

# How gene editing, genomics & big data will positively affect Africa's future

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# THE GLOBAL GOALS

For Sustainable Development

1 NO POVERTY



2 ZERO HUNGER



3 GOOD HEALTH AND WELL-BEING



4 QUALITY EDUCATION



5 GENDER EQUALITY



6 CLEAN WATER AND SANITATION



7 AFFORDABLE AND CLEAN ENERGY



8 DECENT WORK AND ECONOMIC GROWTH



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



15 LIFE ON LAND



16 PEACE AND JUSTICE STRONG INSTITUTIONS



17 PARTNERSHIPS FOR THE GOALS



THE GLOBAL GOALS  
For Sustainable Development

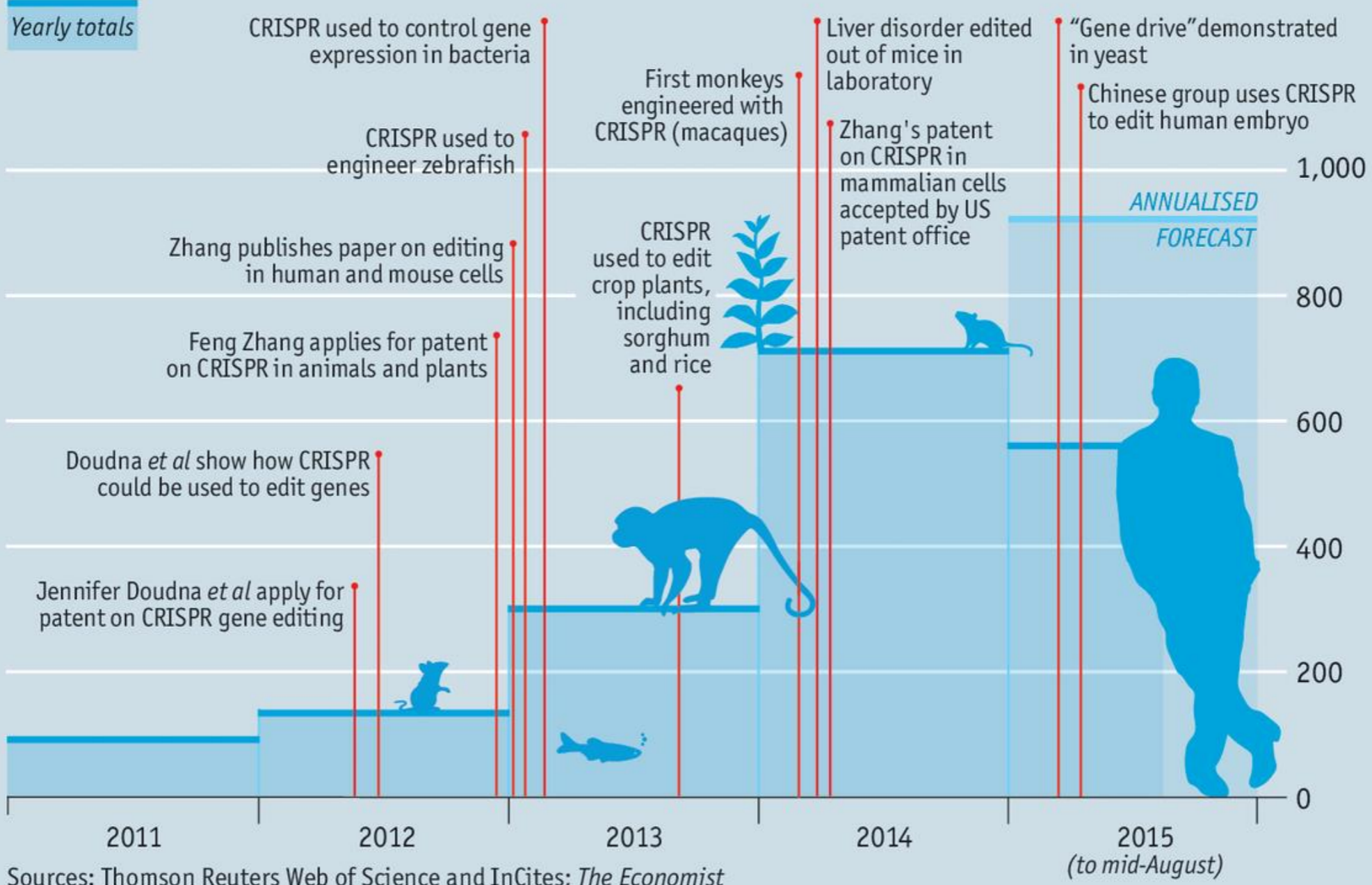
# Biology is where the silicon revolution was in the 1970s

