Stress-induced mutagenesis & complex adaptation
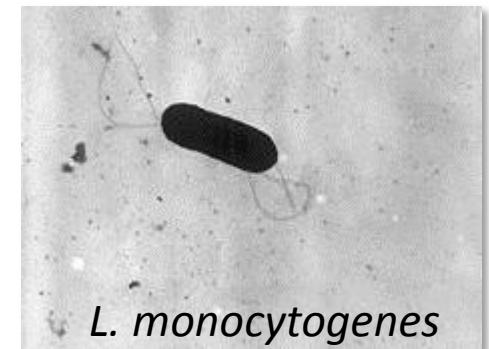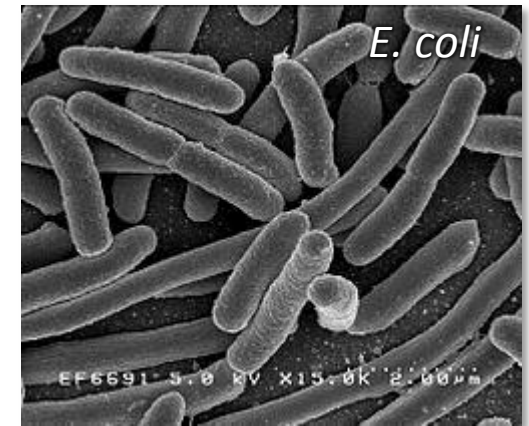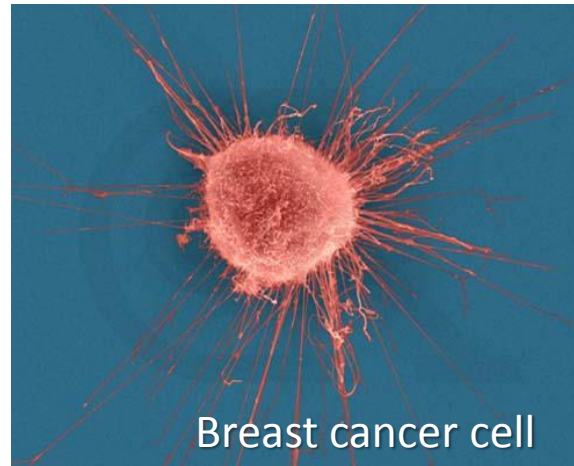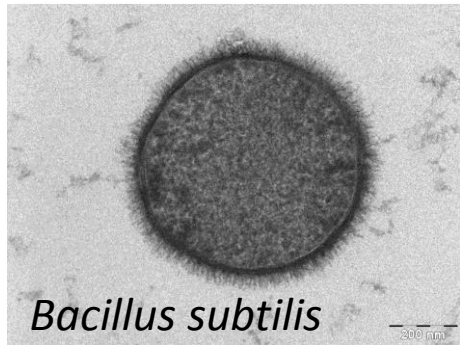
Yoav Ram

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Dept. of Molecular Biology and Ecology of Plants

Life Sciences Faculty

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TEL AVIV UNIVERSITY

Stress-induced mutation

Green algea

Nematodes

Bacillus subtilis

Breast cancer cell

E. coli

D. Melanogaster

M. tuberculosis

L. monocytogenes
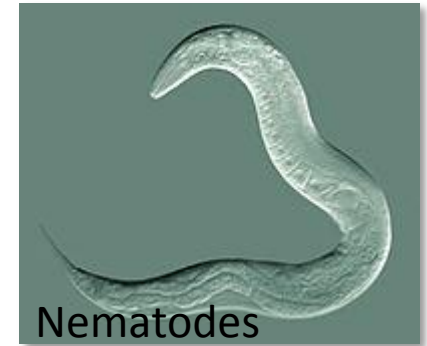
Causes and consequences of Stress-induced mutation

- **Evolution of stress-induced mutation:**
    - SIM can evolve due to 2nd order selection
    - In constant and changing environments
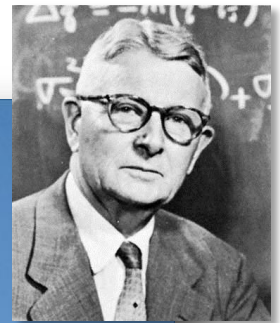
        Ram & Hadany, Evolution 2012

- **Consequences of stress-induced mutation:**
    - **Effect on complex adaptation**

