Paper 5.2 Unit - II

Innate and Learned Behaviours

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Learning

A relatively permanent change in an organism's behavior due to experience.

We learn by association. Our minds naturally connect events that occur in sequence.

Learning and memory are two sides of a coin. A number of surprising findings have lead researchers to believe that virtually everything we encounter is learned and is stored away in the brain

Key components to definition of Learning

1. Learning is **inferred** from performance.

   If there is no behavior to observe then we can't say for sure whether or not learning has occurred.

2. Learning involves a change in the **mental state** of an organism

   We can't see the neurological structures that underlie this mental state but, in theory, they must exist. Acquired knowledge must somehow be coded or represented in the brain.

3. Learning stems from **experience**

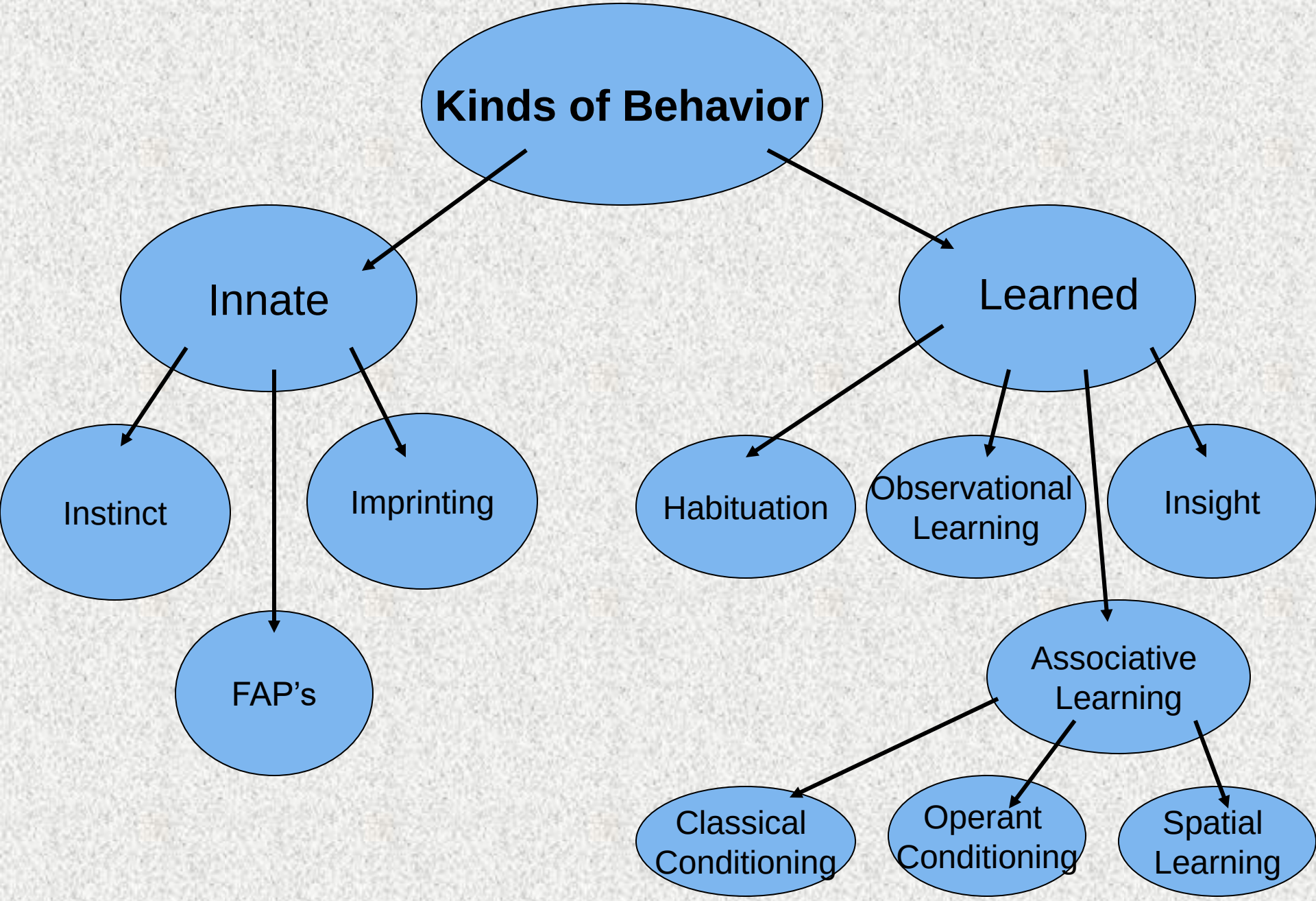
   This distinguishes learning from instinct, which refers to behaviors present at birth (i.e., imprinting in certain species of birds)

4. Learning is **relatively permanent**

Learning persists through time. This part of the definition guards against mistaking a temporary change in behavior, due to fatigue for example, for real learning.

5. Learning is a change in the **potential to behave**.

An animal could acquire knowledge and yet not perform in such a way as to demonstrate that knowledge. The organism could have the potential to behave even though the behavior is not occurring.


Kinds of Behavior
Innate
Learned
Instinct
Imprinting
FAP's
Habituation
Observational Learning
Insight
Associative Learning
Classical Conditioning
Operant Conditioning
Spatial Learning

Types of Learning

- Non-associative
  - Habituation,
  - Sensitization
- Associative
  - Classical conditioning
    - Operant Conditioning

Non- associative Learning

Non- associative Learning

1. Habituation: It is the decrease in response to repeated or continuous stimulation **or**, it is the gradual fading of a response when a stimulus that proves to be safe, neutral or irrelevant is given repeatedly.

- Habituation is the simplest form of learning.
- Habituation like phenomena is found in every group of animals from **Weevil** to **Whales**.
- By habituation animals learn to conserve energy and time by not responding to an irrelevant stimulus.

If a neutral stimulus that has neither noxious nor beneficial consequences is repeatedly delivered to an organism, its response to the stimulus tends to decrease gradually and may eventually cease all together. By habituation animals learn, what not to do.

A Spider is sitting in its web.

The experimenter vibrates point on its web, resembling the signal set up when an insect is trapped.

The spider runs out to investigate the source of the vibration, nothing is found and spider returns to its place in the, centre of the web.

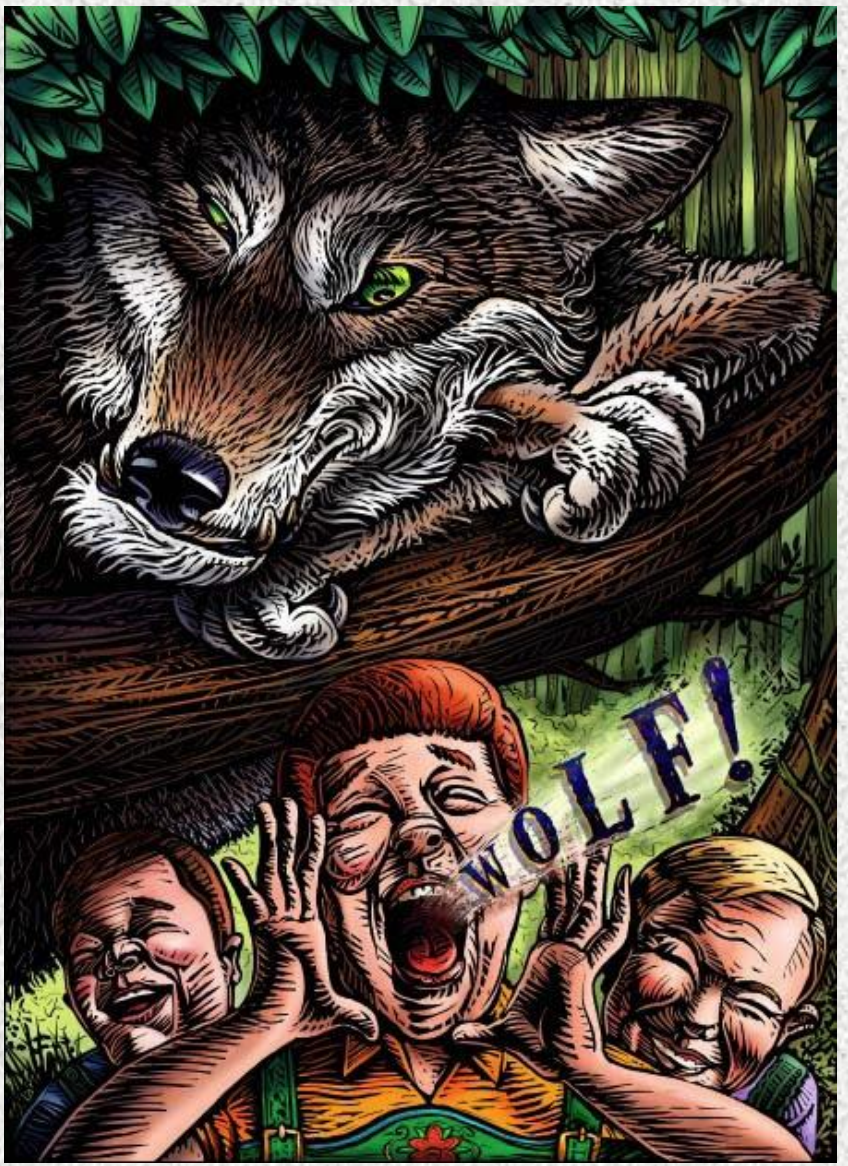
If this same neutral stimulus is given several times, the spider no longer rushes out to investigate.

It remains in the centre of the web. It gets habituated to that stimulus

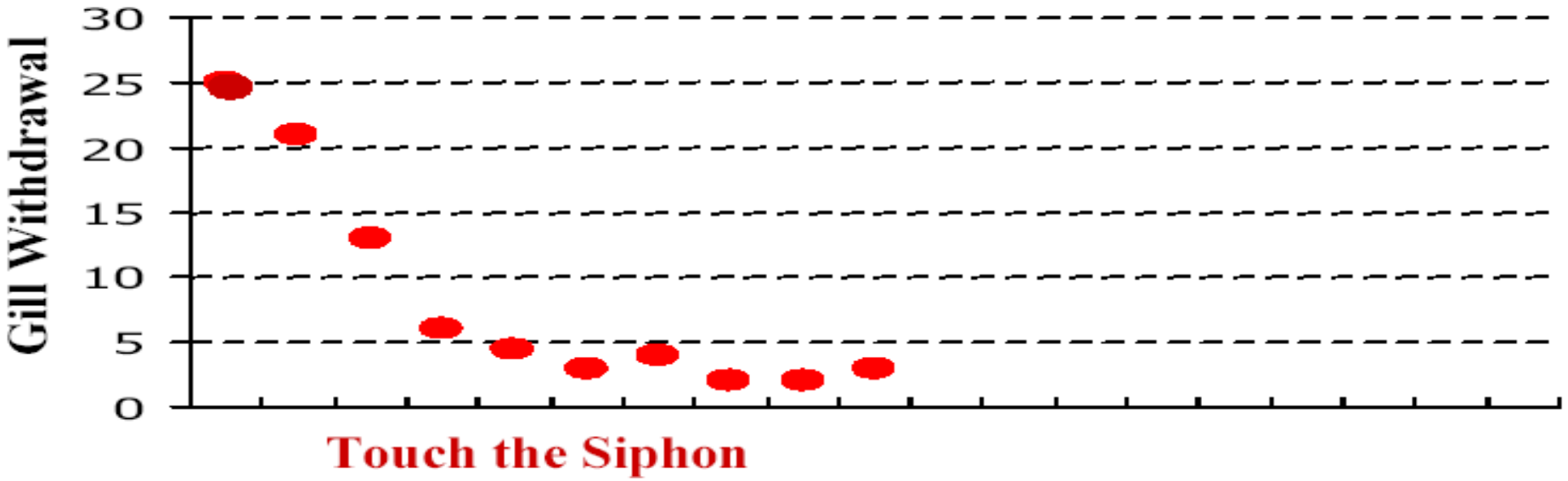
A Snail crawling across a sheet of glass retracts into its Shell when the glass is tapped. After a pause it emerges and continues moving. A second tap causes retraction again but it emerges quickly, frequent tapping on glass ultimately cause no response at all in snail and it will keep on moving. This is due to habituation.

