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The Epidemiological Models

Saptarshi Pyne

Assistant Professor

Department of Computer Science and Engineering
Indian Institute of Technology Jodhpur, Rajasthan, India 342030

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Discussed on blackboard

- Contact network
- The branching process model
- The SIR epidemiological model
- The SIS epidemiological model
- Time-expanded contact network
- The SIRS epidemiological model
- Synchronization and oscillation across time periods and geographical locations (a case study on TB)
- Transient contacts and dangers of concurrency

DNA as a biological contagion

- The Mitochondrial Eve [Cann et al., Nature, 1987]
- The Mitochondrial Eve and Biblical Eve

Article | Published: 01 January 1987

Mitochondrial DNA and human evolution

[Rebecca L. Cann](#), [Mark Stoneking](#) & [Allan C. Wilson](#)

[Nature](#) 325, 31–36 (1987) | [Cite this article](#)

23k Accesses | 1952 Citations | 465 Altmetric | [Metrics](#)

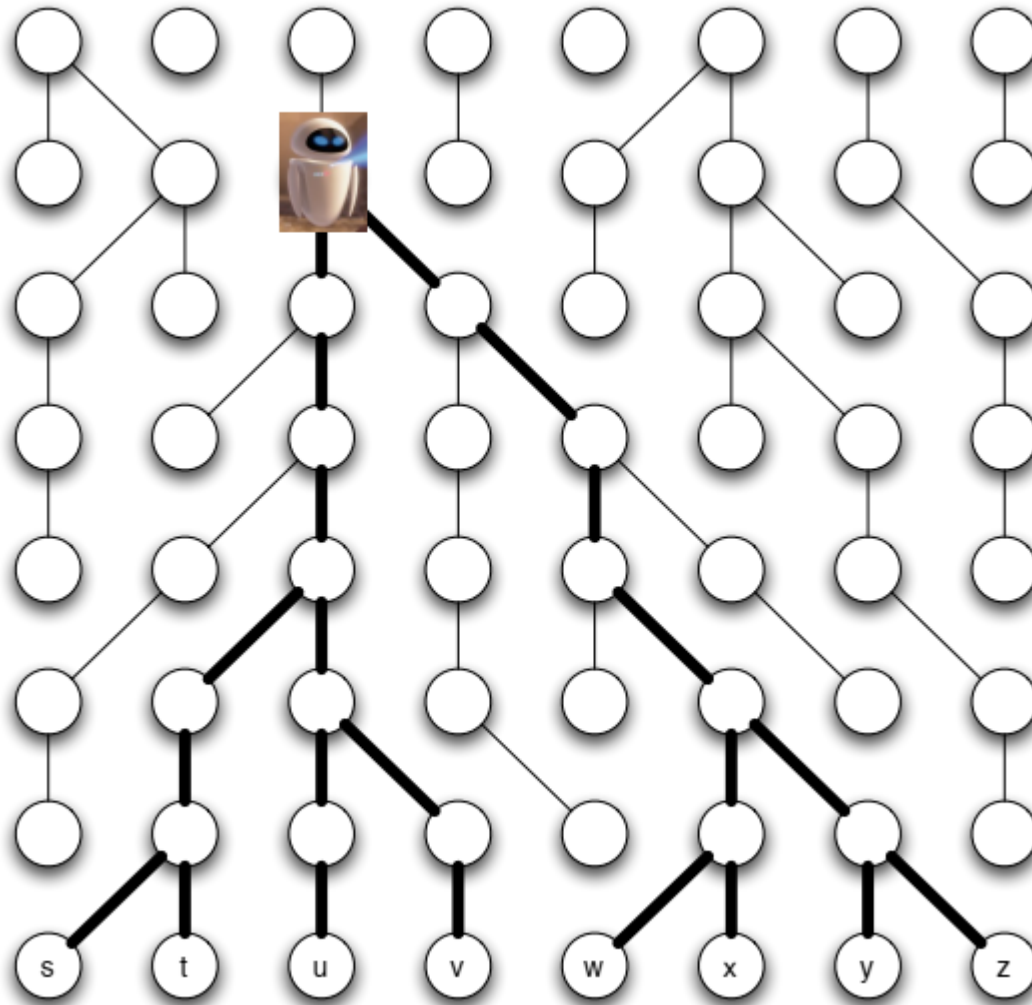
Abstract

Mitochondrial DNAs from 147 people, drawn from five geographic populations have been analysed by restriction mapping. All these mitochondrial DNAs stem from one woman who is postulated to have lived about 200,000 years ago, probably in Africa. All the populations examined except the African population have multiple origins, implying that each area was colonised repeatedly.

Mathematically simulating the existence of the Mitochondrial Eve using the Wright-Fisher model

- The Wright-Fisher model [1931] is a widely used model in population genetics for modelling single parent inheritance (for e.g., asexual reproduction)

Mathematically simulating the existence of the Mitochondrial Eve using the Wright-Fisher Model



Rows = Generations
(Top row = The oldest generation)
Columns = Irrelevant
Edges = Parent-Child relationships

N = No. of individuals in each generation = Constant

The number of distinct lineages reduces with each new generation

Gene as a biological contagion

Q. Can we mathematically simulate the existence of a common Mother using the Wright-Fisher model for humans (i.e. for sexual reproduction)?

A. Yes, if we model each gene as a contagion instead of the whole DNA, we can mathematically simulate the existence of a common Mother for each gene.

References

- David Easley and Jon Kleinberg (2010), ***Networks, Crowds, and Markets: Reasoning About a Highly Connected World***, Cambridge University Press. Pre-publication [draft](#). Book [website](#).
 - Chapter 21 'Epidemics': Sections 21.1–21.7

Thank you