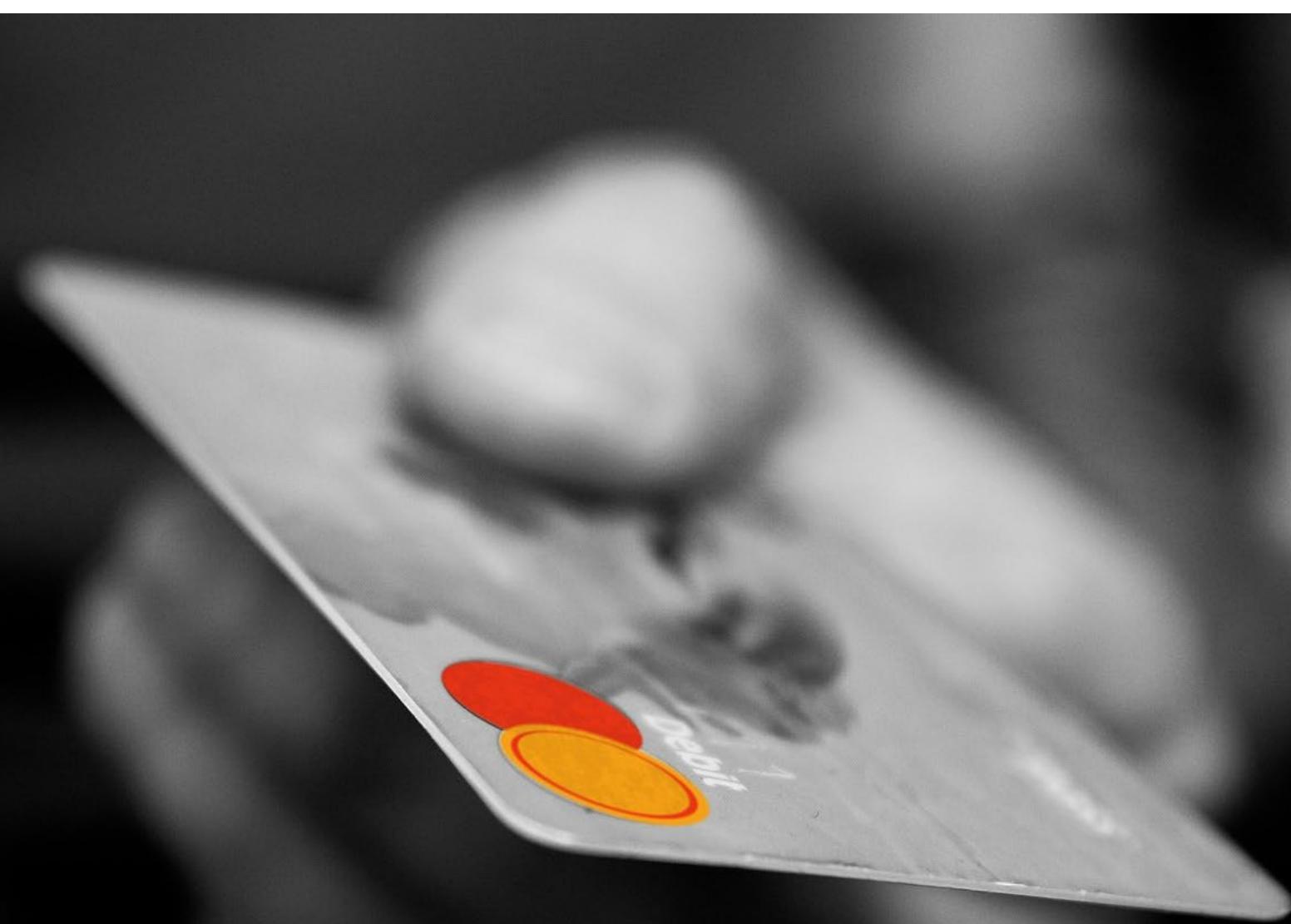
Disease

Personality traits

Mental health



You can't request a new genome.