Habituation

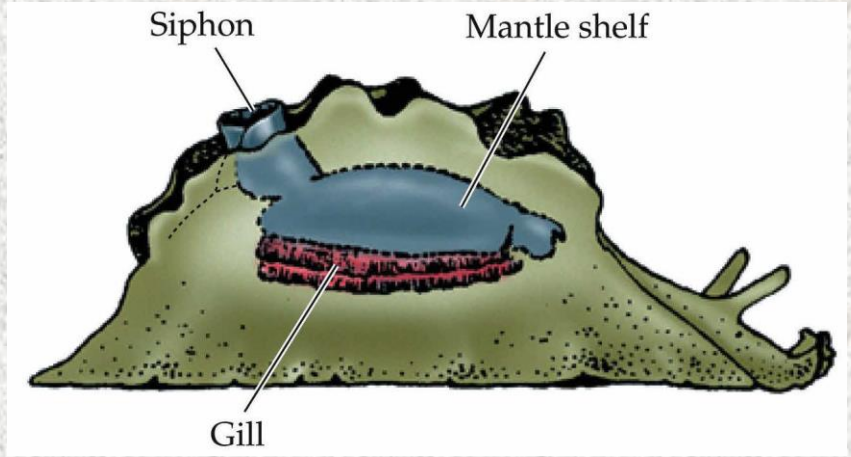
- Loss of response to stimulus
  - "cry-wolf" effect
  - learn *not* to respond to repeated occurrences of stimulus



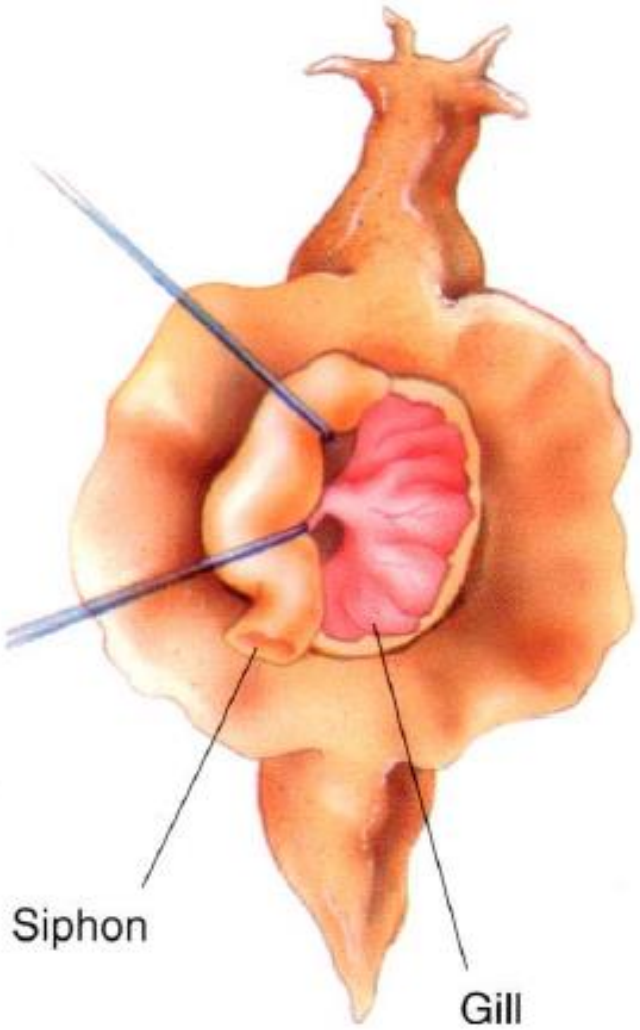
Habituation in the Aplysia

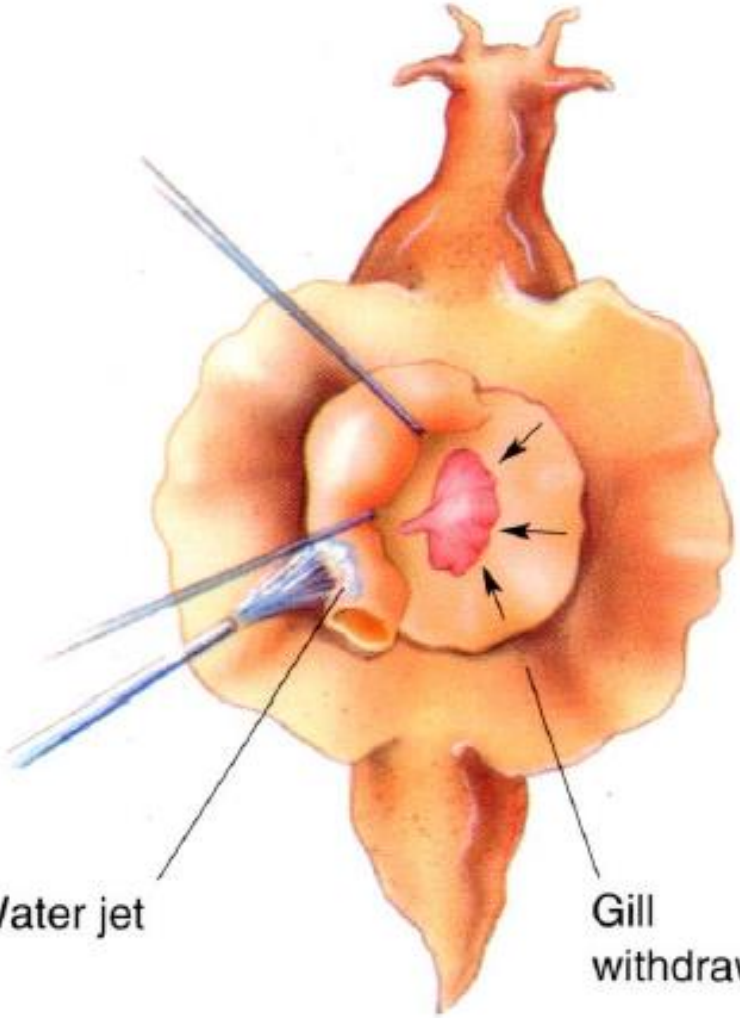


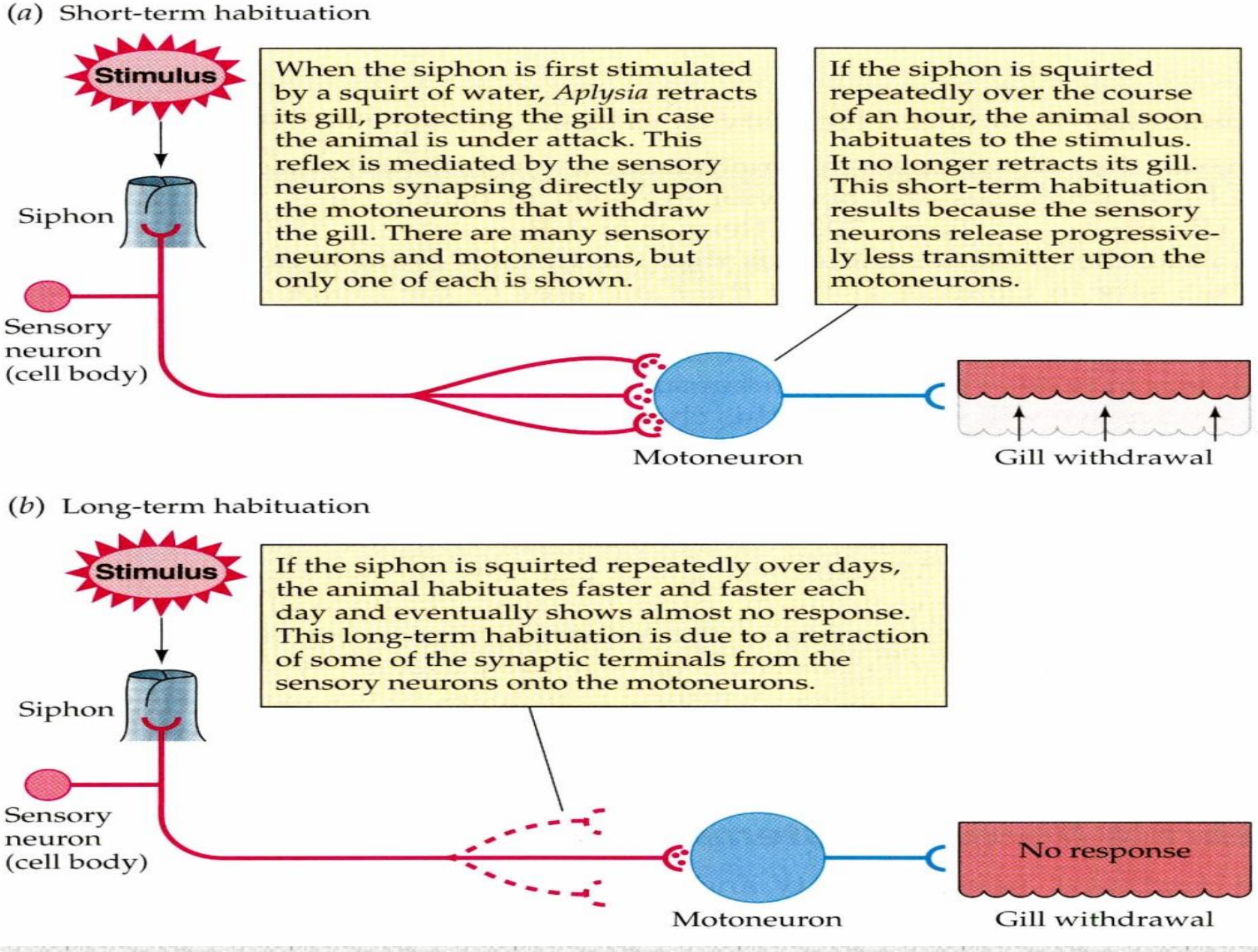
- Repeatedly touching the siphon results in a smaller response (gill withdrawal).

