



## *Tackling societal challenges with machine learning*

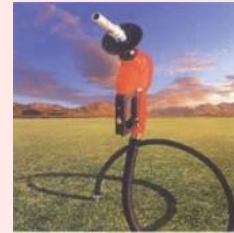
**Human genomics and personalized medicine**



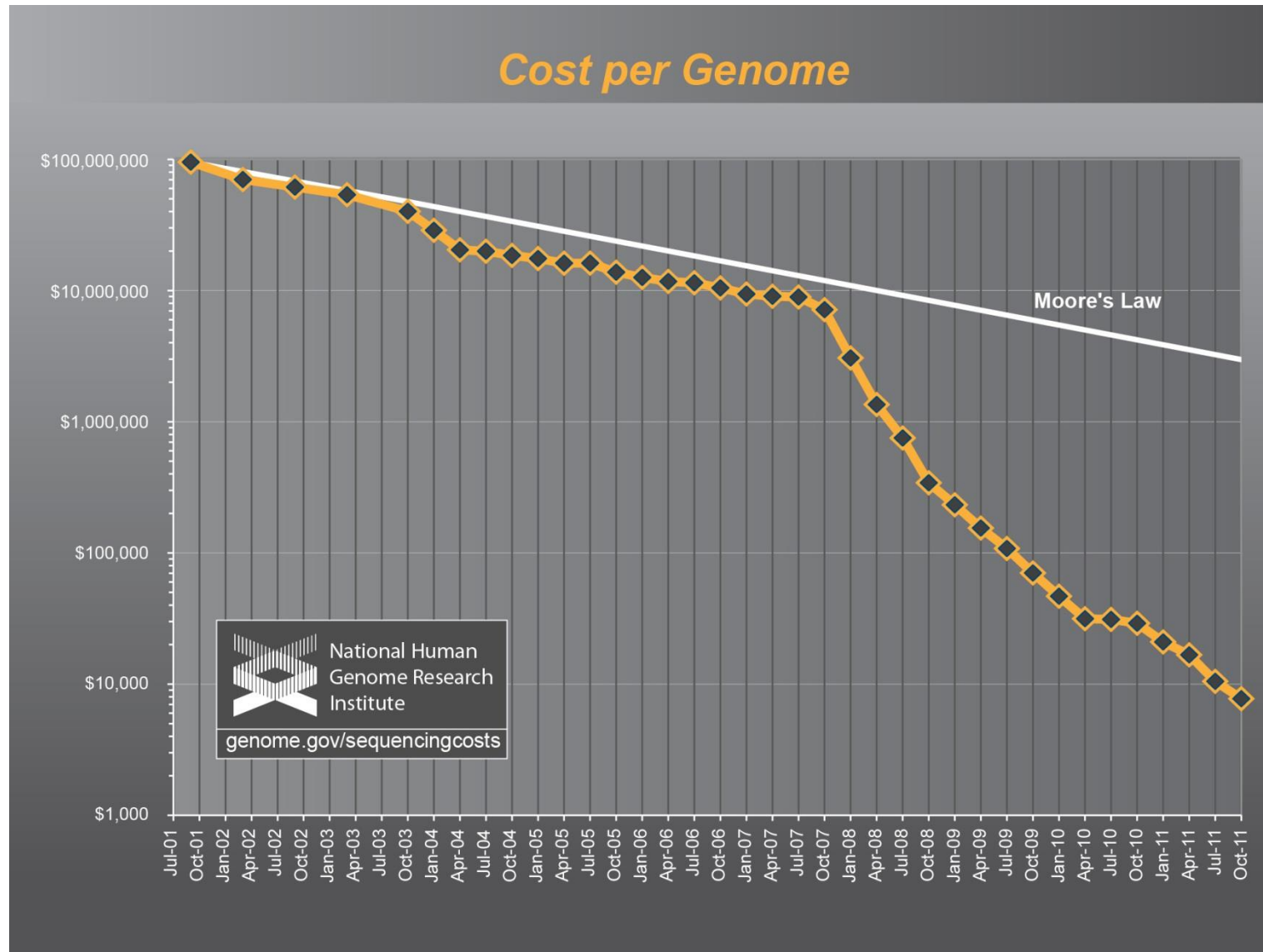
**Vaccine design  
HIV, HCV, HRV**



