6OTH EAAP ANNUAL MEETING

IMPACT OF DARWIN'S THEORIES ON LIVESTOCK BREEDING

AN EXPERIMENTAL APPROACH TO THE INTERFACE BETWEEN NATURAL AND ARTIFICIAL SELECTION

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Can the principle of selection, which we have seen is so potent in the hands of man, apply under nature?

I think we shall see that it can act most efficiently.

The Origin of Species

HOWEVER,

- NATURAL AND ARTIFICIAL SELECTION ACT THROUGH THE SAME MECHANISM (PARENTS' DIFFERENTIAL CONTRIBUTION OF OFFSPRING)

- BUT HAVE DIFFERENT OBJECTIVES (DIRECT SELECTED TRAIT) AND CONSEQUENCES (SECONDARY SELECTED TRAITS)

THUS,

- INDIRECT RESPONSES TO SELECTION ARE RESPONSIBLE FOR:

  1) ADAPTATION AND, SUBSEQUENTLY, DIVERSIFICATION (NATURAL SELECTION), BUT

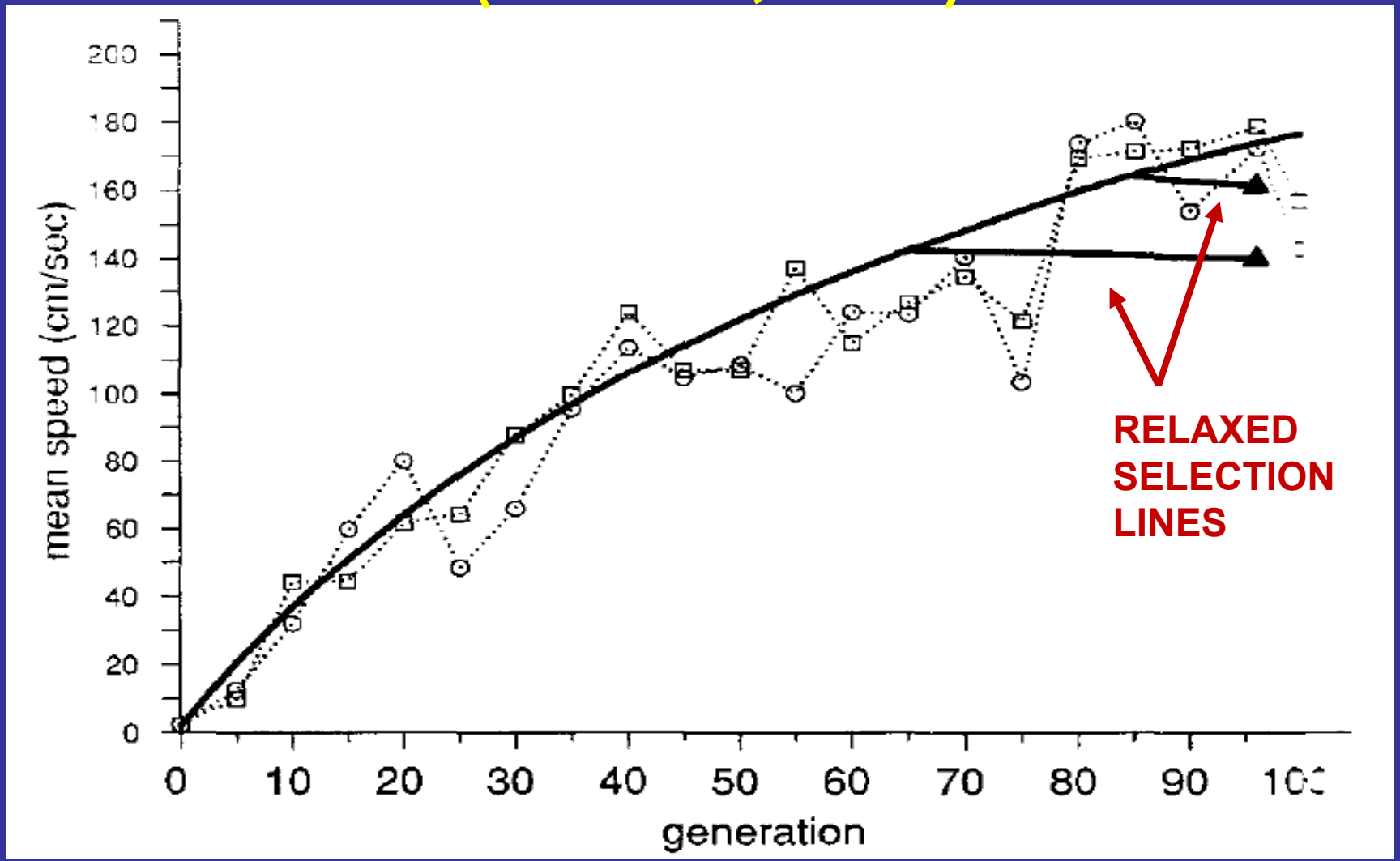
  2) ANTAGONISM BETWEEN ECONOMIC AIMS AND FITNESS (ARTIFICIAL SELECTION)