Police used consumer genealogical websites to identify Golden State Killer suspect



We share DNA with our relatives



2.5 siblings



7.5 first cousins



38 second cousins



190 third cousins



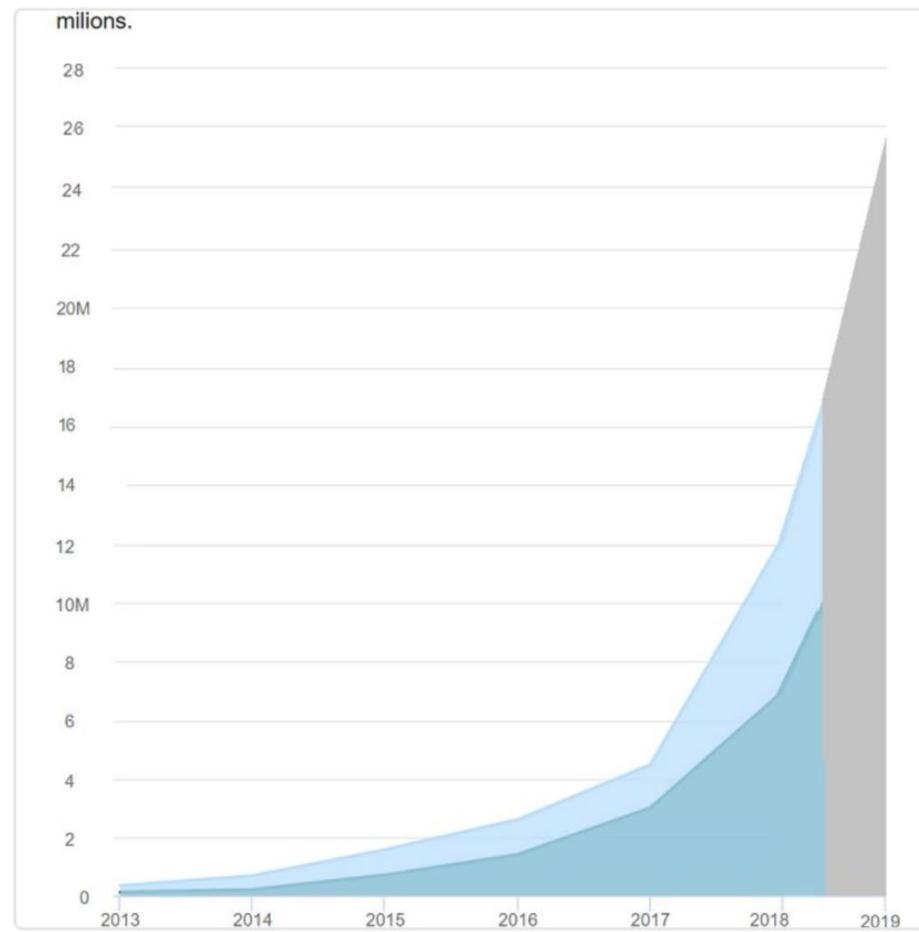
Antonio Regalado

@antonioregalado

Following



Updating our popular consumer DNA test graphic. Number sold has surpassed 17 million!