**Genome assembly of sugar cane**



# The Genomics Revolution

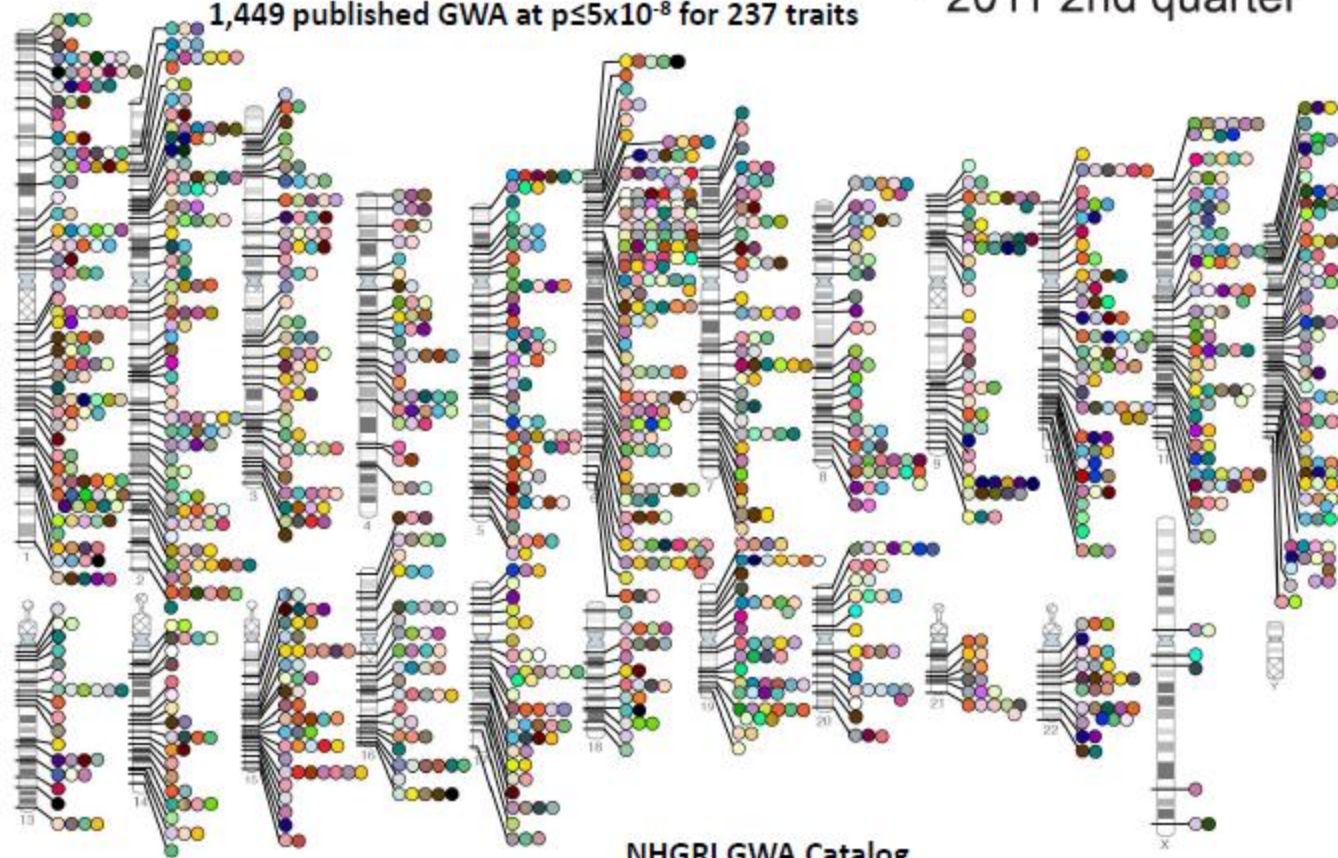


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Published Genome-Wide Associations through 06/2011, 2011 2nd quarter  
1,449 published GWA at  $p \leq 5 \times 10^{-8}$  for 237 traits