- Through genomics we can decode the basic recipe of life in all organisms on earth
- Through synthetic biology we are beginning to make the first synthetic organisms
- Through genome editing we make precise modifications to this basic recipe of life
- Through “big data” and artificial intelligence we can learn at large scale the role of this decoded information in human health, disease, and even human behavior

# Genome Editing is only just beginning to impact the Life Sciences

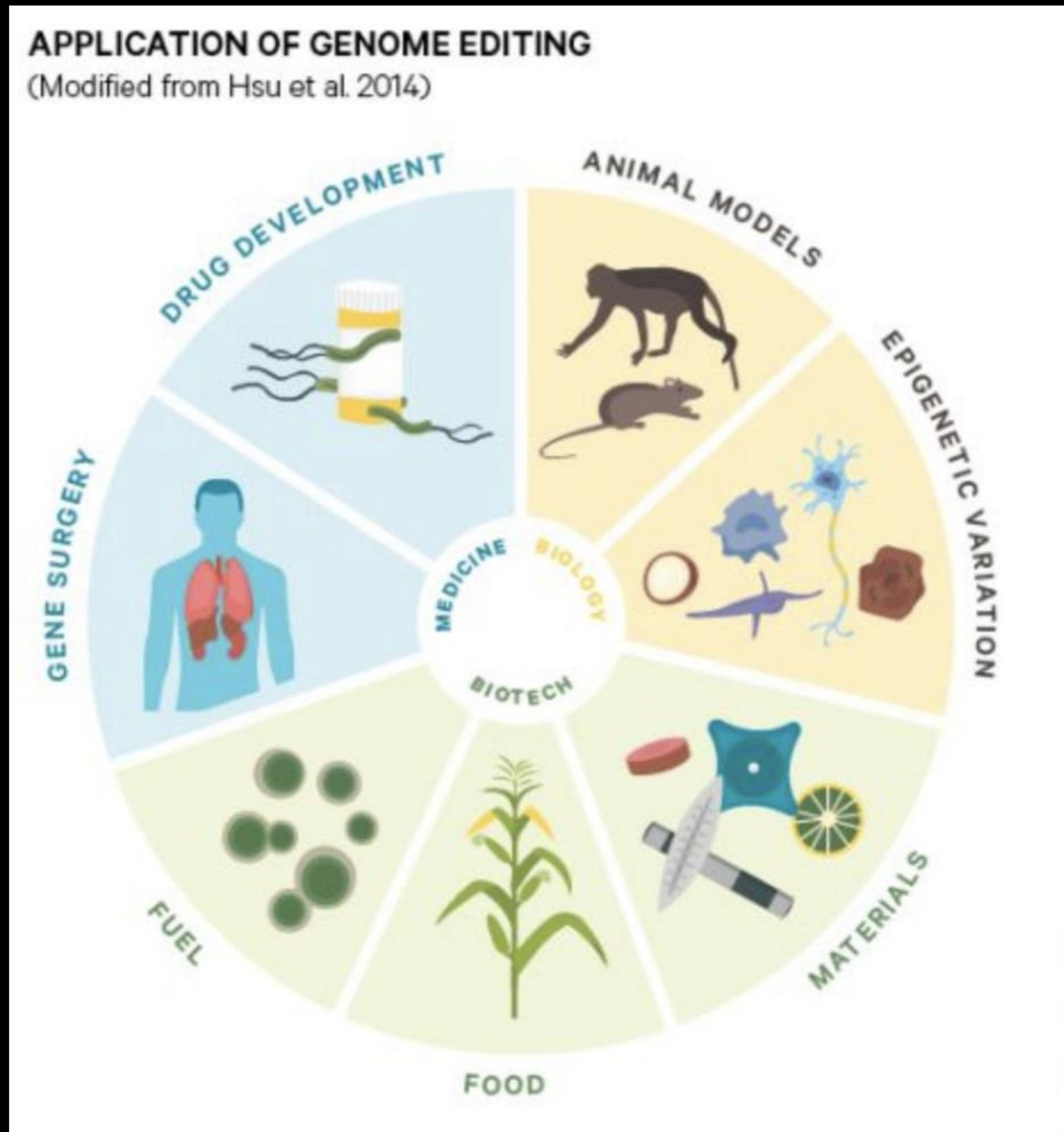