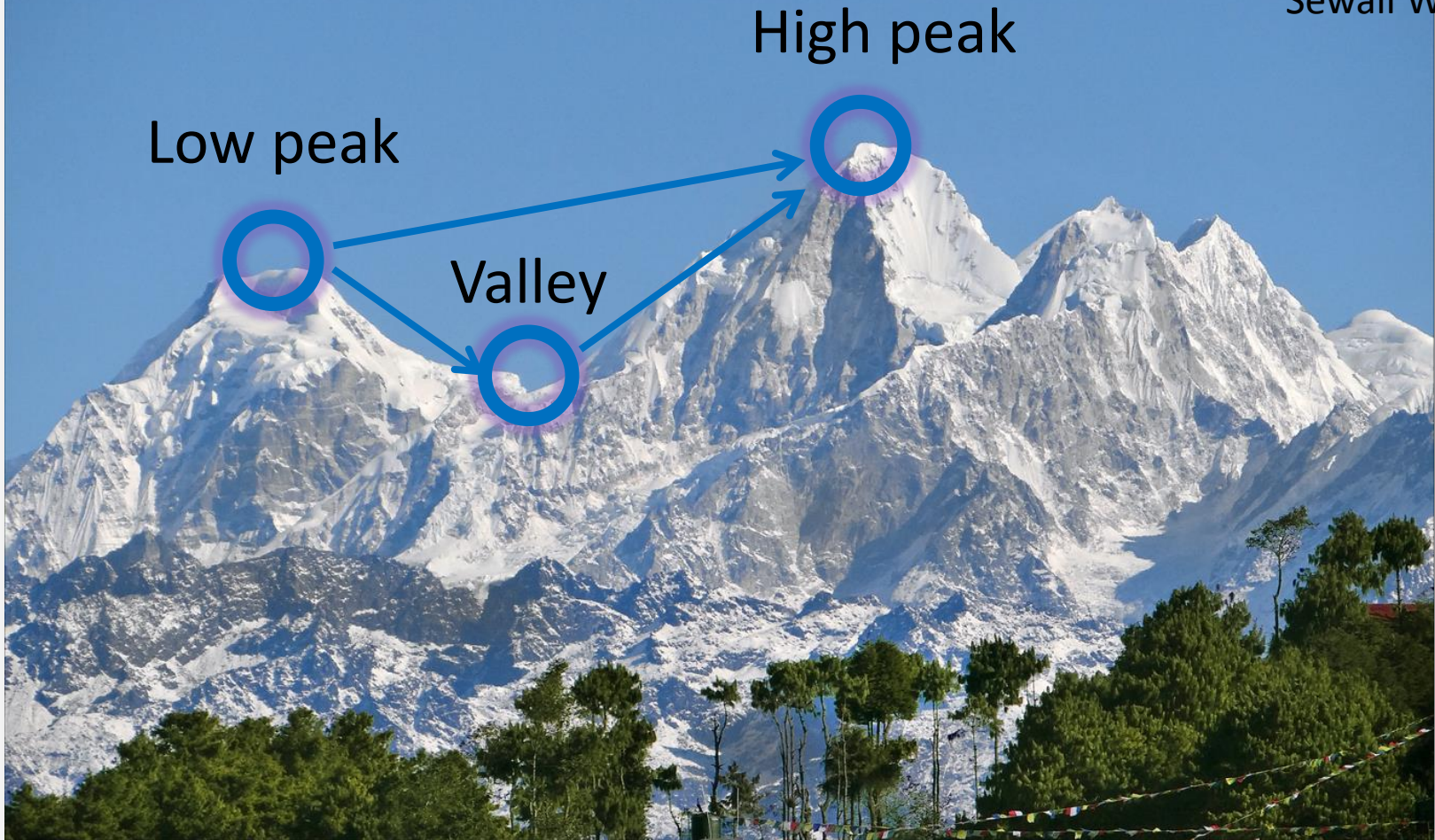   Ram & Hadany, Proceedings B 2014

Adaptive peak shifts

Sewall Wright

High peak

Low peak

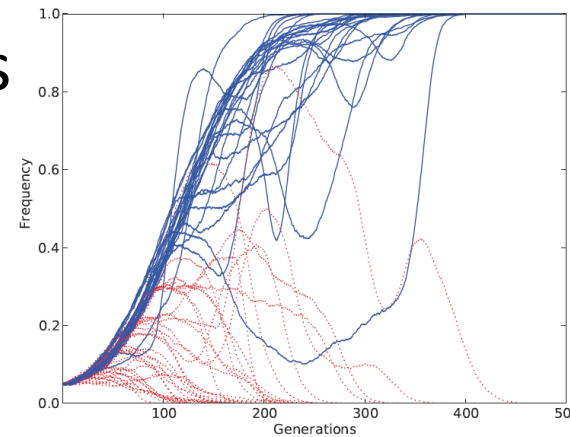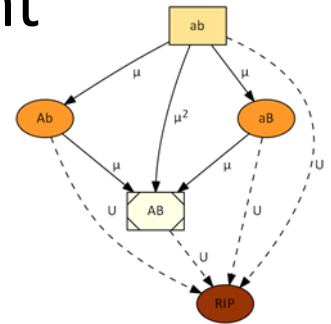**Valley**

