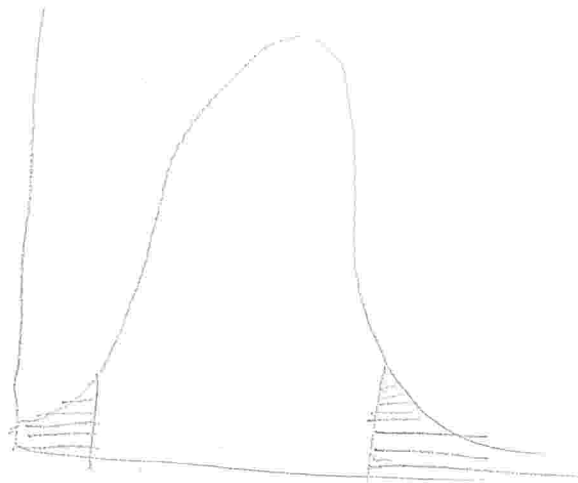
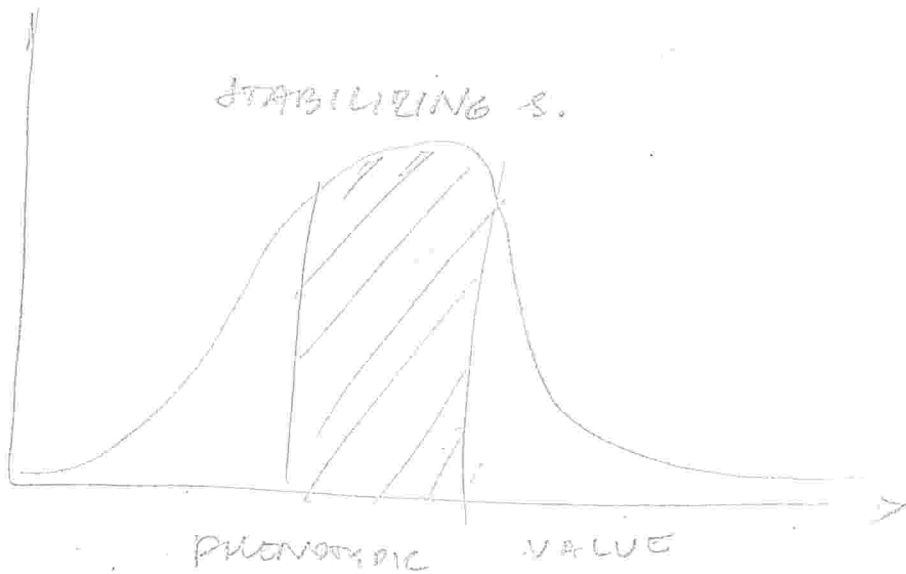


ORCHID FROM MADAGASCAR WITH LONG FLORAL  
TUBE POLLINATED BY NIGHT-FLYING MOTH  
WITH EXCEPTIONALLY LONG PROBOSIS.

# CONTINUOUS TRAITS:

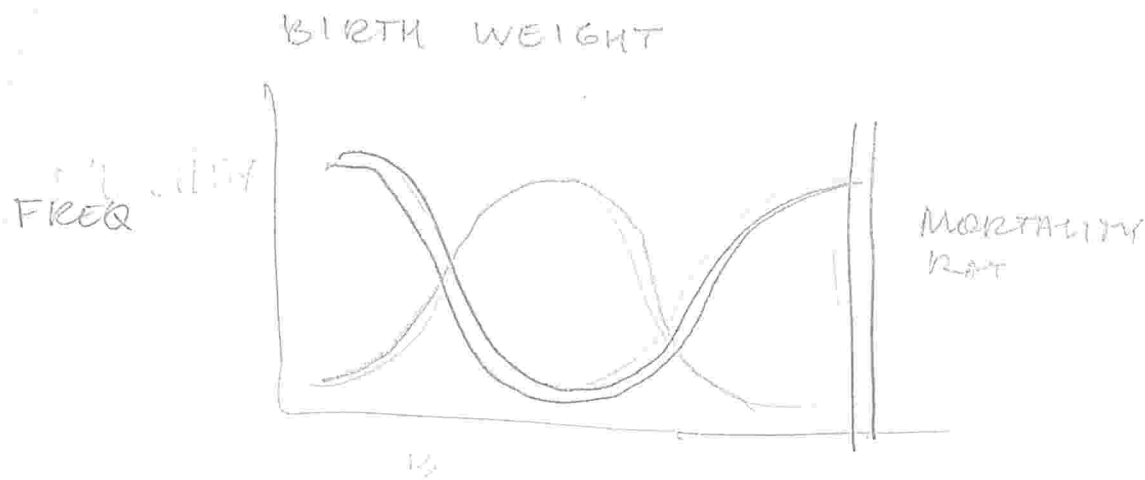
FREQUENCY OF  
PHENOTYPE IN  
THE POPULATION