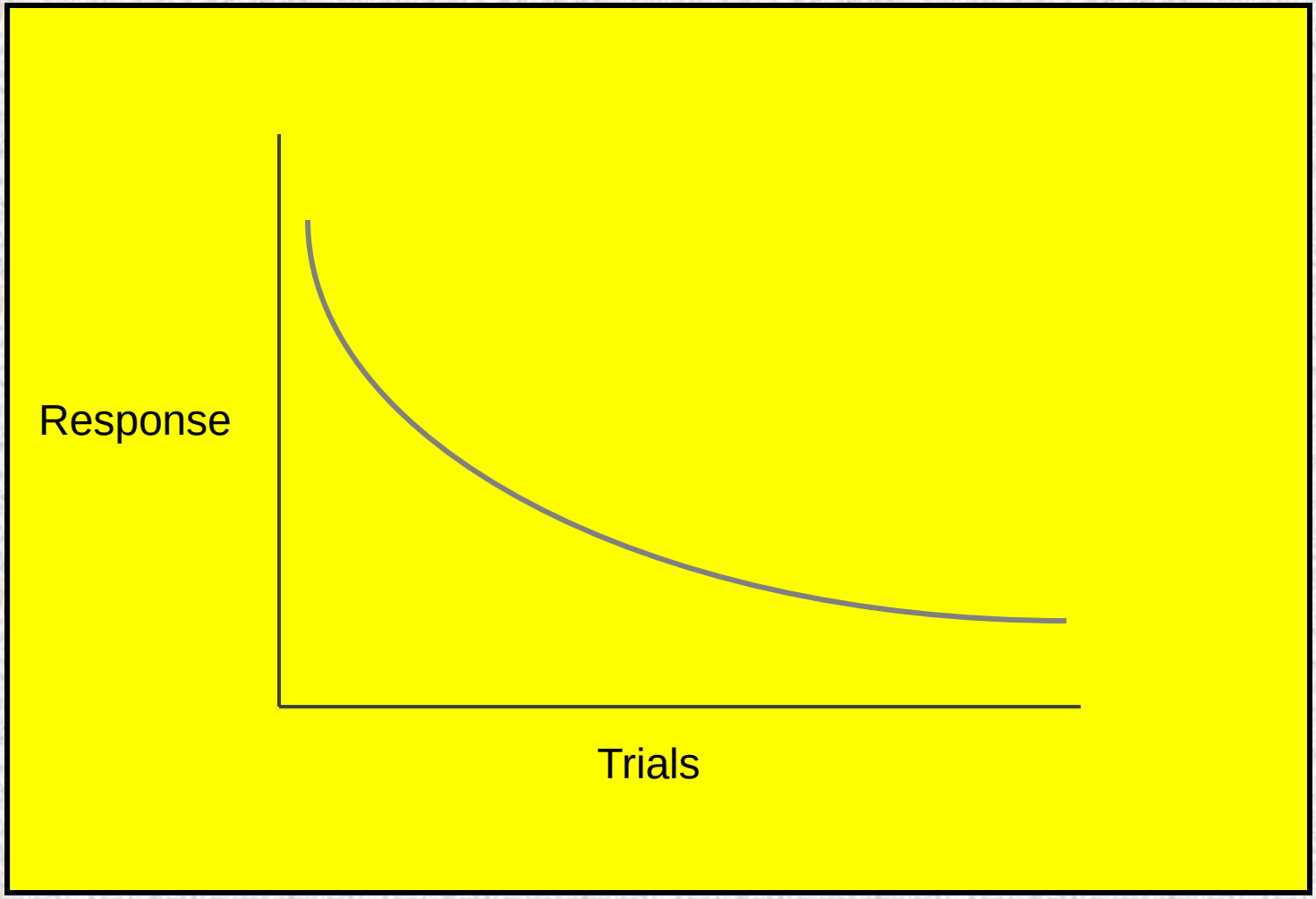


Gill and siphon withdrawal reflex - tactile or electrical stimulation of the siphon causes withdrawal of the gill and siphon






(a) Short-term habituation
Stimulus
When the siphon is first stimulated by a squirt of water, *Aplysia* retracts its gill, protecting the gill in case the animal is under attack. This reflex is mediated by the sensory neurons synapsing directly upon the motoneurons that withdraw the gill. There are many sensory neurons and motoneurons, but only one of each is shown.
If the siphon is squirted repeatedly over the course of an hour, the animal soon habituates to the stimulus. It no longer retracts its gill. This short-term habituation results because the sensory neurons release progressively less transmitter upon the motoneurons.
Siphon
Sensory neuron (cell body)
Motoneuron
Gill withdrawal
(b) Long-term habituation
Stimulus
If the siphon is squirted repeatedly over days, the animal habituates faster and faster each day and eventually shows almost no response. This long-term habituation is due to a retraction of some of the synaptic terminals from the sensory neurons onto the motoneurons.
Siphon
Sensory neuron (cell body)
No response
Motoneuron
Gill withdrawal


Response
Trials

Dishabituation

It has been experimentally proved that "the effect of repeated stimulation of one kind is cancelled by a new stimulus of another kind and this is called **"Dishabituation".**

Example

once hydra was habituated with soft mechanical touch, it responded to another kind of stimulus say a fish of light.

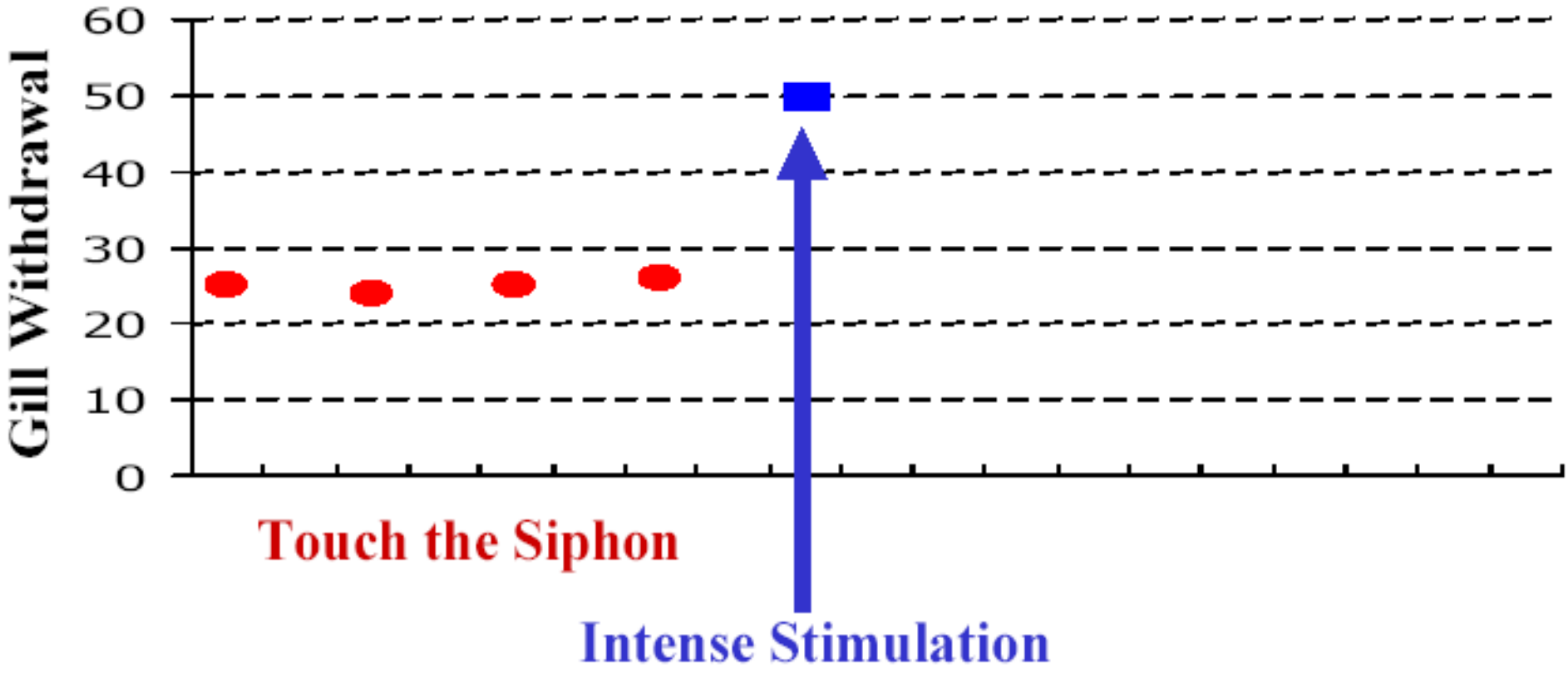
2. Sensitization

- Repeated exposure to a stimulus results in increased responding to that stimulus

Sensitization is an increase in response to a mild stimulus as a result to previous exposure to more intense stimuli.

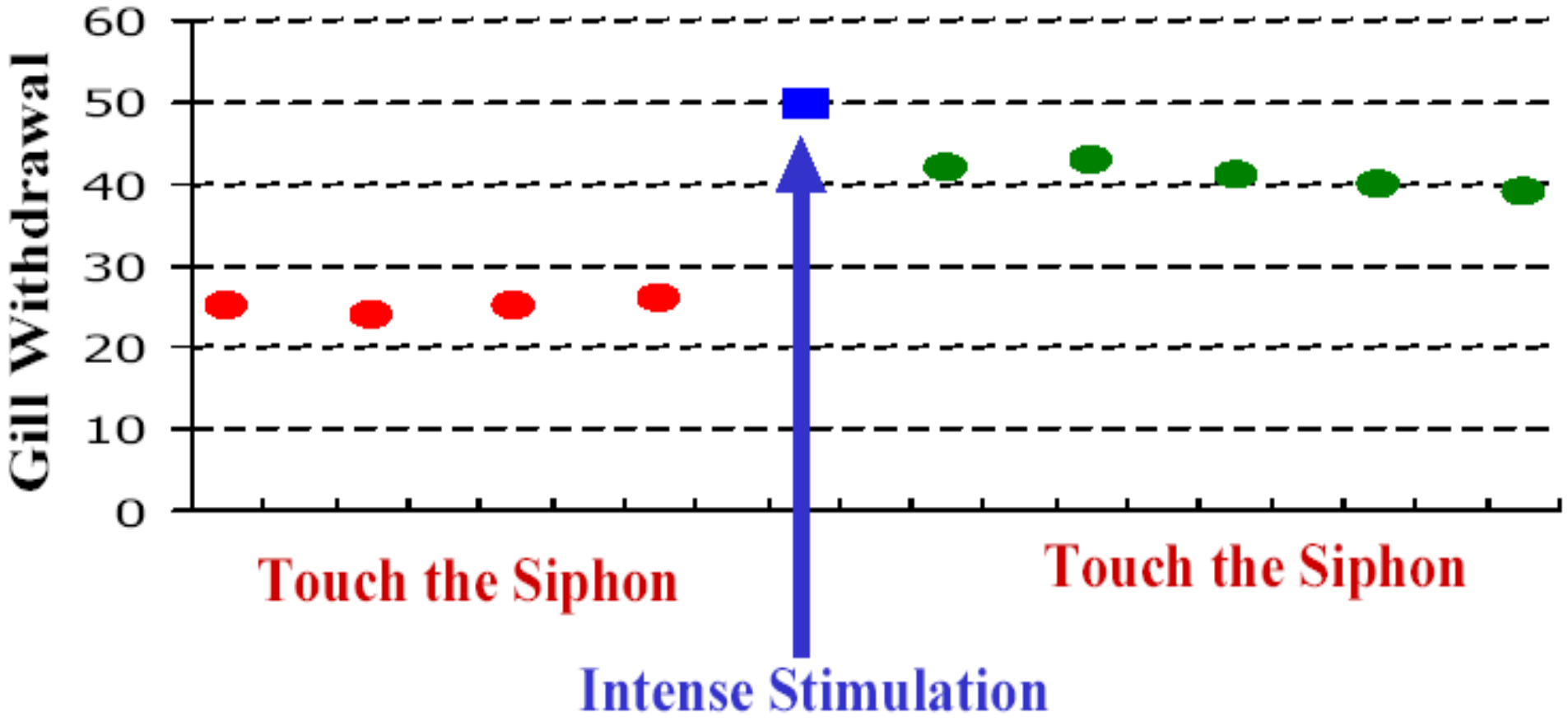
- **Increased responsiveness**
  - Following a noxious stimulus
- **Less stimulus specific than habituation**
  - general increase in vigilance
  - sensitized responses to wide range of stimuli