NHGRI GWA Catalog  
[www.genome.gov/GWASStudies](http://www.genome.gov/GWASStudies)

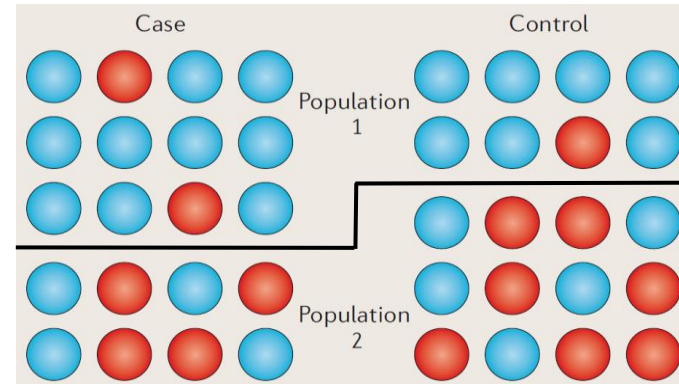


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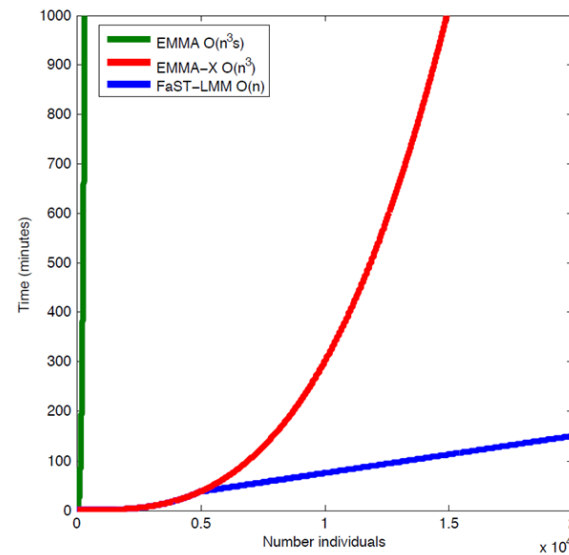


### Linear mixed models:

- $O(N^3)$  runtime  
 $O(N^2)$  memory use  
 $N < 5,000$
- FaST-LMM has  $O(N)$  runtime and memory use;  $N > 100,000$
- More power than traditional approach

nature **methods** September 2011

nature **methods** June 2012



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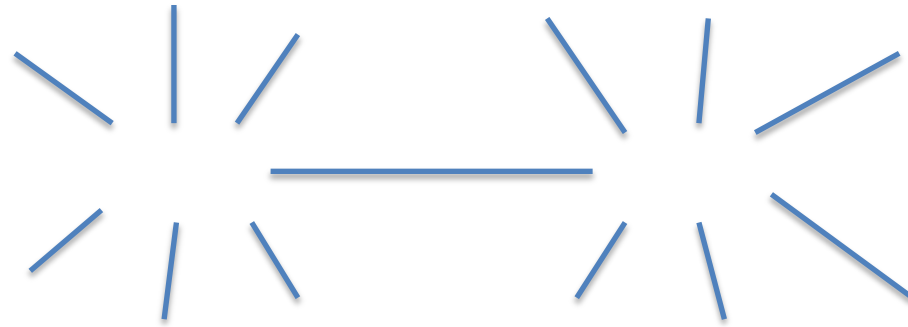
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SCIENTIFIC REPORTS

## An Exhaustive Epistatic SNP Association Analysis on Expanded Wellcome Trust Data

Christoph Lippert, Jennifer Listgarten, Robert I. Davidson, Jeff Baxter, Hoifung Poon, Carl M. Kadie & David Heckerman