10:47 AM - 6 Aug 2018 from Cambridge, MA





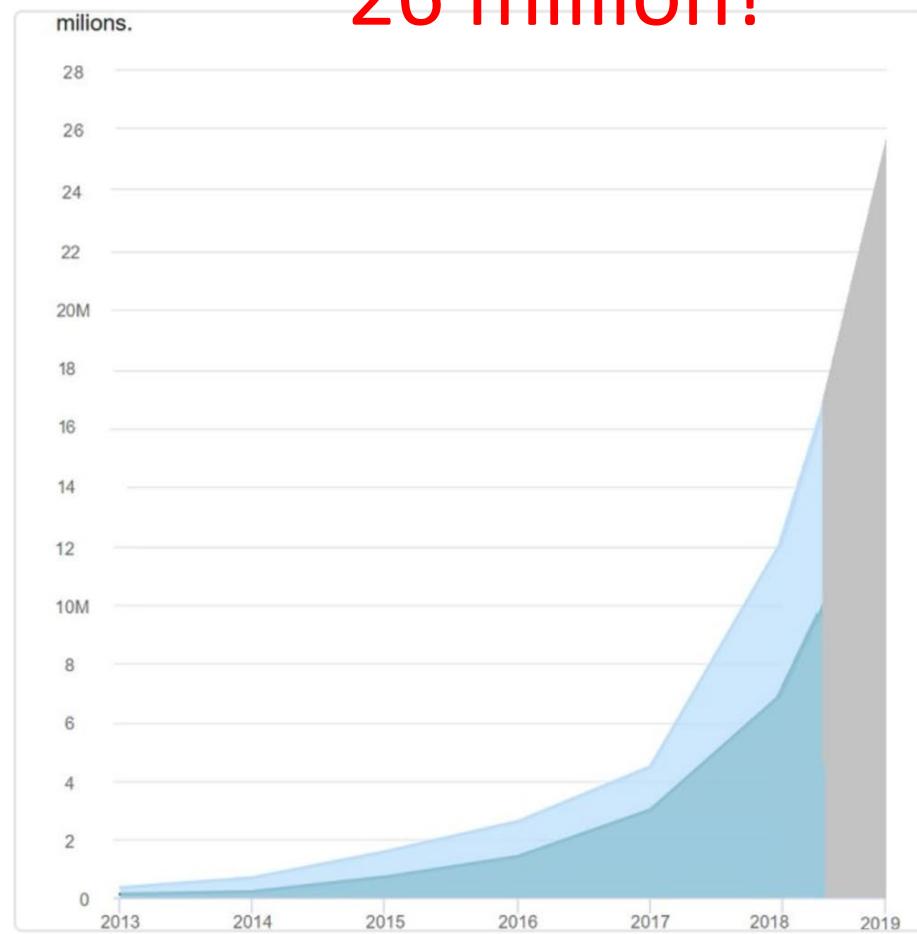
Antonio Regalado

@antonioregalado

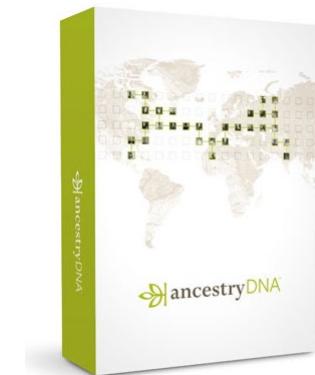
Following



Updating our popular consumer DNA test graphic. Number sold has surpassed ~~17 million!~~ **26 million!**



10:47 AM - 6 Aug 2018 from Cambridge, MA





Online genealogy has created an unregulated forensic database for police

ABC Science By Dr Caitlin Curtis

Updated 13 August 2018 at 5:15 am

First posted 13 August 2018 at 5:10 am

One Of The Biggest At-Home DNA Testing Companies Is Working With The FBI

The move is sure to raise privacy concerns as law enforcement gains the ability to match DNA from crime scenes to a vast library of possible relatives.



Salvador Hernandez
BuzzFeed News Reporter

January 31, 2019, at 8:52 p.m. ET



Who owns our DNA?



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FAMILIE
HISTORIE

We provide DNA testing of envelopes, postcards and aerogrammes from your passed loved-ones to enhance your genealogical research.

Find out more!