Sensitization in the Aplysia



- Provide an intense stimulation.

Sensitization in the Aplysia



After the gill withdrawal reflex has habituated, a shock to the tail sensitizes the gill withdrawal reflex elicited by touching either the mantle or siphon

Dishabituation **is a case of** ***Sensitization***

These 2 studies show that increases or decreases in responding can occur with repeated presentations of stimuli

Decreases in responsiveness by repeated stimulation = **Habituation**

Increases in responsiveness by repeated stimulation = **Sensitization**

Duration of Habituation & Sensitization

- Can be short term
  - lasts hours
  - Change in neural activity
- or long term
  - several weeks
  - change in neural structure ~

Short-term habituation:

-rapid presentations of a stimulus with a short interval between presentations

-results in habituation quickly but see **spontaneous recovery**

-the degree of spontaneous recovery depends on length of rest interval.

Long-term habituation:

-one stimulus presentation a day

-see more long-term effects

-see less spontaneous recovery

Generalization

- Organism reacts to similar stimuli in the same way

generalization is greater in Sensitization

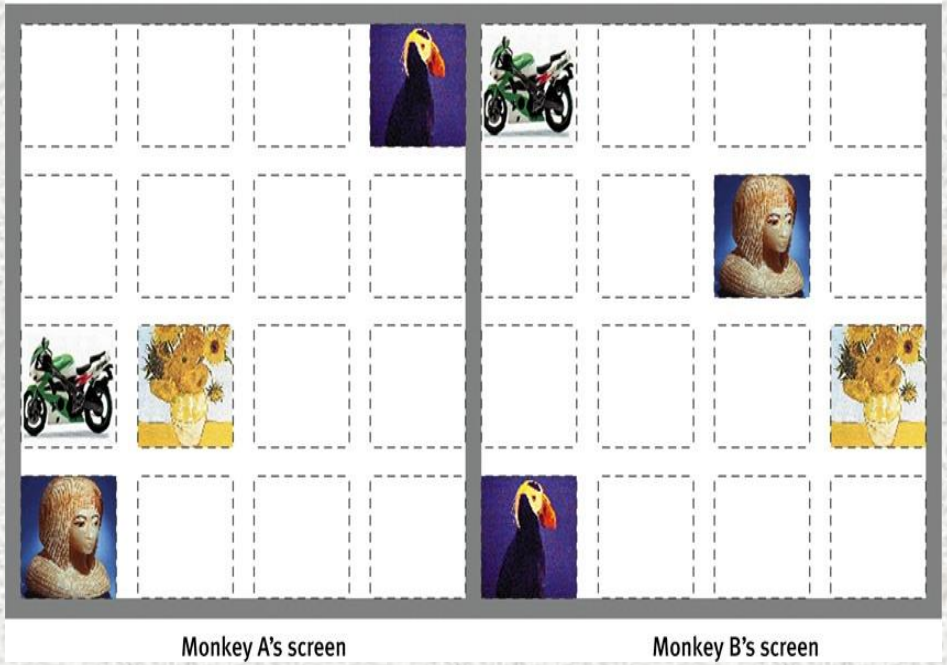
If when some animal is alarmed by red color signal then animal will fear with all red color signals.

Observational Learning

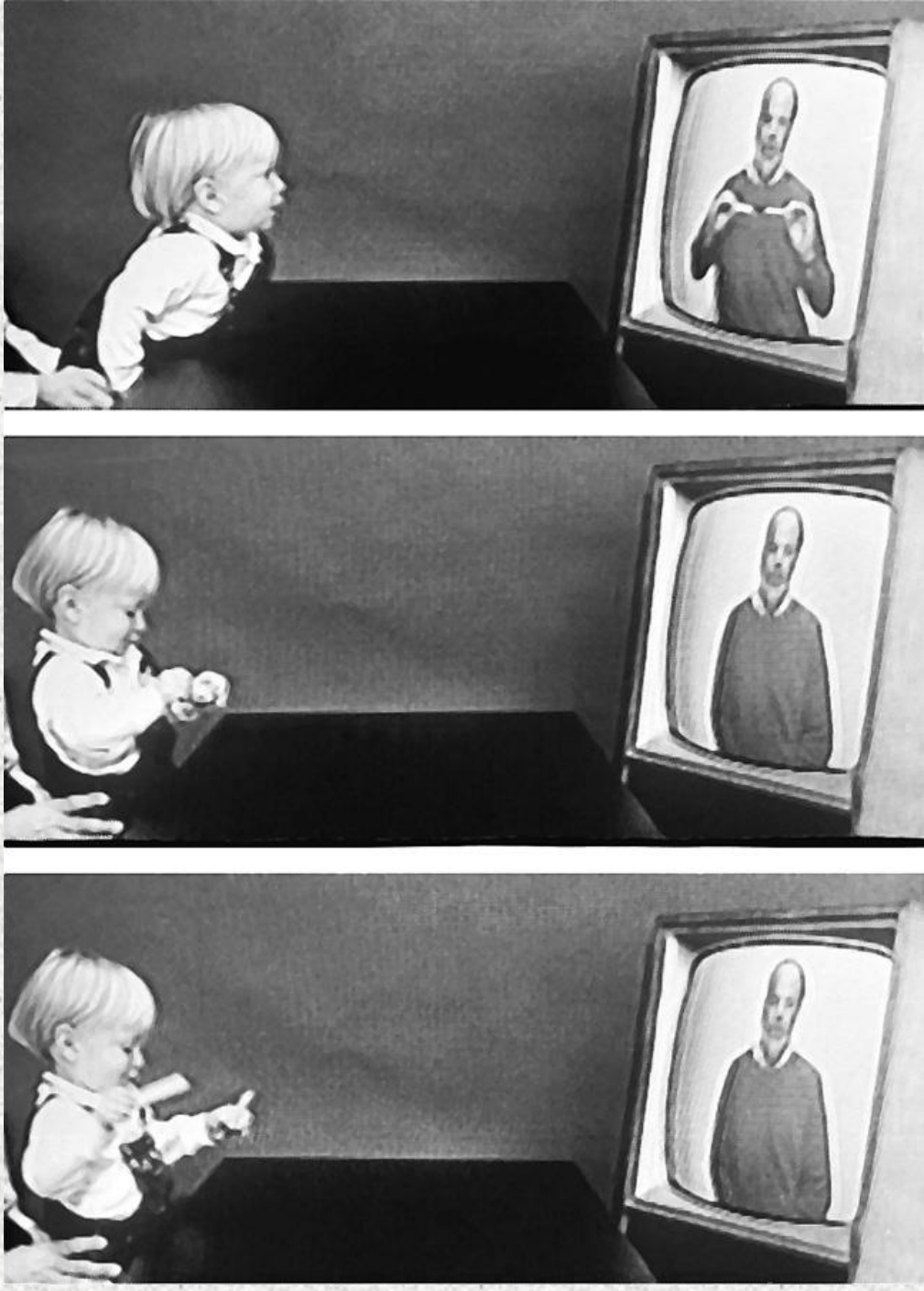
- **Occurs when animals copy the behavior of another animal without any previous +ve reinforcement of the behavior**
- Example:
  - **Japanese monkeys usually remove sand from food by brushing them with their hands. One monkey discovered that dipping food in water more easily rid the food of sand. Through observational learning, many of the other monkeys began to use water to clean their food.**

Higher animals, especially humans, learn through observing and imitating others.

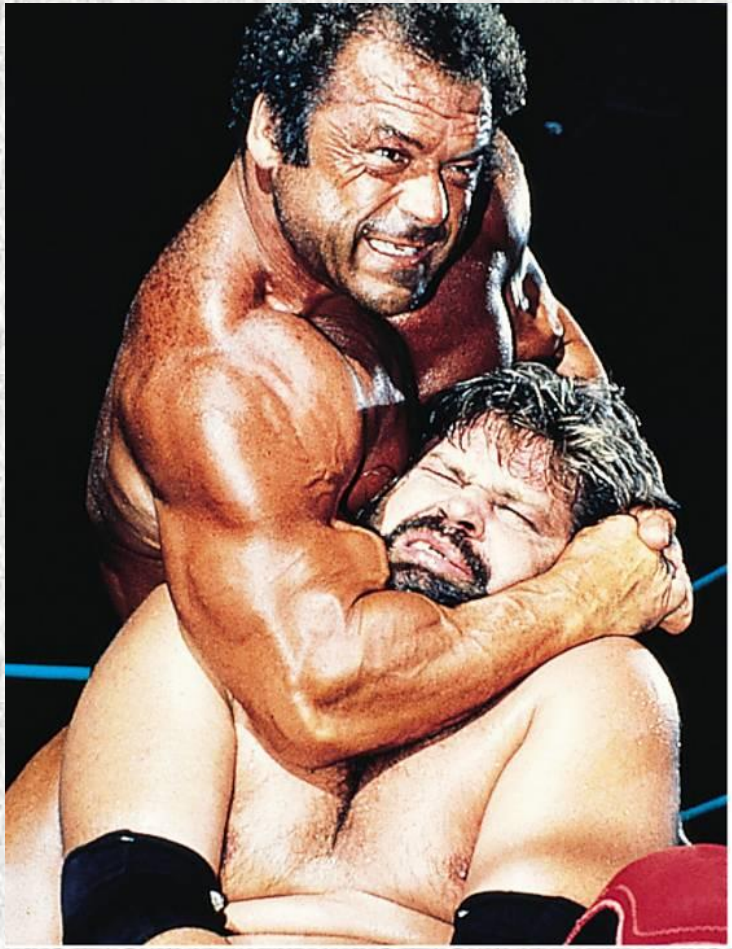
The monkey on the right imitates the monkey on the left in touching the pictures in a certain order to obtain a reward.