DISRUPTIVE SELECTION

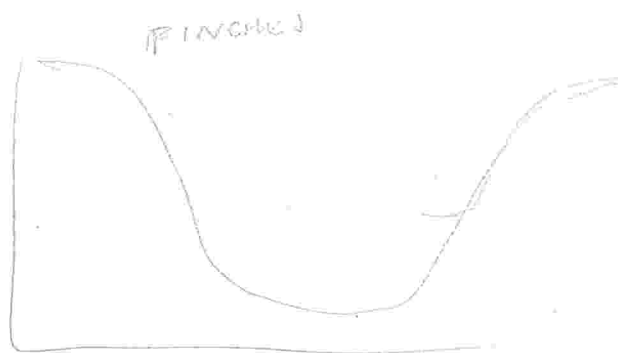
STATEMENTS ABOUT SELECTION ARE STATE-SPECIFIC

## EXAMPLES



### DISRUPTIVE SELECTION

• DISCRETE RESOURCES



WHAT ARE  
THE AGENTS  
OF SELECTION?

TRICKY, EVEN THOUGH  
HUNDREDS OF MEASUREMENTS  
OF VARIABILITY AND  
FITNESS DIFFERENCES ARE  
MADE EVERY DAY

### EVOLUTION OF POPULATION

- EVOLUTION OF INDUSTRIAL MELANISM IN THE PEPPERED MOTH
- HEAVY METAL RESISTANCE OF BLAKES

M. MAYRUS DEVOTES LIFE TO CROCK KETTLEWELL

---

DECLINE IN FREQUENCY OF THE BLACK (MELANIC) FORM AFTER INTRODUCTION OF THE CLEAN AIR ACT 1954

---

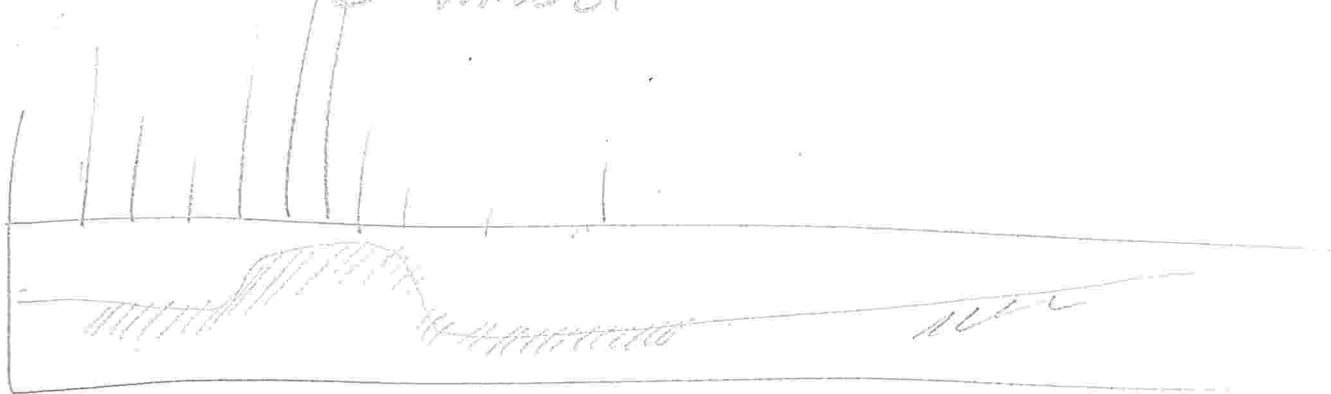
EVOLUTION BY POLLUTION — PLANTS

- MINE WASTE HEAVILY POLLUTED WITH HEAVY METALS
- MOST MINES LESS THAN 100 YEARS OLD

GRASS COLONISED THE MINE TAILINGS.