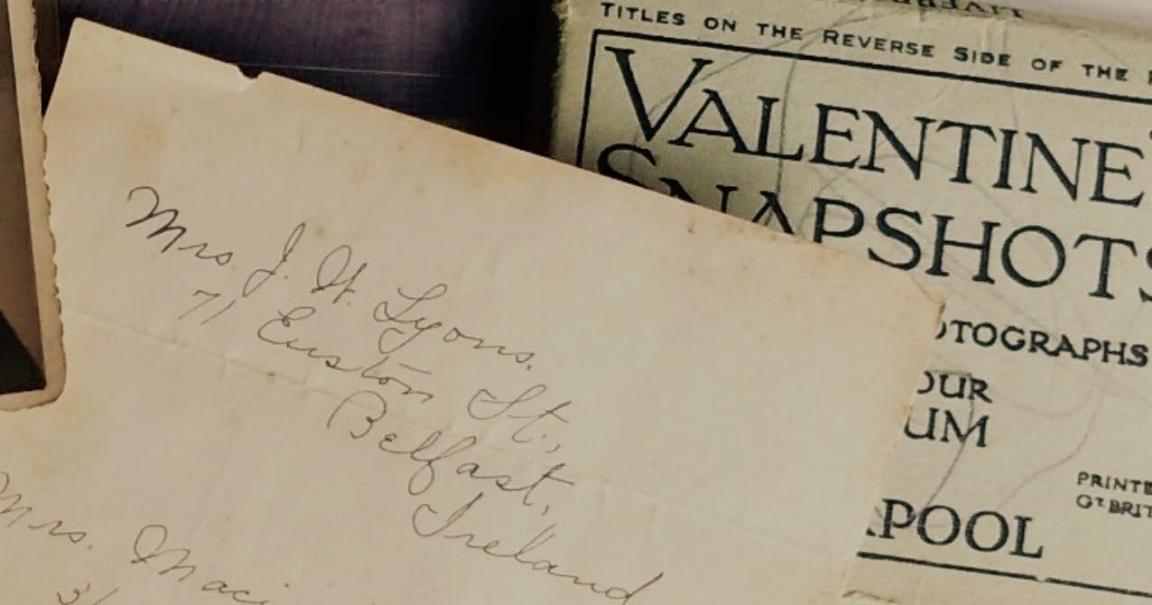
totheletterDNA.com

HET IS VAN HET GROOTSTE BELANG DAT
DIE KLEINE ZORGVULDIG BEWAARD EN
AANGEKE VAN GEBORTE
DEN VERTOOND WORDE

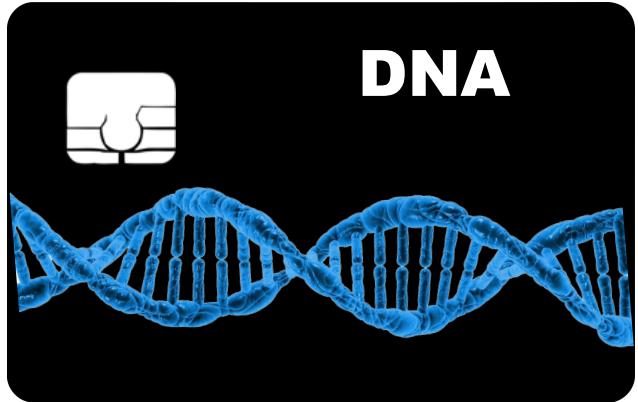


De Heer en
N de Groot-D

Mr & Mrs John Grant,
150 Bell Houston Drive,
Houston, Texas,
U.S.A.
Scotland

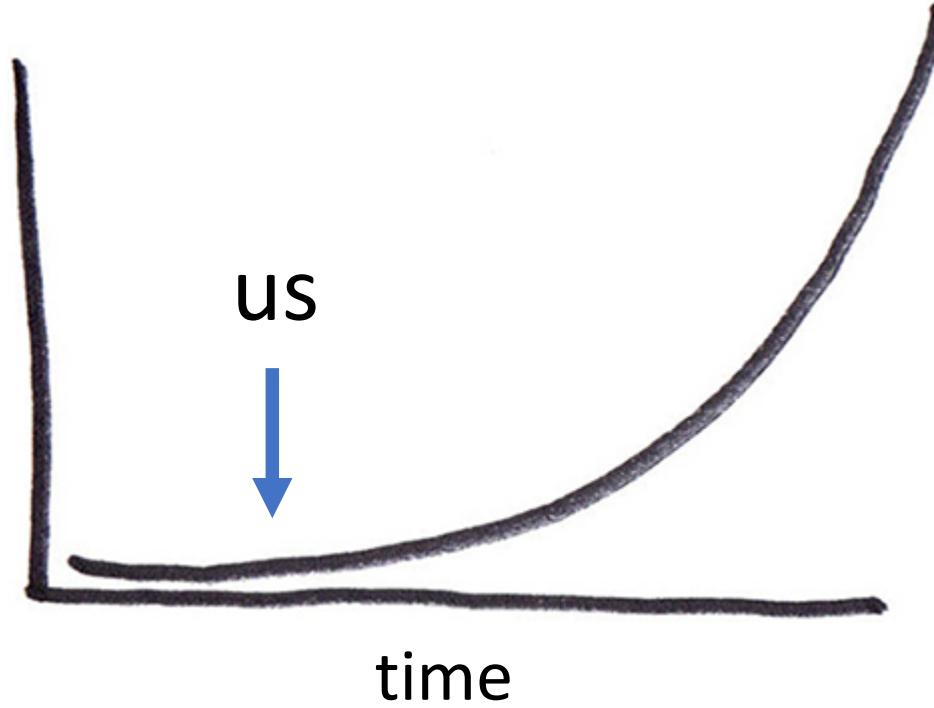


What are the implications of a privacy breach?