Learning by observation begins early in life. This 14-month-old child imitates the adult on TV in pulling a toy apart.



Research shows that viewing media violence leads to an increased expression of aggression.

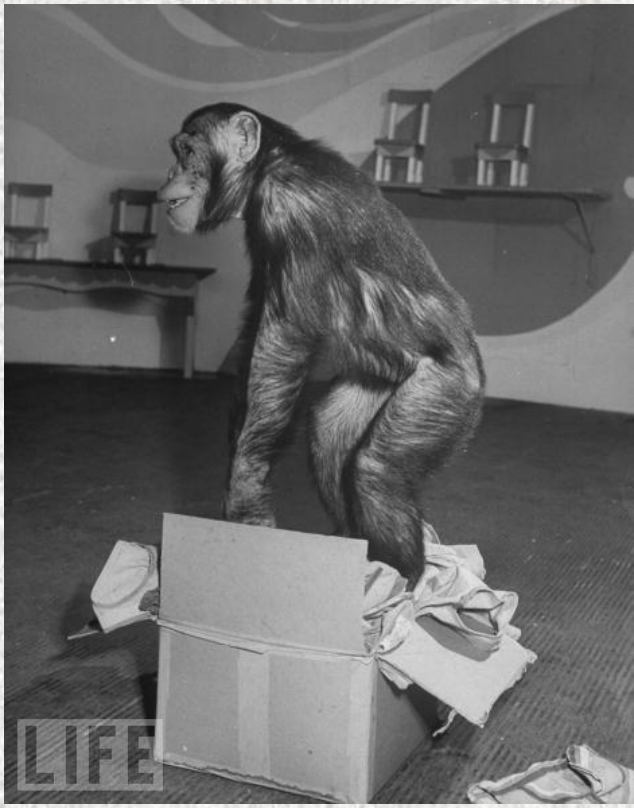


Children modeling after pro wrestlers



Insight learning

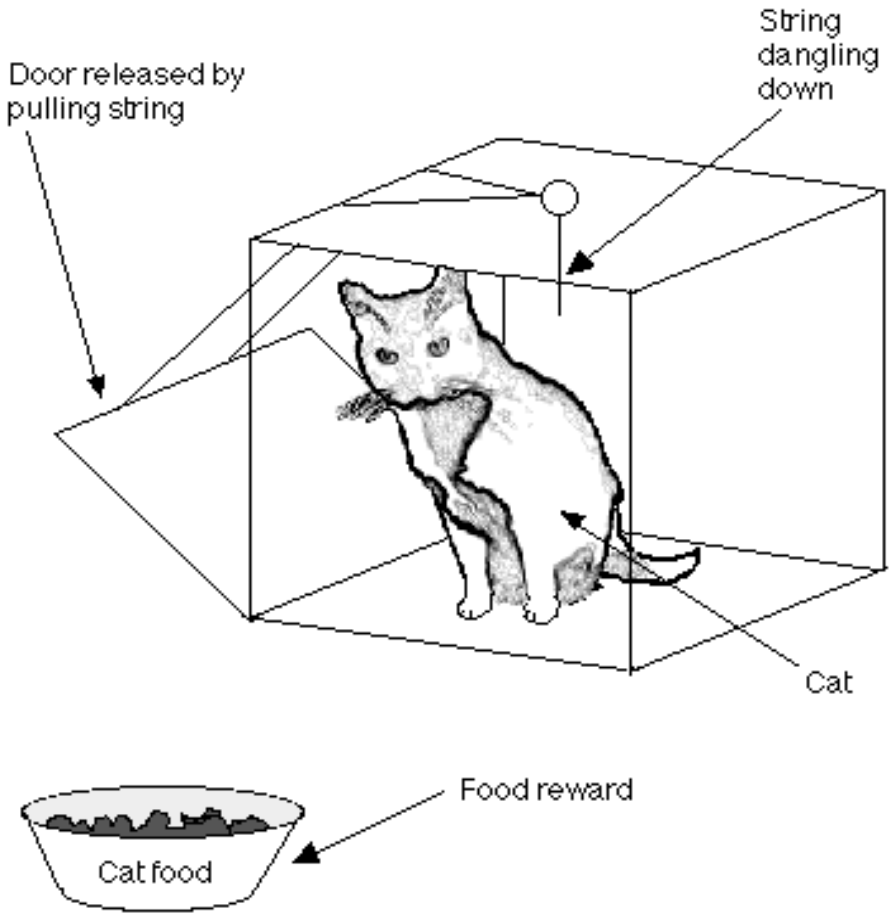
- *Insight* is when learning seems to occur in a sudden "flash" as elements of a situation come together



- When an animal, exposed to a totally new situation and without prior experience or observation, performs a behavior that generates a desirable outcome.

- Example
  - **A chimpanzee placed in a room with food beyond their reach will stack boxes up to get to the food.**

Figure 18.2 Thorndike's puzzle box



Associative Learning

Associative Learning

- **When an animal learns that two events are connected.**
  - EX: Dog learns that the smell/sight of food leads to eating (they will then begin to salivate)
- **Types of Associative Learning**
  - Classical Conditioning
  - Operant Conditioning
  - Cognitive Learning

Association:

If 2 sensations, or stimuli, repeatedly occur together, the mental reactions to those stimuli become associated such that when the first sensation or stimulus is given, it triggers the memory of the associated stimulus.

Those of you with pets will have already seen this phenomenon in action.

"I think Mom's using the can opener."

Types

Classical conditioning: learning to link two stimuli in a way that helps us anticipate an event to which we have a reaction

Operant conditioning: changing behavior choices in response to consequences

Cognitive learning: acquiring new behaviors and information through observation and information, rather than by direct experience

Classical Conditioning

How it works: after repeated exposure to two stimuli occurring in sequence, we associate those stimuli with each other.

Result: our natural response to one stimulus now can be triggered by the new, predictive stimulus.

After Repetition

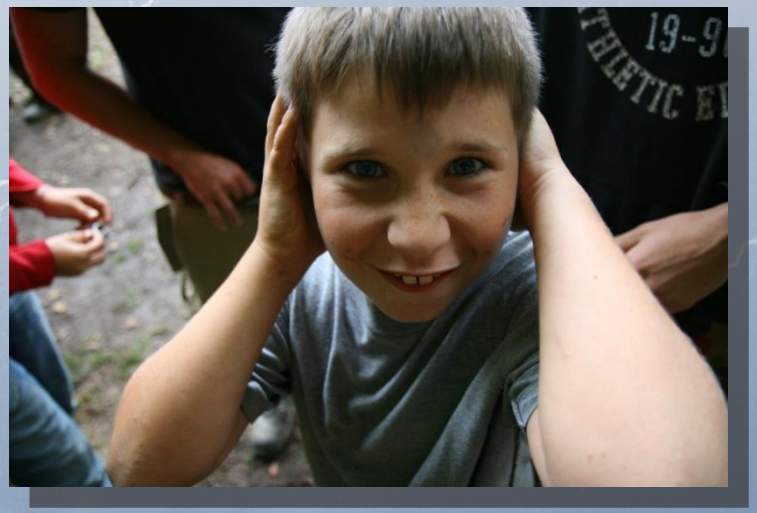
Stimulus: See lightning

Response: Cover ears to avoid sound

Stimulus 1: See lightning

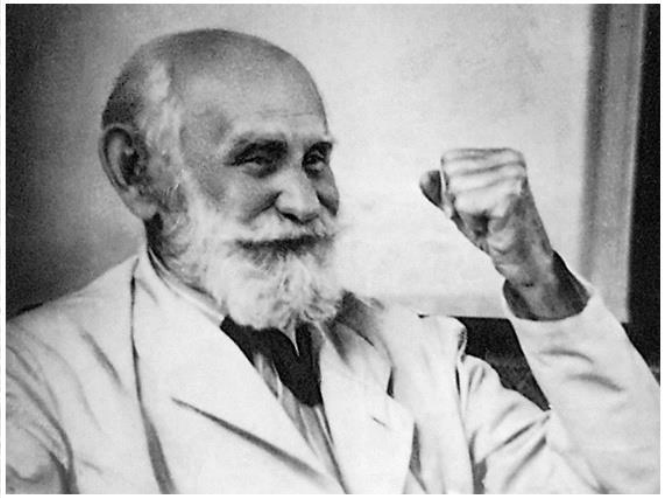
Stimulus 2: Hear thunder

Here, our response to thunder becomes associated with lightning.



Classical Conditioning

Ideas of classical conditioning originate from old philosophical theories. However, it was the Russian physiologist Ivan Pavlov who elucidated classical conditioning. His work provided a basis for later behaviorists like John Watson.

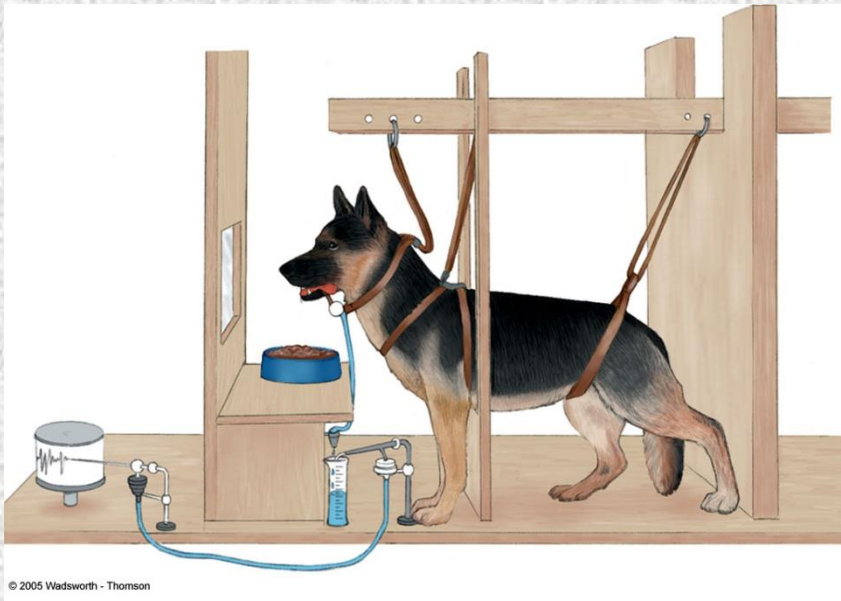


Sovfoto

Ivan Pavlov (1849-1936)

While studying salivation in dogs, Ivan Pavlov found that salivation from eating food was eventually triggered by what should have been neutral stimuli such as:

- just seeing the food.
- seeing the dish.
- seeing the person who brought the food.
- just hearing that person's footsteps.



