

9.20 M.I.T. 2005

Class #(12)-13

Early evolution of behavior;
Learning and plasticity

Notes on Evolution and the Organization of Behavior

1. What are the most basic multipurpose movement abilities of animals from protozoa to primate?

Earliest evolution of behavior: Single-celled organisms

- Elementary life-support
 - Intracellular movements and transport across cell membrane
- Multipurpose movement abilities
 - Locomotor **approach** movements
 - Foraging, feeding
 - Locomotor **avoidance/escape** movements
 - Avoiding and escaping predators
 - **Orienting**
 - Responses to sensory inputs
 - **Grasping**
- Special purpose movements for consummatory behavior

Multicellular animals

- Note that all of the behaviors listed for single-celled organisms apply
- In addition:

Notes on Evolution and the Organization of Behavior

2. What are the three types of basic support of behavior (the three stabilities). Give examples of each for vertebrates.

Basic supports of behavior: internal automatisms and the mantle of reflexes

1. Stability of the internal milieu: “vital functions”
 - Respiration: breathing behavior *via* reflex actions and endogenous brain mechanisms
 - Circulation of blood *via* heartbeat, with reflex regulation
 - Chemical environment (blood, lymph, extracellular fluids)
 - Temperature regulation *via* reflex actions
2. Stability in space
 - Postural supports *via* reflex actions
3. Stability in time: the background
 - Temporal organization of the day-night cycle: Circadian rhythms and entrainment by natural light cycle
 - Longer and shorter rhythms

Above the level of reflexes and internal automatisms, these supports are extended by brain evolution. For which is the forebrain most important?

Notes on Evolution and the Organization of Behavior

3. Above these basic supports are the regulators of behavior – the basic controllers we call drives or motivational systems.

List the most basic groups of drives/controllers, found in all vertebrates. (Most of these, if not all, are also found in invertebrates.)

Regulators of behavior: the basic drives (“controllers”)

1) Ingestion drives

- Hunger
- Thirst

2) Related but distinct drives

- Foraging
- Predatory attack in cats
- Prying in starlings
- Poking with a spine in cactus finches
- Etc.

Regulators of behavior: the basic drives (“controllers”)

3) Defense: anti-predator motivations

- Escape
- Avoidance

4) Defense: social motivations

- Territorial
- Position in hierarchy

Regulators of behavior: the basic drives (“controllers”)

5) Reproductive drives

- Pairing
 - Roaming (searching)
 - Advertising
 - Selecting or responding
- Mating
- Brood tending (parental behavior)

Regulators of behavior: the basic drives (“controllers”)

- 6) Exploration of novelty: Roles of novelty detection
 - Security; defense
 - Arrest of current actions; orienting
 - Exploration to correct and expand the “cognitive map”
 - Ingestion functions (e.g., neophobia)
 - Sexuality functions
- 7) Other motivations (many): e.g., for shelter/nest construction, for locomotion, for play of various sorts, learned motivations...

Scott, ch 4: Genes and behavior, pp 57-66

4. Variations in a single gene can result in variations in behavior. What kind of effect on the body must such a gene have?
5. What are “hygienic bees”? Why do bee colonies (hives) need them?

Scott, ch 4: Genes and behavior, pp 57-66

6. How is it possible for an individual who has no offspring to have greater “inclusive fitness” than an individual who has offspring?

Answer by describing an example.

(See the box on pp 64-65.)

Scott, ch 4: C. Learning, pp 66-75

7. *Write definitions for “habituation” and “sensory adaptation”. The textbook describes briefly only the former. You must find the rest elsewhere.

8. *Give examples of habituation from your own experience. Can we habituate to complex stimuli as well as to simple stimuli? Answer with your examples.

Scott, ch 4: C. Learning, pp 66-75

9. Why do scientists choose to study learning in animals like sea slugs and snails and certain insects? Give more than one reason.

10. The author makes a mistake on p 71 in his description of classical conditioning. What is it?

Scott, ch 4: C. Learning, pp 66-75

11. *In your own development, how have you shown learning by imitation and by mimicry? What is the difference between these two processes?
12. *Imitation and/or mimicry have been observed in many non-human primates. Briefly describe an example of such learning in non-primate animals, not found in the Scott textbook. (It occurs, for example, in the development of cats.)