- EVEN FOR QUASI-NEUTRAL TRAITS, ANTAGONISM BETWEEN THE AIMS OF NATURAL AND ARTIFICIAL SELECTION WILL BUILD UP SOONER (FOR SMALL EFFECTIVE SIZE N_e) OR LATER (LARGE N_e)

K. E. WEBER DROSOPHILA SELECTION EXPERIMENT

- SELECTED TRAIT: FLYING SPEED IN WIND TUNNEL
- FLIES SCORED/LINE AND GENERATION: 46000
- SELECTED PROPORTION: 4.5%
- EFFECTIVE SIZE: $500 \leq N_e \leq 1000$
- MEAN SPEED INCREASED FROM 2 TO 170 CM/SEC IN 100 GENERATIONS
- MINIMAL FITNESS LOSS IN SELECTED LINES

RETENTION OF PHENOTYPE DURING 10-30 GENERATIONS OF RELAXATION (WEBER, 1995)



- **My *Variation of Animals and Plants under Domestication* […] gives all my observations and an immense number of facts […] about our domestic productions. In the second volume the causes and laws of variation, inheritance, &c., are discussed, as far as our present state of knowledge permits. Towards the end of the work I give my well abused hypothesis of Pangenesis**

C. Darwin: Autobiography

LÓPEZ-FANJUL & GARCÍA-DORADO REGENERATION EXPERIMENT

AFTER 485 GENERATIONS OF ACCUMULATION OF NEW MUTATIONS,

A DROSOPHILA POPULATION (N_e ~ 500), GENETICALLY INVARIANT IN ITS ORIGIN, RECOVERED THE STANDARD LEVEL OF GENETIC VARIANCE OF LABORATORY POPULATIONS FOR BRISTLE NUMBER