Ivan Pavlov

- was a Russian physiologist who accidentally discovered this type of learning

- he was studying the physiology of digestion when he noticed a funny thing.

- digestion starts in the mouth where saliva begins to break down food. Dogs would salivate when he put the food powder in their mouths.

- But experienced dogs would also salivate when the experimenter walked in the room or at the sight of food.

Terms in Conditioning

- **UCS or US** = unconditioned stimulus
- **UCR or UR**= unconditioned response
- **CS** = conditioned stimulus
- **CR** = conditioned response

- **Unconditioned(al) Stimulus (US):**

a stimulus that has the ability to produce a specified response before conditioning begins.

- **Unconditioned(al) Response (UR):**

the response produced by the **Unconditioned Stimulus.**

- **Conditioned(al) Stimulus (CS):**

aneutral stimulus that becomes to produce a new response because it is associated with the Unconditioned Stimulus.

- **Conditioned Response (CR):**

the response produced by the **Conditioned Stimulus.**

Before Conditioning

Unconditioned stimulus and response:

a stimulus which triggers a response naturally, before/without any conditioning

Unconditioned stimulus (US): yummy dog food

Unconditioned response (UR): dog salivates

Before Conditioning

Neutral stimulus:

a stimulus which does not trigger a response

Neutral stimulus (NS)

No response

During Conditioning

The bell/tone (N.S.) is repeatedly presented with the food (U.S.).

Neutral stimulus (NS)

Unconditioned stimulus (US)

Unconditioned response (UR): dog salivates

After Conditioning

The dog begins to salivate upon hearing the tone (neutral stimulus becomes conditioned stimulus).

Conditioned (formerly neutral) stimulus

Conditioned response: dog salivates

- Ivan Pavlov pioneered classical conditioning in which pairing of two stimuli changes the response to one of them.

- **The unconditioned stimulus (UCS)** is one that naturally evokes the **unconditioned response (UCR).**

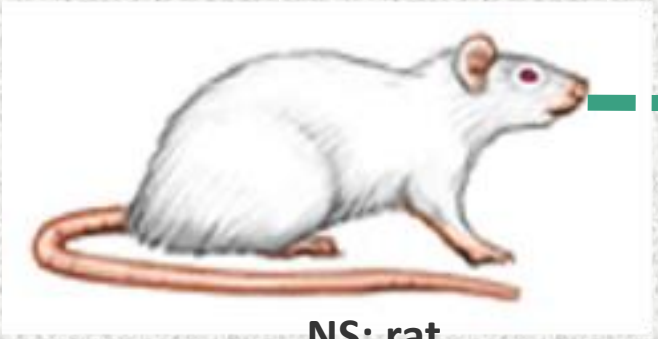
- After several repeated pairings the **CS with the UCS repeatedly**, the CS alone will come to evoke the response, which is now known as the **conditioned response (CR).**

John B. Watson and Classical Conditioning: Playing with Fear

- In 1920, 9-month-old Little Albert was not afraid of rats.
- John B. Watson and Rosalie Rayner then clanged a steel bar every time a rat was presented to Albert.
- Albert acquired a fear of rats, and generalized this fear to other soft and furry things.

Little Albert Experiment

Before Conditioning



NS: rat

No fear

UCS: steel bar hit with hammer

Natural reflex: fear

Little Albert Experiment

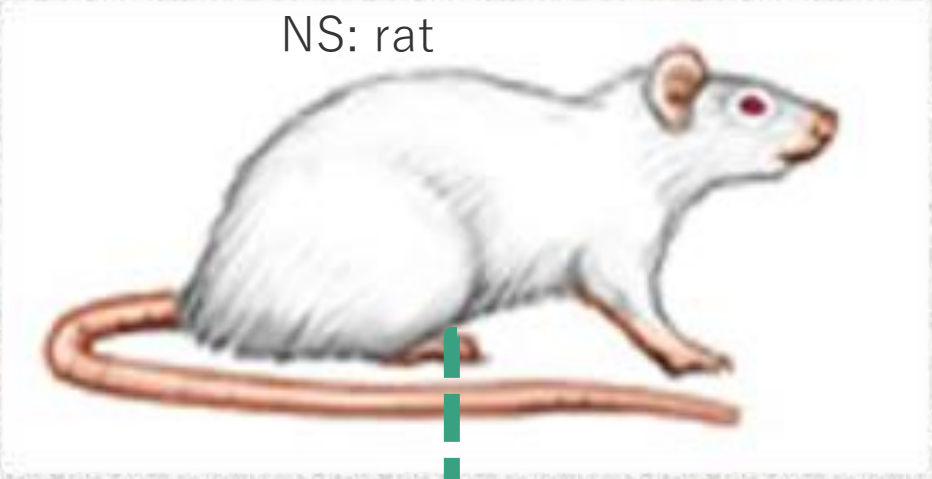
NS: rat

UCS: steel bar hit with hammer

Natural reflex: fear

During Conditioning

Little Albert Experiment



After Conditioning

Conditioned reflex: fear

Your friend uses the same shampoo. Soon, the smell of that shampoo makes you feel happy.

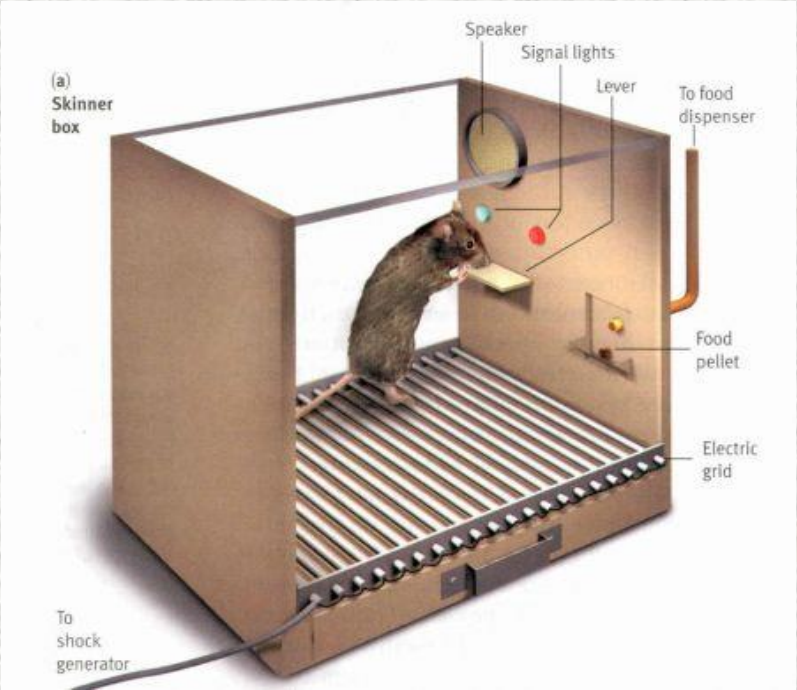
The door to your house squeaks loudly when you open it. Soon, your dog begins wagging its tail when the door squeaks.

The nurse says, “This won’t hurt a bit,” just before stabbing you with a needle. The next time you hear “This won’t hurt,” you cringe in fear.

You have a meal at a fast food restaurant that causes food poisoning. The next time you see a sign for that restaurant, you feel nauseated.

Operant Conditioning

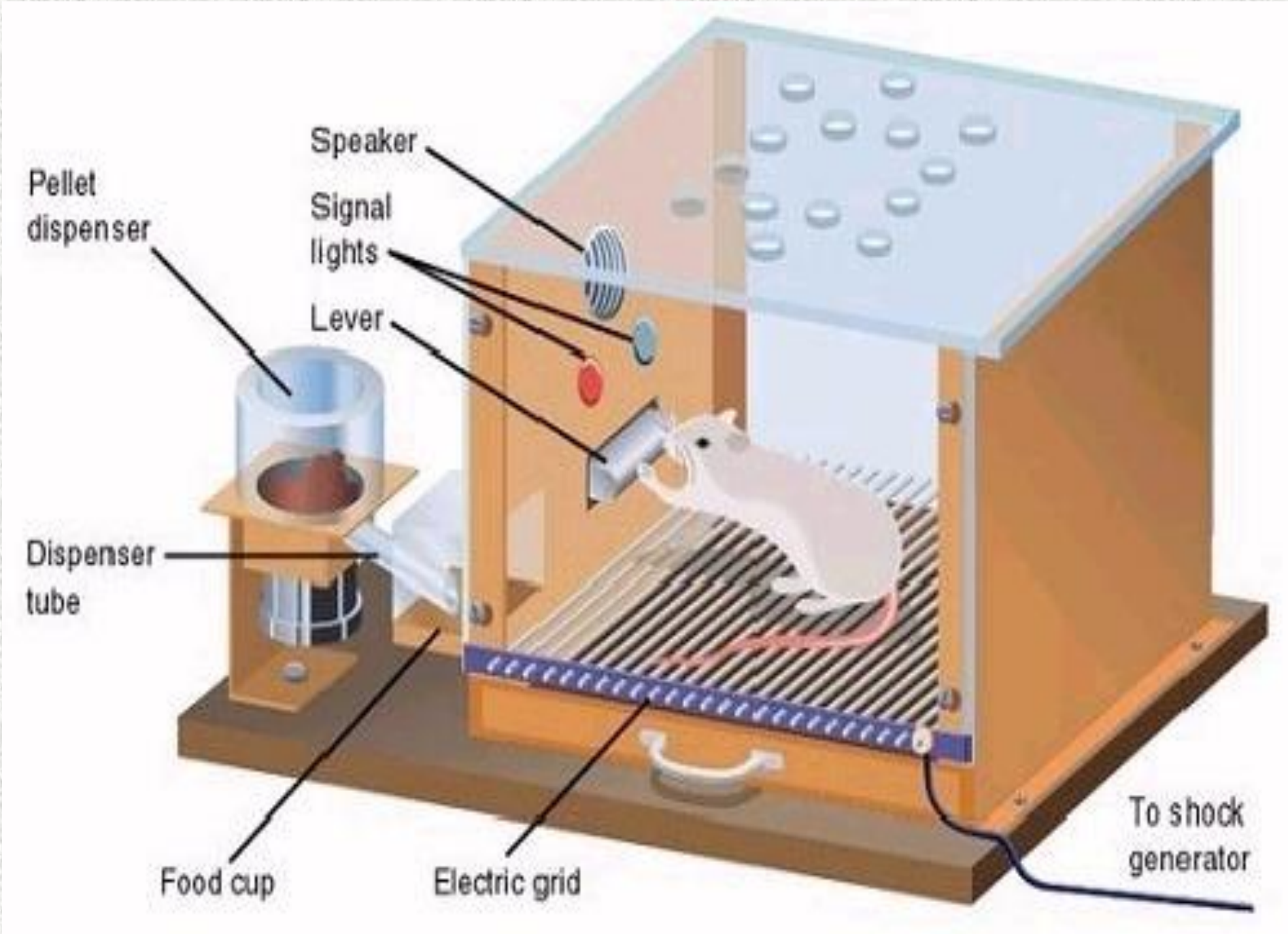
- Also known as trial and error learning
- Occurs when an animal connects its own behavior with a particular response.
- This is how we train animals- positive and negative reinforcement.