?

understanding



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Polygenic risk scores



Intelligence



Image: Pixabay

Scientific Studies of Reading

ISSN: 1088-8438 (Print) 1532-799X (Online) Journal homepage: <https://www.tandfonline.com/loi/hssr20>

Genome-Wide Polygenic Scores Predict Reading Performance Throughout the School Years

Saskia Selzam, Philip S. Dale, Richard K. Wagner, John C. DeFries, Martin Cederlöf, Paul F. O'Reilly, Eva Krapohl & Robert Plomin



Current Opinion in Psychology

Volume 27, June 2019, Pages 6-12



What genome-wide association studies reveal about the association between intelligence and physical health, illness, and mortality

Ian J Deary¹, Sarah E Harris^{1, 2}, W David Hill¹

MENU ▾

nature
genetics

Article | Published: 23 July 2018

Gene discovery and polygenic prediction from a genome-wide association study of educational attainment in 1.1 million individuals

James J. Lee, Robbee Wedow, [...] David Cesarini

Nature Genetics 50, 1112–1121 (2018) | Download Citation ↴

Molecular
Psychiatry

Original Article | OPEN | Published: 04 July 2017

A genome-wide association study for extremely high intelligence

D Zabaneh, E Krapohl, H A Gaspar, C Curtis, S H Lee, H Patel, S Newhouse, H M Wu, M A Simpson, M Putallaz, D Lubinski, R Plomin & G Breen ✉

Molecular Psychiatry 23, 1226–1232 (2018) | Download Citation ↴

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Map My Gene

Create the Champion in Your Child through DNA Mapping

Polygenic scores mediate the Jewish phenotypic advantage in educational attainment and cognitive ability compared with Catholics and Lutherans.

Dunkel, Curtis S., Woodley of Menie, Michael A., Pallesen, Jonatan, Kirkegaard, Emil O. W.