→ TOLERANT GENOTYPES INVADE MINE TAILINGS FROM NEARBY PASTURES

→ GENE FLOW BETWEEN PASTURE AND MINE IS RESTRICTED DUE TO DIFFERENT PLANT FLOWERING TIMES.



A COST TO HEAVY METAL TOLERANCE

→ IS THERE A BIG REDUCTION OF THE GENETIC DIVERSITY? → YES.

---

EVOLUTION IN THE LAB —

“EXPERIMENTAL EVOLUTION”

→ RICHARD LENSKI

→ 20-YR EXPERIMENTS WITH *E. COLI*

→ COMPETE THE ANCESTORS WITH THE PROGENY FREEZING

# BISTON BETULARIA AND INDUSTRIAL MELANISM

→ LIGHT AND DARK FORMS OF SPECIES  
MAY REST ON THE TREE

→ BEFORE 1850 DARK MOTHS ARE RARE,  
- CAUSED BY SINGLE DOMINANT ALLELE



## KETTLEWELL'S TRIUMPH

- MEDICAL DOCTOR WITH THE HOBBY OF REARING MOTHS AND BUTTERFLIES
- SO SMITTEN BY BEING IN OXFORD - QUIT BEING A DOCTOR
- DID MARK, RECAPTURE STUDIES
- PUBLISHED SEVERAL PAPERS THAT BECAME CLASSICAL STUDIES

→ DOUBTS RAISED ABOUT BIRD PREDATION EXPERIMENTS;

- MOTHS WERE REARED IN ONE LAB.
- MOTHS PUT ON TRUNKS AT UNNATURAL HIGH DENSITIES
- MOTHS RARELY SEEN ON TRUNKS

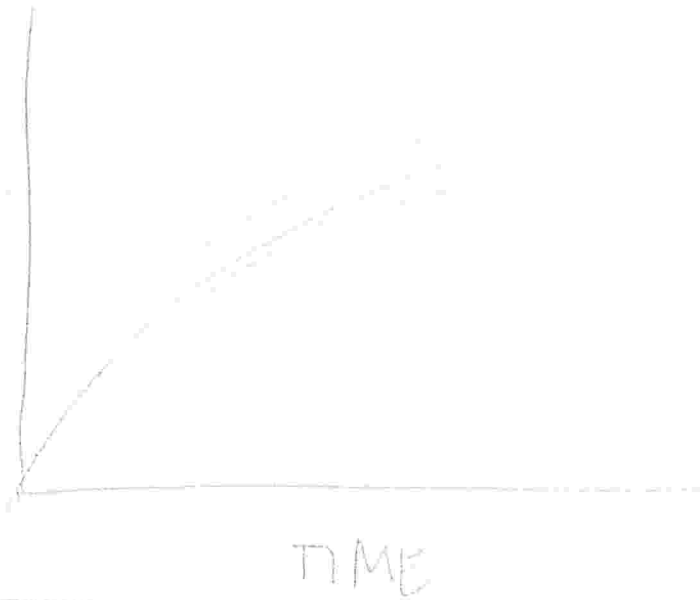
WITH ROBOTICS:

SINGLE STRAIN



CITRATE/GLUCOSE MEDIUM

RELATIVE FITNESS



CIT+ BENEFICIAL MUTATION AT ~33 000<sup>TH</sup> GENERATION

OPEN QUESTIONS ABOUT ADAPTATION

WHAT IS THE RELATIVE IMPORTANCE  
OF STANDING GENETIC VARIATION VS  
NEW MUTATIONS?

THE CONVERGENT ADAPTATIONS IN  
UNRELATED ORGANISMS ARE RESULTS  
OF THE SAME OR DIFFERENT GENES?