- **Example:**
  - **Psychologist Skinner trained rats to push levers to obtain food or avoid painful shocks.**

- Extinction: when a **learned** behavior no longer exhibits the expected response, the learning can be reversed or forgotten

- **B F Skinner**


Speaker
Pellet dispenser
Signal lights
Lever
Dispenser tube
Food cup
Electric grid
To shock generator

Child associates his “response” (behavior) with consequences.

- Child learns to repeat behaviors (saying “please”) which were followed by desirable results (cookie).

- Child learns to avoid behaviors (yelling “give me…!”) which were followed by undesirable results (scolding or loss of cookie).

- In operant conditioning, responses are followed by reinforcement or punishment that either strengthen or weaken the behavior.
  - Reinforcers are events that increase the probability that the response will occur again.
  - Punishment are events that decrease the probability that the response will occur again.

How it works:

An act of chosen behavior (a “response”) is followed by a reward or punitive feedback from the environment.

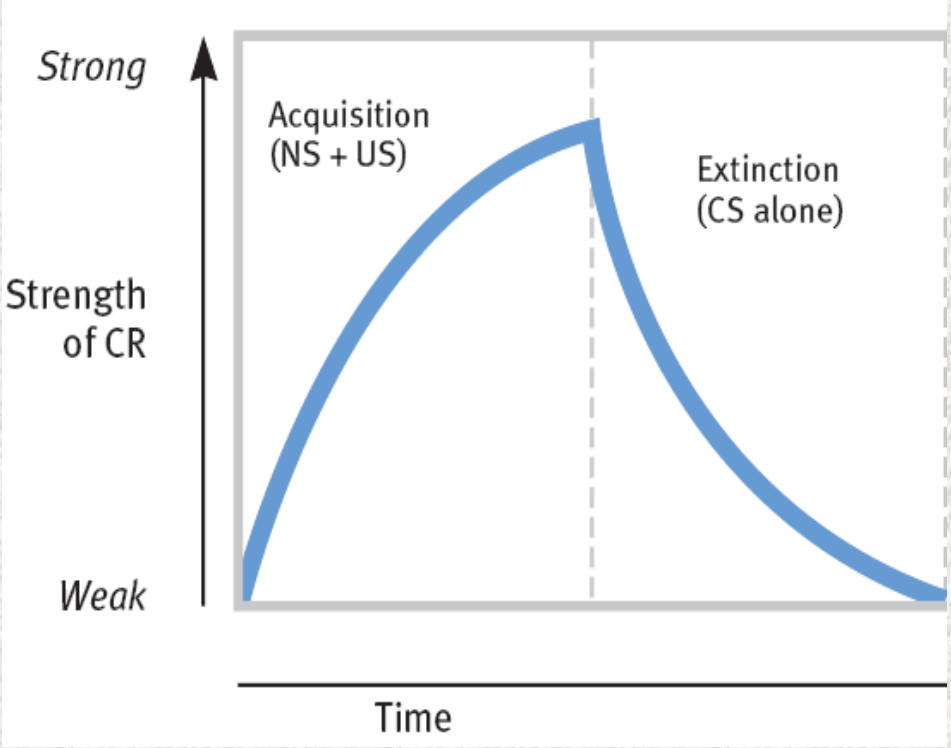
Results:

- **Reinforced** behavior is more likely to be tried again.
- **Punished** behavior is less likely to be chosen in the future.

Acquisition *refers to the initial stage of learning / conditioning.*

Extinction refers to the decreasing of a conditioned response.

If the US (food) stops appearing with the CS (bell), then the CR decreases.



Reinforcement

- **Reinforcement** *refers to any feedback from the environment that makes a behavior more likely to recur.*
  - Positive (adding) reinforcement: **adding** something desirable (e.g., warmth)
  - Negative (taking away) reinforcement: **ending** something unpleasant (e.g., the cold)

Different Schedules of Reinforcement

We may schedule our reinforcements based on an **interval** of time that has gone by.

- **Fixed interval schedule:** reward every hour
- **Variable interval schedule:** reward after a changing/random amount of time passes

We may plan for a certain **ratio** of rewards per number of instances of the desired behavior.

- **Fixed ratio schedule:** reward every five targeted behaviors
- **Variable ratio schedule:** reward after a randomly chosen instance of the target behavior

Which Schedule of Reinforcement is This?
Ratio or Interval?
Fixed or Variable?

1. Rat gets food every third time it presses the lever **FR**
2. Getting paid weekly no matter how much work is done **FI**
3. Getting paid for every ten boxes you make **FR**
4. Hitting a jackpot sometimes on the slot machine **VR**
5. Checking cell phone all day; sometimes getting a text **VI**
6. Buy eight pizzas, get the next one free **FR**

Punishment

Punishments have the opposite effects of reinforcement. These consequences make the target behavior less likely to occur in the future.

+ Positive Punishment

You ADD something unpleasant/aversive (ex: spank the child)

- Negative Punishment

You TAKE AWAY something pleasant/ desired (ex: no TV time, no attention)-- MINUS is the "negative" here

Positive does **not** mean "good" or "desirable" and negative does **not** mean "bad" or "undesirable."

More effective forms of operant conditioning
The Power of Rephrasing

- **Positive punishment**: "You're playing video games instead of practicing the piano, so I am justified in YELLING at you."
- **Negative punishment**: "You're avoiding practicing, so I'm turning off your game."
- **Positive reinforcement**: "After you practice, we'll play a game!"
- **Negative reinforcement**: "I will stop staring at you and bugging you as soon as I see that you are practicing."

Summary: Types of Consequences

Adding stimuli	Subtract stimuli	Outcome
Positive + Reinforcement (You get candy)	Negative – Reinforcement (I stop yelling)	**Strengthens target behavior** (You do chores)
Positive + Punishment (You get spanked)	Negative – Punishment (No cell phone)	**Reduces target behavior** (cursing)

= uses desirable stimuli

= uses unpleasant stimuli

COMPARISON OF CLASSICAL AND OPERANT CONDITIONING

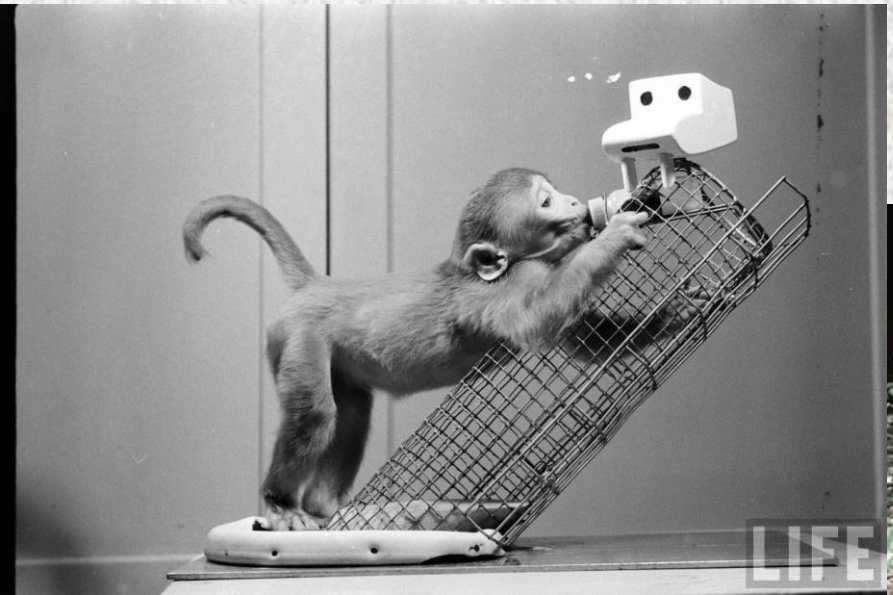
	Classical Conditioning	Operant Conditioning
Response	Involuntary, automatic.	Voluntary, operates on environment.
Acquisition	Associating events; CS announces US.	Associating response with a consequence (reinforcer or punisher).
Extinction	CR decreases when CS is repeatedly presented alone.	Responding decreases when reinforcement stops.
Cognitive processes	Organisms develop expectation that CS signals the arrival of US.	Organisms develop expectation that a response will be reinforced or punished; they also exhibit latent learning, without reinforcement.

Classical conditioning forms associations between stimuli (CS and US).

Operant conditioning, on the other hand, forms an association between behaviors and the resulting events.

Cognitive learning

- Manipulate concepts to arrive at an adaptive behavior
- Internal memory used as an additional sensory/information source
- Mental trial-and-error



Motivation

- Set of factors that activate, direct and maintain behavior, usually toward some goal called Motivation

- **Intrinsic motivation**

  refers to *the desire to perform a behavior well for its own sake*. The reward is internalized as a feeling of satisfaction.

- **Extrinsic motivation**

  refers to *doing a behavior to receive rewards from others*.

Extrinsic vs. Intrinsic Motivation

- **Intrinsic motivation** = motivation resulting from internal, personal satisfaction from a task or activity

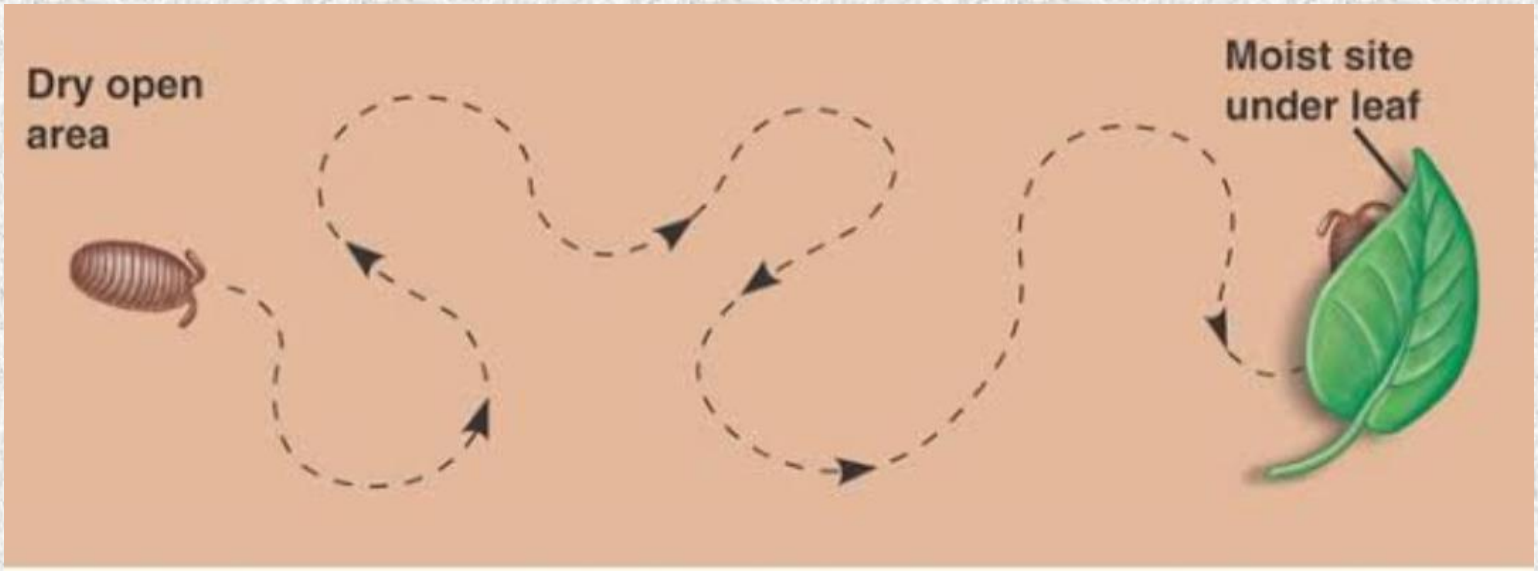
- **Extrinsic motivation** = motivation based on external rewards or threat of punishment

Intrinsic - Do you study for the grade or for love of learning?
Extrinsic - Did your parents pay you for grades?