## Stepping up

Number of CRISPR papers published and some research highlights



Economist.com

# Africa will feel the effects of gene editing first in agriculture



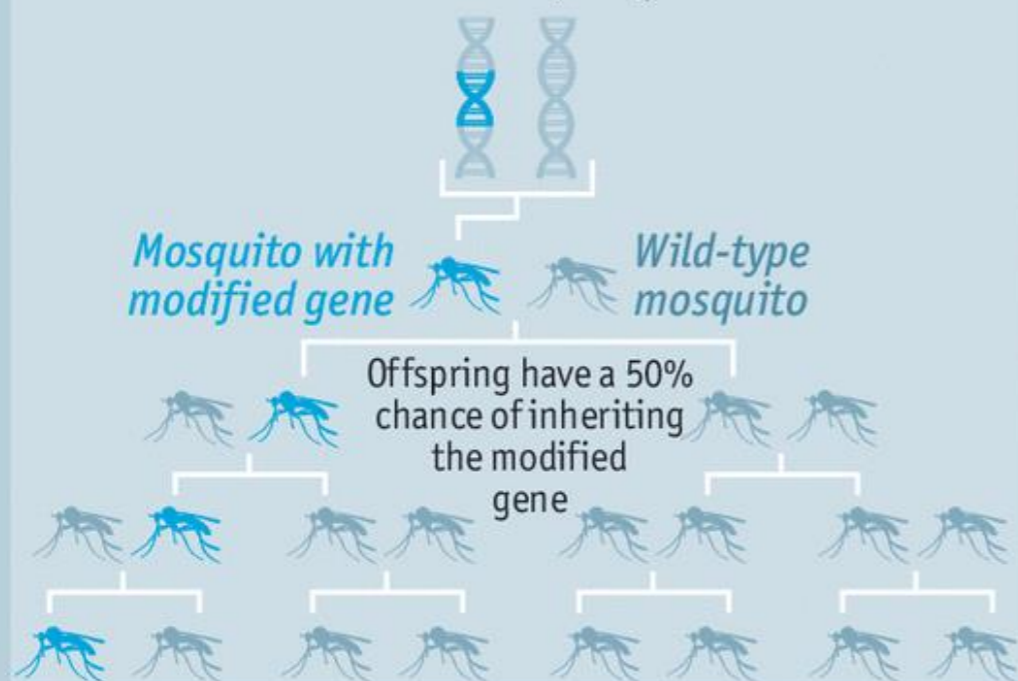
# ...And potentially in managing epidemics

## Bye bye, brother Mendel

How gene-drives can quickly change whole populations

### NORMAL INHERITANCE

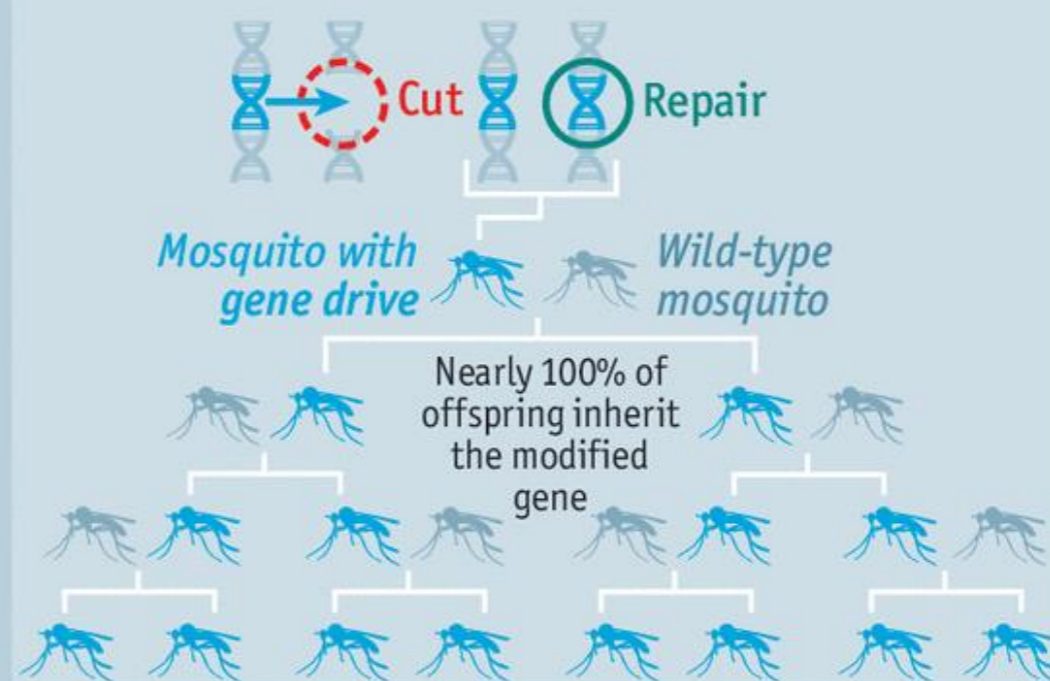
A gene on only one chromosome gets into only some offspring