Evolutionary Behavioral Sciences, Jan 24 , 2019, No Pagination Specified

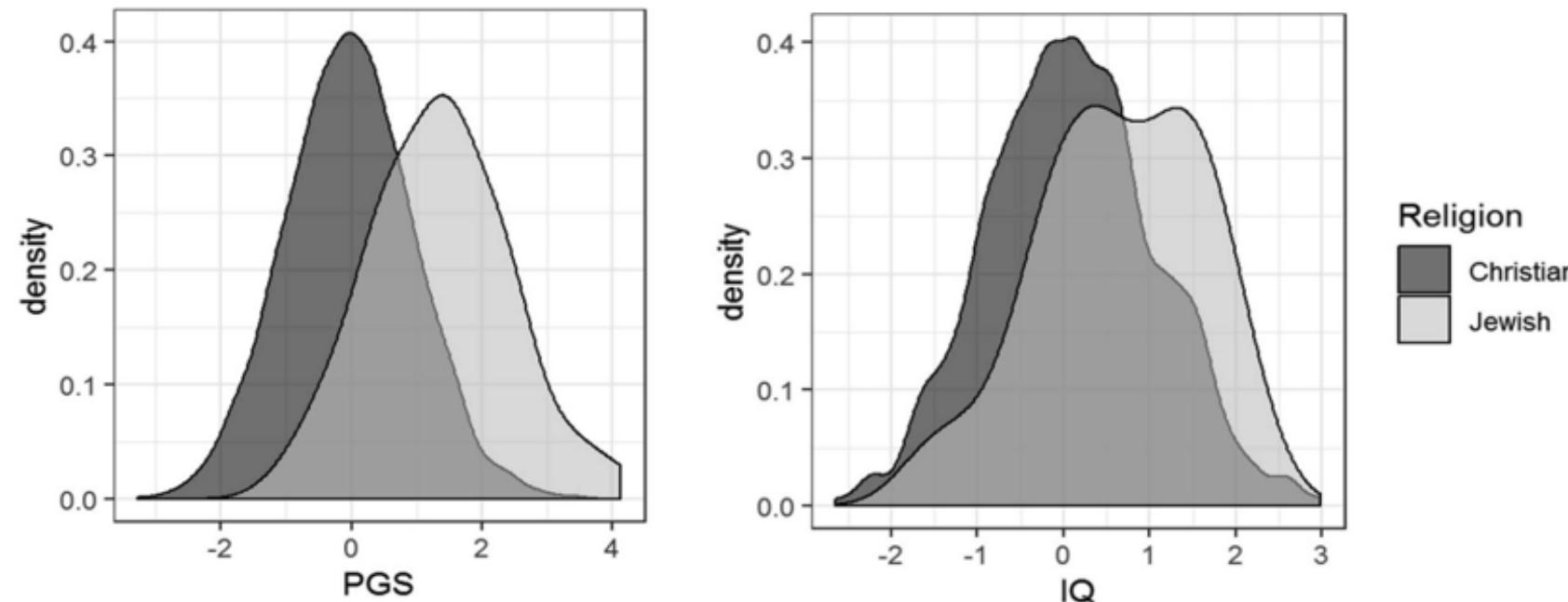


Figure 1. Distribution of Jewish and Christian IQ and PGS.

Mental health



Image: Pixabay



Current Opinion in Psychology

Volume 27, June 2019, Pages 77-81

Polygenic risk scoring and prediction of mental health outcomes

John S Anderson ¹, Jess Shade ¹, Emily DiBlasi ¹, Andrey A Shabalina ^{1,2}, Anna R Docherty ^{1,2}

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<https://doi.org/10.1016/j.copsyc.2018.09.002>

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COMMUNICATIONS BIOLOGY

Article | OPEN | Published: 08 October 2018

Applying polygenic risk scoring for psychiatric disorders to a large family with bipolar disorder and major depressive disorder

Simone de Jong, Mateus Jose Abdalla Diniz, Andriana Saloma, Ary Gadelha, Marcos L. Santoro, Vanessa K. Ota, Cristiano Noto, Major Depressive Disorder and Bipolar Disorder Working Groups of the Psychiatric Genomics Consortium, Charles Curtis, Stephen J. Newhouse, Hamel Patel, Lynsey S. Hall, Paul F. O'Reilly, Sintia I. Belanger, Rodrigo A. Bressan & Jerome Breen

<https://doi.org/10.1016/j.nicl.2018.10.008> [Under a Creative Commons license](#)

Translational Psychiatry

Article | OPEN | Published: 10 September 2018

Association of schizophrenia polygenic risk score with manic and depressive psychosis in bipolar disorder

Matej Markota, Brandon J. Coombes, Beth R. Larrabee, Susan L. McElroy, David J. Bond, Marin Veldic, Colin L. Colby, Mohit Chauhan, Alfredo B. Cuellar-Barboza, Manuel Fuentes, Simon Kung, Miguel L. Prieto, Teresa A. Rummans, William V. Bobo, Mark A. Frye & Joanna M. Biernacka

[Translational Psychiatry 8, Article number: 188 \(2018\) | Download Citation](#)

NeuroImage: Clinical

Volume 20, 2018, Pages 1026-1036

[open access](#)



Associations between polygenic risk scores for four psychiatric illnesses and brain structure using multivariate pattern recognition

Siri Ranlund ^a, Maria Joao Rosa ^b, Simone de Jong ^{c, d}, James H. Cole ^{a, e}, Marinos Kyriakopoulos ^{f, g}, Cynthia H.Y. Fu ^{h, i}, Mitul A. Mehta ^a, Danai Dima ^{a, j, k}

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<https://doi.org/10.1016/j.nicl.2018.10.008>

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Free Access

Is there an optimum endurance polygenic profile?