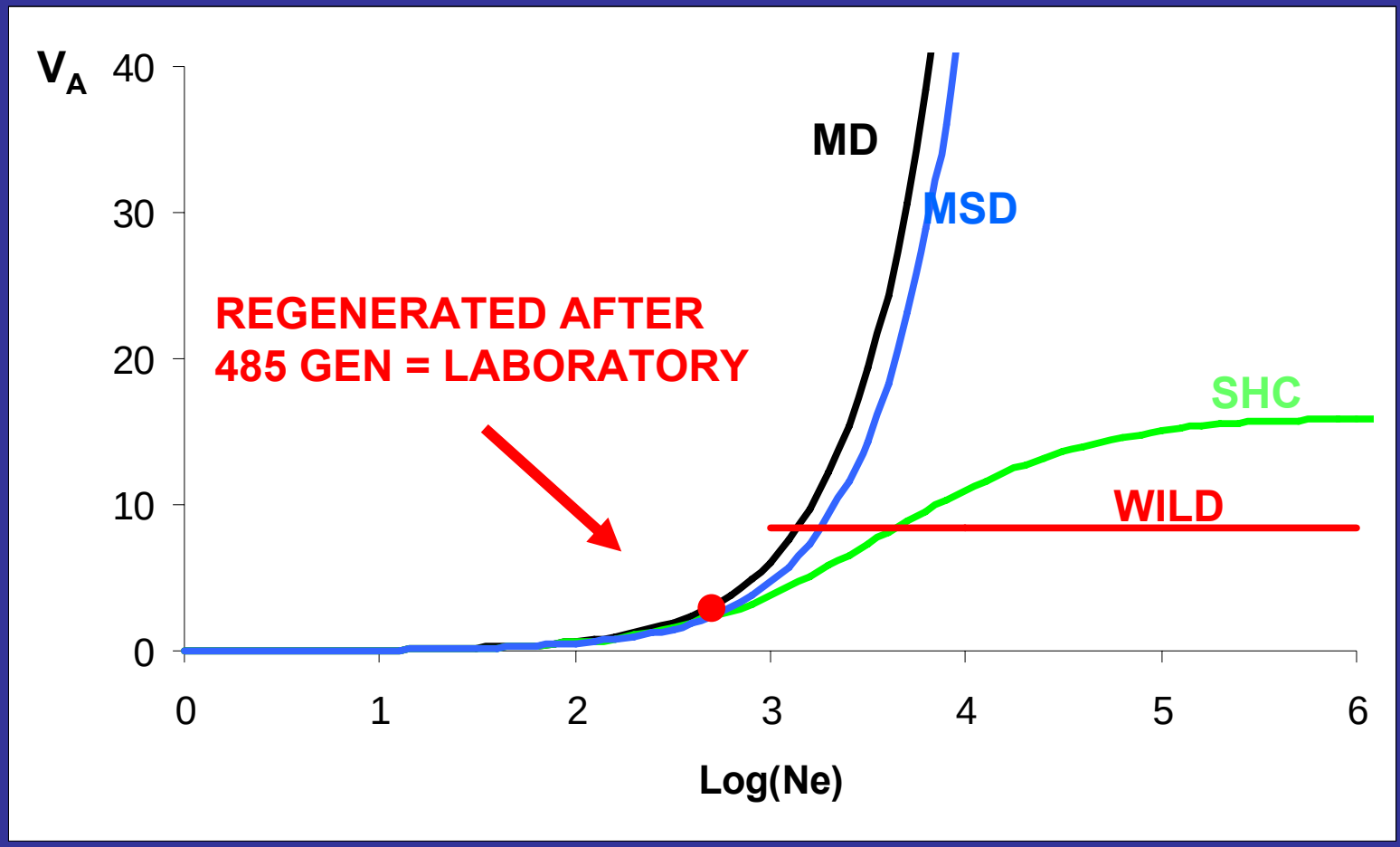
ESTIMATED ADDITIVE VARIANCE:

- REGENERATED = 4.2
- LABORATORY POPULATIONS AVERAGE = 4.5
- WILD POPULATIONS AVERAGE = 8.4

PREDICTED ADDITIVE VARIANCE AT BALANCE:

- MUTATION-DRIFT (MD)
- MUTATION-DRIFT- APPARENT STABILIZING SELECTION (MSD)
- MUTATION-DRIFT- REAL STABILIZING SELECTION (SHC)