Source: *Nature*

### GENE DRIVE

Gene drive inserted into one chromosome copies itself into the other



Economist.com

The Impact of Genome Editing has been profound

# Seven Governance Principles for Human Genome Editing

**Promoting Well-Being**

**Transparency**

**Due Care**

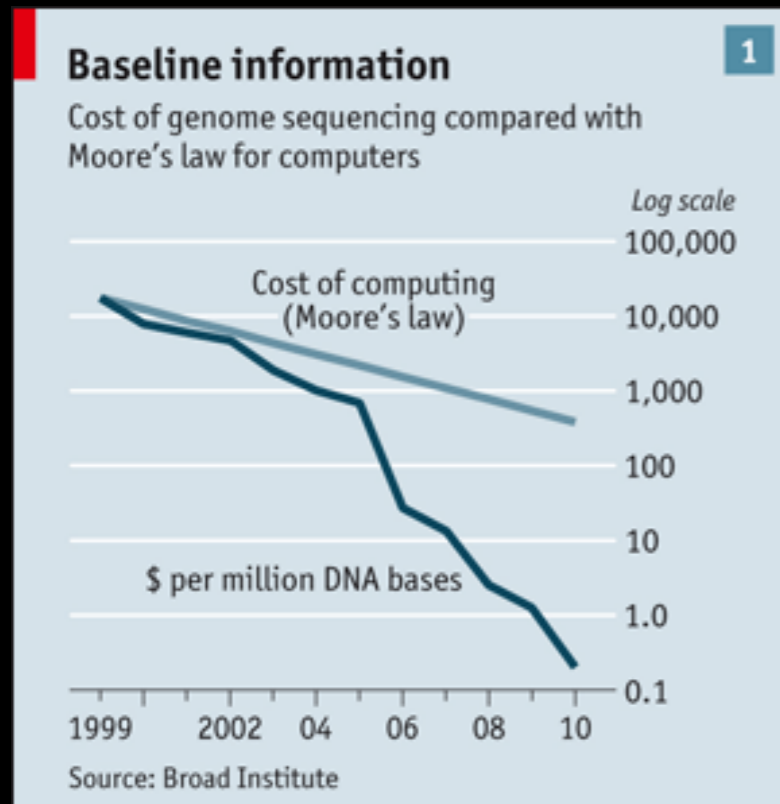
**Responsible Science**

**Respect for Persons**

**Fairness**

**Transnational Cooperation**

Biology is where the silicon revolution was in the 1970s...but evolving much faster



Next generation sequencing has revolutionized the field and ushered in the age of genomics, profoundly changing clinical medicine to agriculture, in short anywhere there is the study of life. Its implications transcend many industries.