Jonatan R. Ruiz, Félix Gómez-Gallego, Catalina Santiago, Marta González-Freire, Zoraida Verde, Carl Foster, Alejandro Lucia

Didi Tang, Beijing

September 8 2018, 12:01am,
The Times

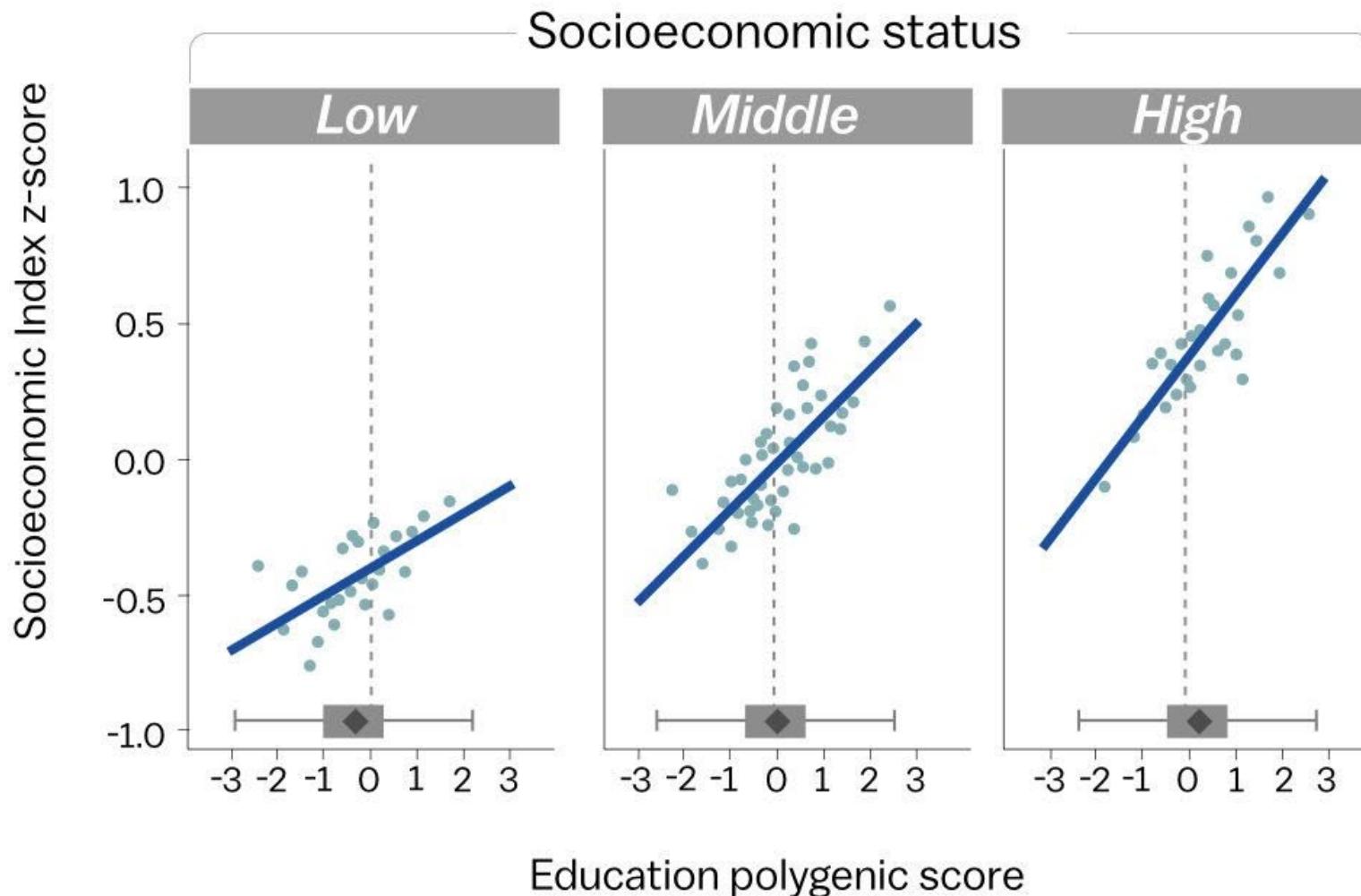
Gene testing to identify gold medal contenders



China won the most golds at the 2008 Beijing Games but its form has since slipped
AL BELLO/GETTY IMAGES

Beijing is planning to genetically screen elite athletes in an attempt to improve its Olympic medal haul.