←—Fitness—→

←**Genotype**→

4

Methods

$$p' = \frac{p}{p + (1-p)(1-s)}$$

- ## Model

  – Follow allele frequencies over many generations

  – Probability of appearance of adapted mutant

  – Probability of fixation of adapted mutant
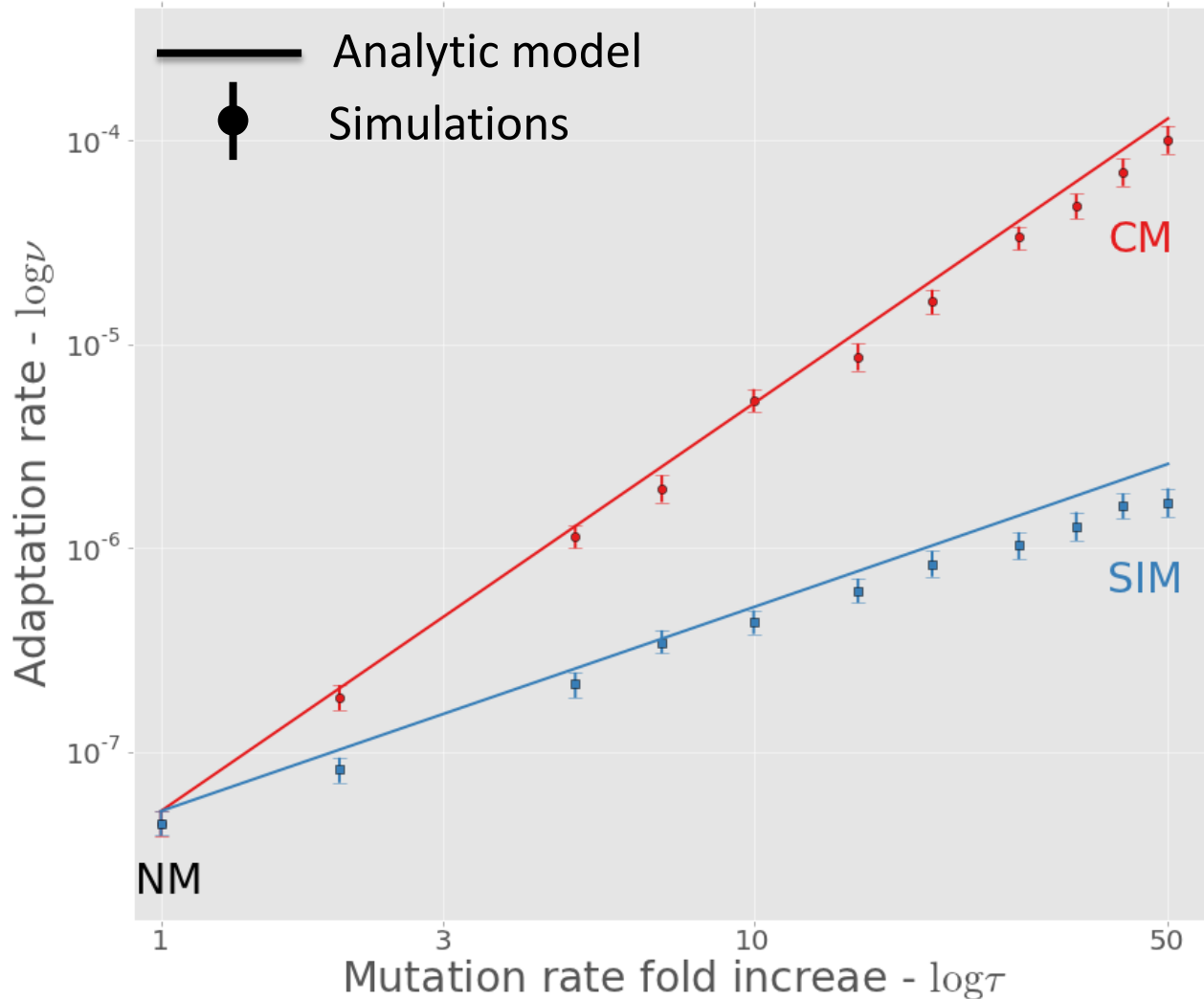
- ## Simulations

