ANIMAL'S ENVIRONMENT

→ HABITAT (BIOMA)

(deep sea, desert, etc.)

↓

ENVIRONMENT DEFINED WITHIN A BIOM

(underground, underwood, etc.)

↓

MICROENVIRONMENT (MICROHABITAT)

(the animal chooses a certain microhabitat, e.g., a type of plant, and modifies it, e.g., building a den, interaction with other animals and plants, excretion and junk, etc.)

ENVIRONMENT CLASSIFICATION

(independent of the level, i.e. biome or microenv.)

- STRESS INTENSITY (- ABIOTIC, - BIOTIC)

- AMPLITUDE OF FLUCTUATIONS (relative concept, e.g. depend on the animal's size)
  (and VELOCITY OR CYCLIC PATTERN)

- AVAILABILITY OF ENERGY/RESOURCES

  ↓ DESERTS/POLES (shorter alimentary chains, lower metabolic activity)

  ↑ RAIN FORESTS, CORAL REEFS (even stable): more complex chains
  higher specialization
  " adaptive radiation

SELECTION r (variable environments)] EXTREMES OF
K (stable ")] A CONTINUUM
A (extreme ")
ADVERSITY

ADAPTATION (uses of the term)

- CHARACTER OR TRAIT (e.g. presence of Hb)

- PROCESS (natural selection modifies the frequency of genes influencing fitness)

more correct ↗

- COMPENSATORY MODIFICATIONS on a short term, in response to environmental variations. Depends on PHENOTYPIC PLASTICITY.

Better to say: ACCLIMATION
ACCLIMATIZATION
ACUTE RESPONSES

PROVING THAT A GIVEN CHARACTERISTIC IS ADAPTIVE IS DIFFICULT.

Nonetheless, many physiological characters have well quantifiable effects on survival, e.g., more than many morphological features.

TIME SCALE OF PHYSIOLOGICAL RESPONSES

- ACUTE RESPONSES (s or min) TO THE CHANGES of the ORGANISM'S OR CELLULAR STATE (e.g., ↑ VENTILATION OR HEART RATE)

- HOURS TO WEEKS : ACCLIMATION (or acclimat. in the LAB.)

  E.g., response to altitude or seasonal changes

  MAY INVOLVE changes of GENE EXPRESSION or long-term tissue changes (vascularization, muscle mass, etc.)

- PHENOTYPIC or DEVELOPMENTAL PLASTICITY

  Abiotic (T, pH, salinity, photoperiod, etc.) or biotic (population density, hormones, etc) FACTORS. These modulate the developmental program and thus the final phenotype.

  For instance, desert rodents grown in the absence of water have a kidney medulla thicker than those reared with free access to water.

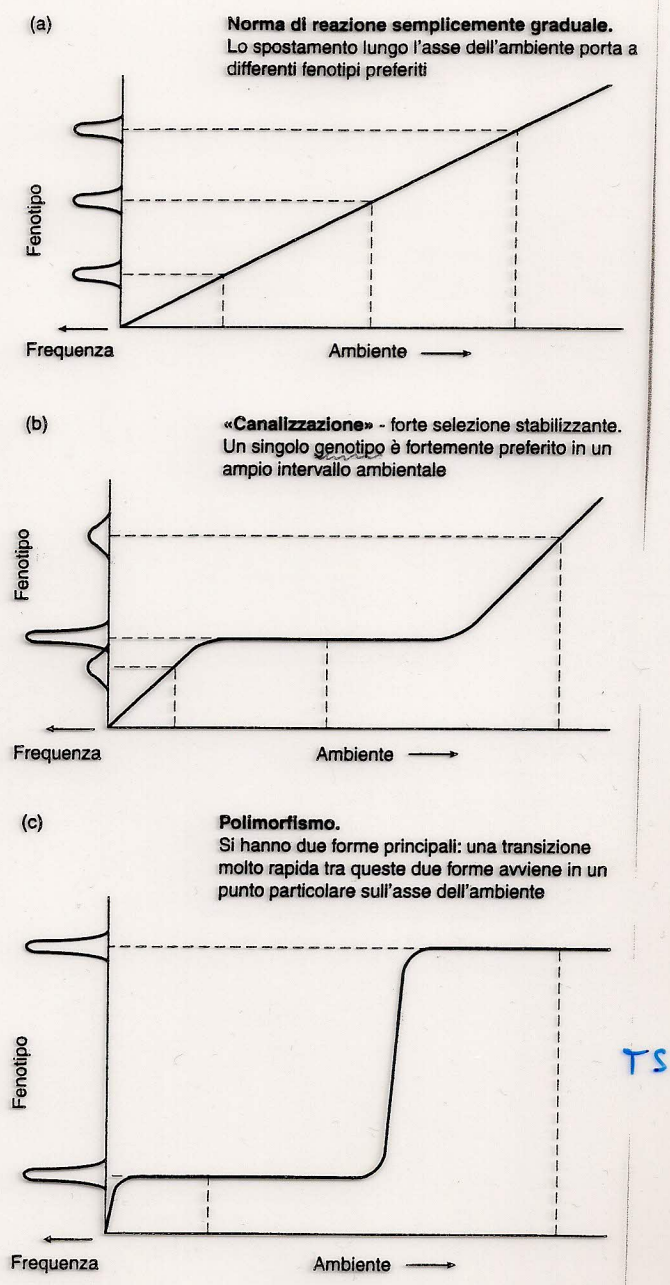

Figura 1.5. Norma di reazione come mezzo di comprensione degli effetti ambientali sul fenotipo.

TS Δ Rettil.

STRATEGIES OF PHYSIOLOGICAL RESPONSE

(HOMEOSTASIS OR NOT)

- AVOIDANCE

  SPATIAL (migration)

  TEMPORAL (torpor, cyste...)

- CONFORMITY

  homeostasis is not maintained for the entire organism

  tolerance limits

- REGULATION (+ HYPER-, HYPOREGULATION)

  homeostasis is maintained

  tolerance limits

They depend on a concourse of biochemical, physiological, morphological and behavioral responses.

- SMALL SOFT BODY ANIMALS :

  MORE LIKELY AVOIDANCE OR CONFORMITY

  - HIGH S/Vol
  - EASY USE OF MICROENVIRONMENTS
  - SCARSELY ISOLATES AND LITTLE PROTECTION against ΔVol

- SMALL and MEDIUM SIZED ANIMALS WITH EXOSKELETON

  - REGULATE MORE EASILY, more independent of environment.
  - OSMOTIC and T PROTECTION
  - but AVOIDANCE REMAINS IMPORTANT.

- BIG ANIMALS

  - often REGULATORS (especially Vertebrates, in sea environments)
  - Low S/Vol
  - "COARSE-GRAINED" ENVIRONMENT
  - ENERGY STORES, MORE COMPLEX ORGANS