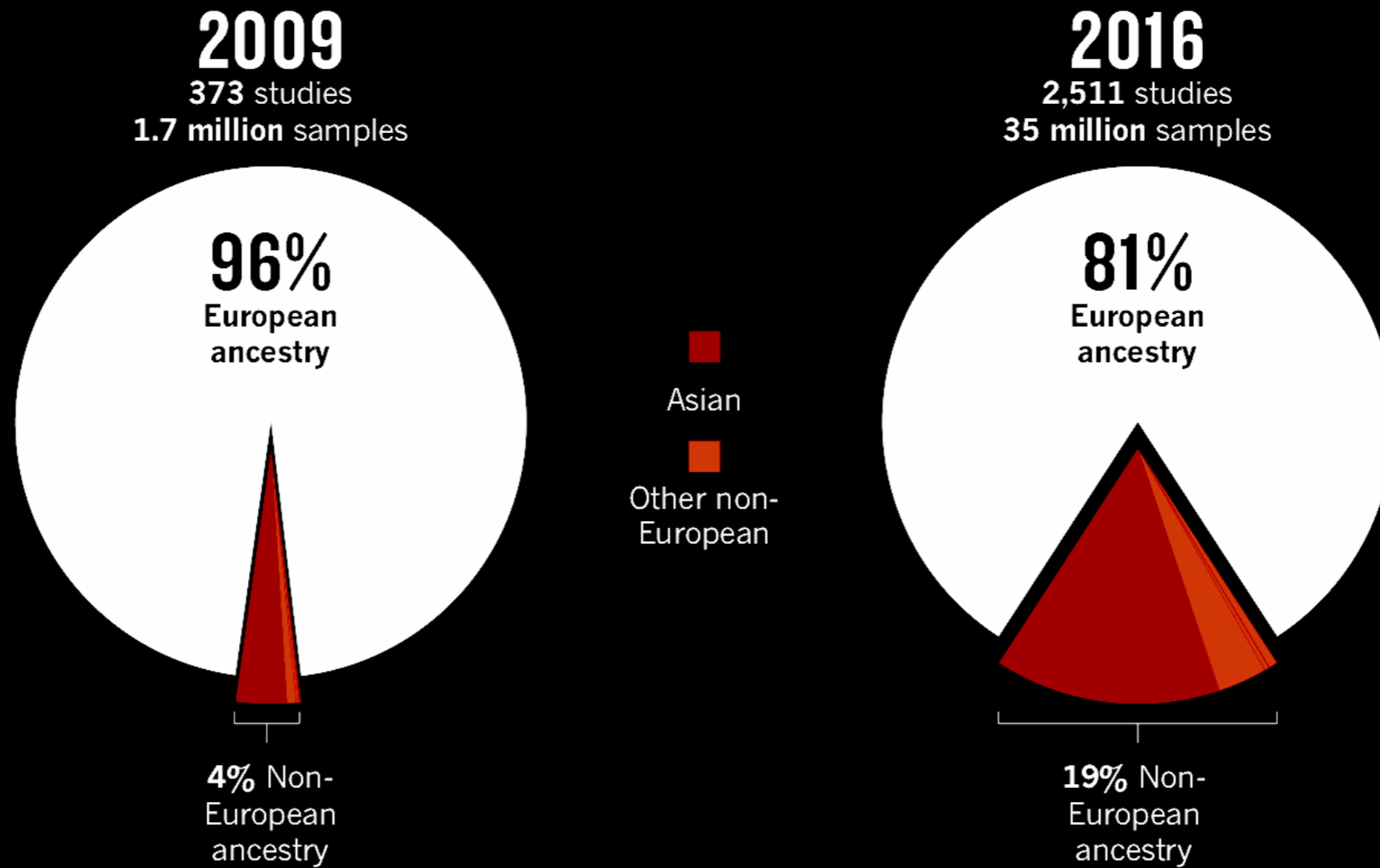
# Biology is now a “Big Data” Science

- Huge amounts of data are produced in the decoding (sequencing) process
- Data science can be applied to this to determine correlations between DNA sequences, traits and further used in “deep” learning
- Specific use cases range from clinical medicine such as oncology to agriculture and plant biology
- This data is curated in the “cloud” and access in clinical medicine is increasingly regulated

# Who's Biological "Big Data" is it?

## PERSISTENT BIAS

Over the past seven years, the proportion of participants in genome-wide association studies (GWAS) that are of Asian ancestry has increased. Groups of other ancestries continue to be very poorly represented.



Source: Nature October 2016

We should ensure that all people,  
regardless of their economic means,  
have access to technology's benefits.

**MILDRED SOLOMON**

President, Hastings Center