ESTIMATES AND PREDICTIONS OF ADDITIVE VARIANCE

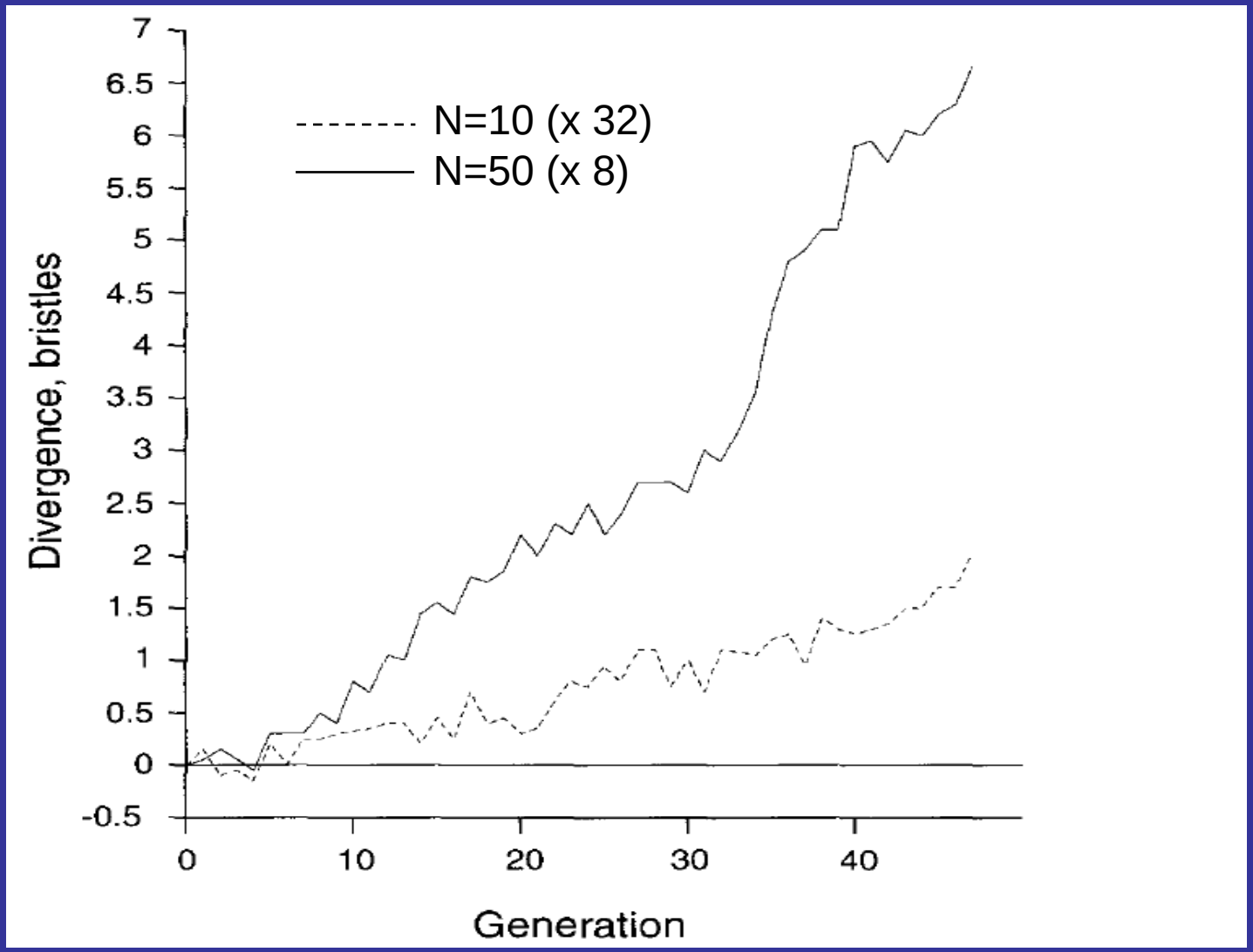


LÓPEZ & LÓPEZ-FANJUL DROSOPHILA SELECTION EXPERIMENT

- FROM A DROSOPHILA POPULATION,
  GENETICALLY INVARIANT IN ITS ORIGIN,
  DIVERGENT SELECTION FOR BRISTLE NUMBER WAS CARRIED OUT DURING 46 GENERATIONS
  [16 REPLICATES (10/50) AND 4 REPLICATES (50/250) PER DIRECTION OF SELECTION]

- THE RESPONSE WAS PROPORTIONAL TO N_e

DIVERGENT SELECTION RESPONSE STARTING FROM AN ISOGENIC LINE (LÓPEZ & LÓPEZ-FANJUL, 1993)



CONCLUSIONS

- THE VARIATION OF MANY METRIC TRAITS ARISES BY MUTATION AND IS SUBSEQUENTLY SHAPED BY STABILIZING SELECTION AND DRIFT
- IF NATURAL SELECTION IS NOT STRONG AND THE EFFECTIVE POPULATION SIZE IS NOT SMALL, LARGE RESPONSES TO ARTIFICIAL SELECTION CAN BE ATTAINED AND WILL NOT BE ANTAGONISED BY NATURAL SELECTION DURING MANY GENERATIONS
- MUTATION HAS AN IMPORTANT ROLE IN SUSTAINING LONG-TERM SELECTION RESPONSE