What polygenic scores can teach us about the power of wealth





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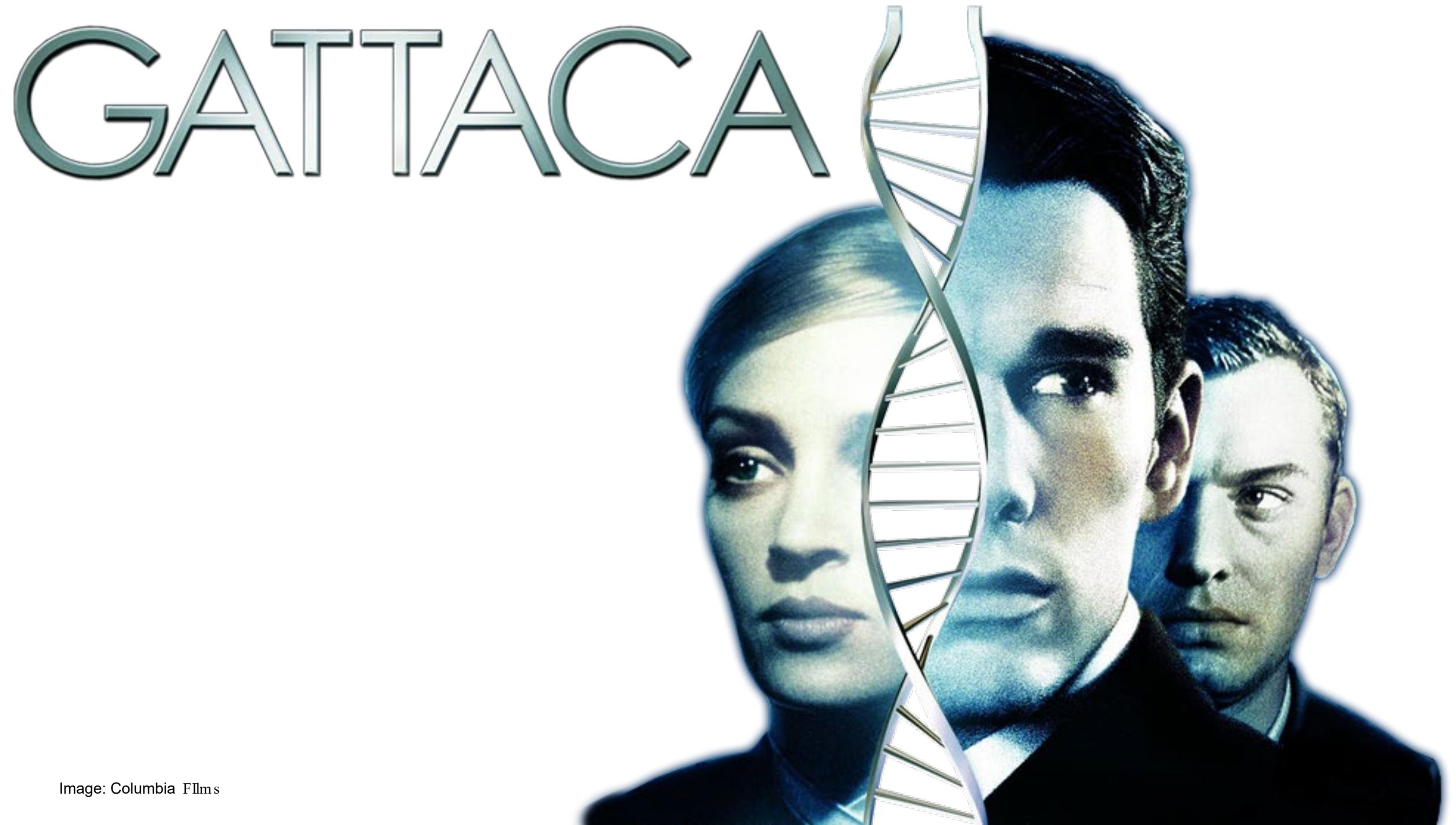


Image: Columbia Pictures

Genetic Data Protection Act

What's the solution?

- Legislation
- Innovation
- Education





Thanks!

Dr Caitlin Curtis
University of Queensland



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