  – Stochastic realizations of analytic model
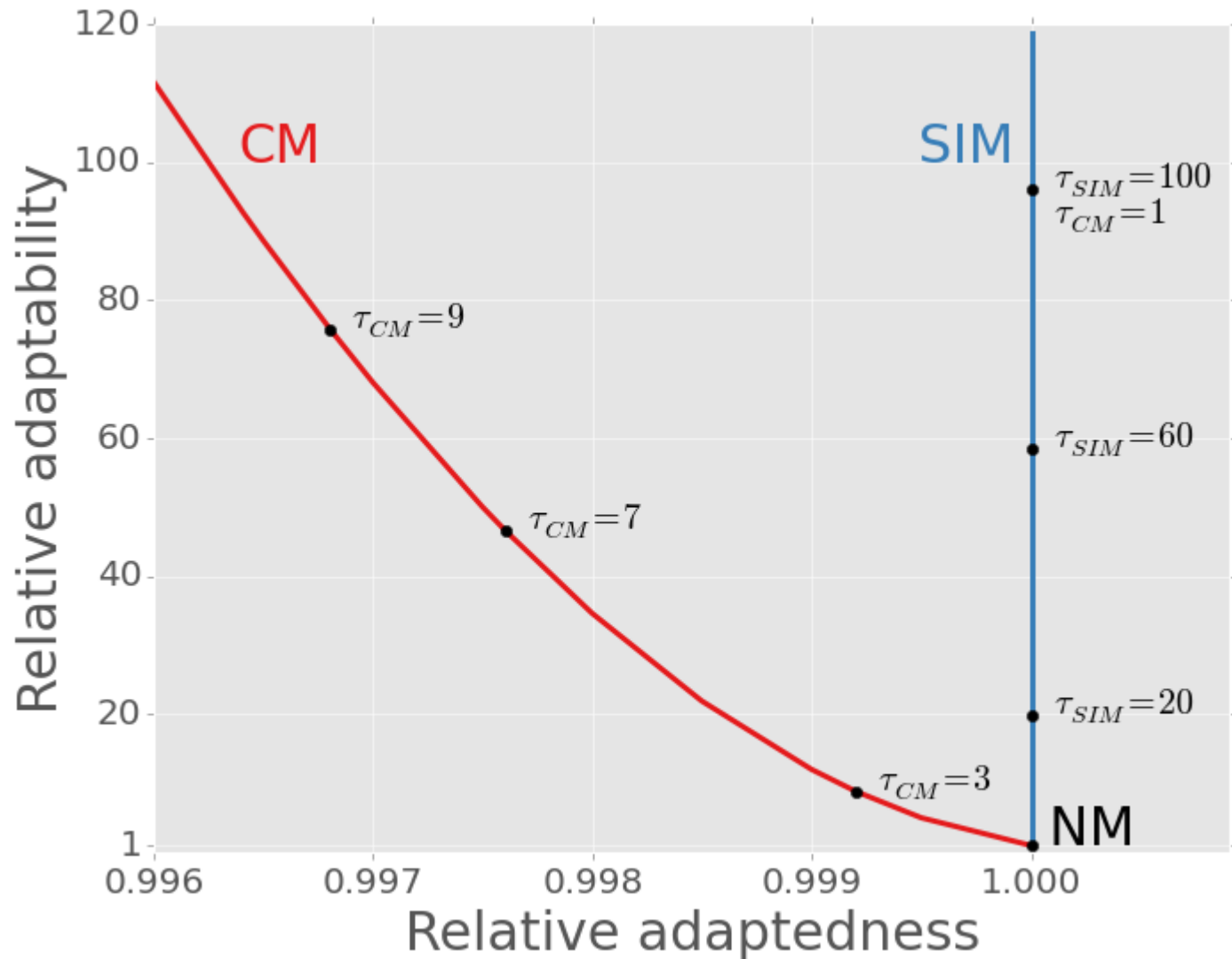
  – Statistical analysis of many replicates

5

Adaptation rate

CM: constitutive mutation

SIM: stress-induced mutation

SIM breaks the trade-off between *adaptability* and *adaptedness*

Acknowledgments

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