Kinesis and Taxis (Taxes)

Kinesis

Random movement of an organism in response to a stimulus



(a) Kinesis increases the chance that a sow bug will encounter and stay in a moist environment.

Examples of kinesis

Woodlice – lose water in dry conditions.

- When in dry area – move more rapidly + change direction more often
- When in damp area – move less rapidly + change direction less often.

This increases chance of organism moving into or staying in favourable conditions, preventing them drying out and increasing there chance of survival

Kinesis Example: Woodlice

- How does this increase their chance of survival?
- They spend more time in favourable moist conditions then less favourable drier ones.
- This prevents them drying out and so increases their chance of survival.

Kineses

Non directional response to stimulus

The more unfavourable the conditions the more rapidly the organism moves and changes direction more often.

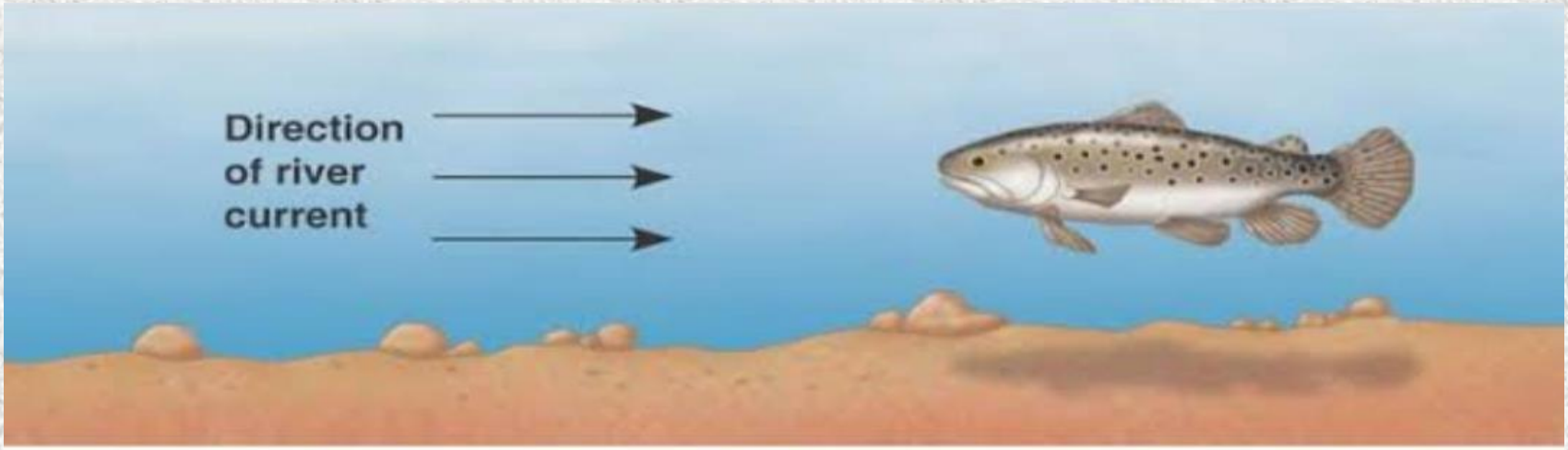
This response enables the organism to return to favourable conditions more rapidly.

Taxis

Directional movement of organism towards or away from stimulus

Two Types of Taxes

1. **Positive Taxis –** towards the stimulus
2. **Negative Taxis –** away from stimulus

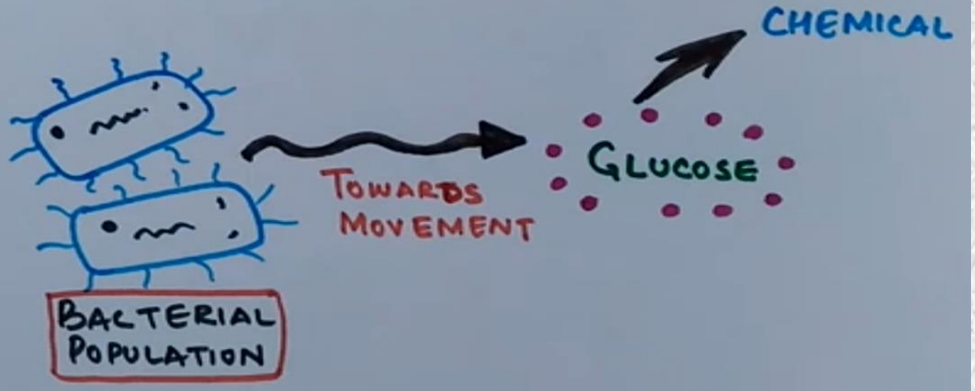


(b) Positive rheotaxis keeps trout facing into the current, the direction from which most food comes.

Phototaxis

CHEMOTAXIS

MOVEMENT OF AN ORGANISM OR CELLS WITHIN AN ORGANISM IN RESPONSE TO A CHEMICAL STIMULUS.



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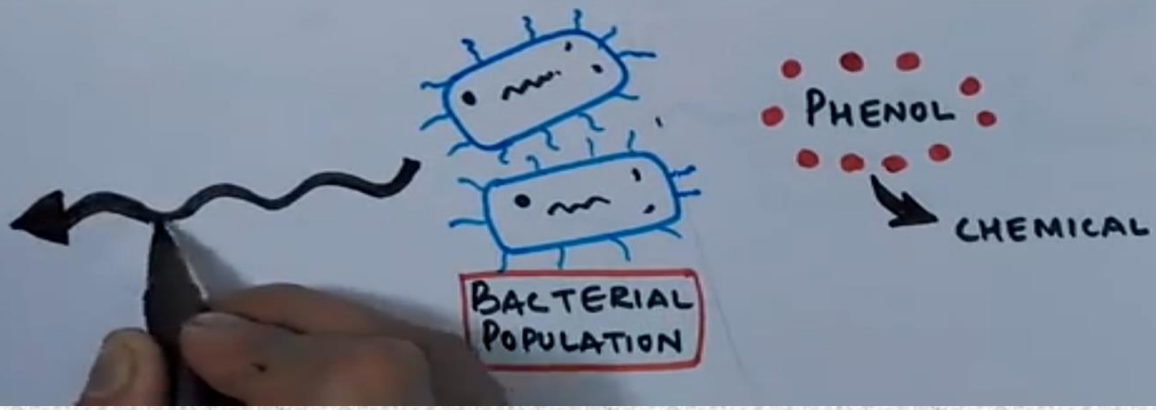


Example of taxis

- Single-celled algae move towards light (positive phototaxis). How does this increase their chance of survival?

- Earthworms move away from light (negative phototaxis). How does this increase their chance of survival?

- Some bacteria move towards a high conc. Of glucose (positive chemotaxis). How does this increase their chance of survival?

Chemotaxis – Chemicals

Phototaxis - Light

Hydrotaxis - Water

Rheotaxis – Water Current

Thermotaxis - Temperature

Barotaxis - Pressure

Aerotaxis - Air

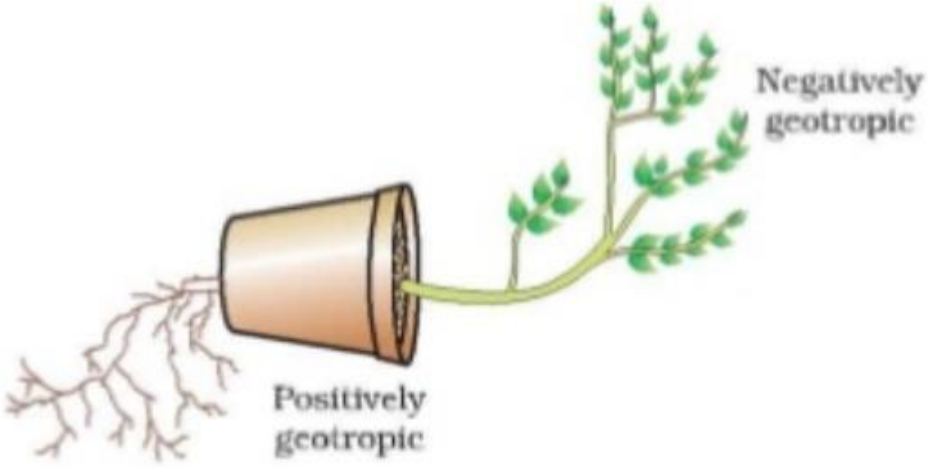
Magnetotaxis – Magnetic Field

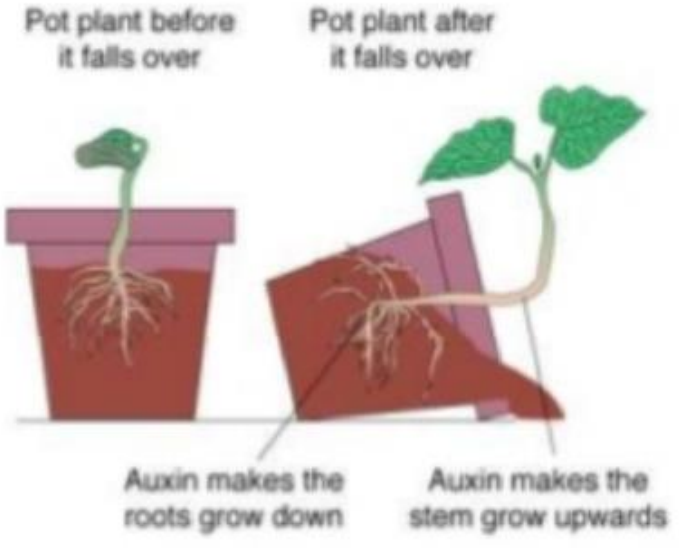
Trophism

Movement of part of organism towards or away from stimulus

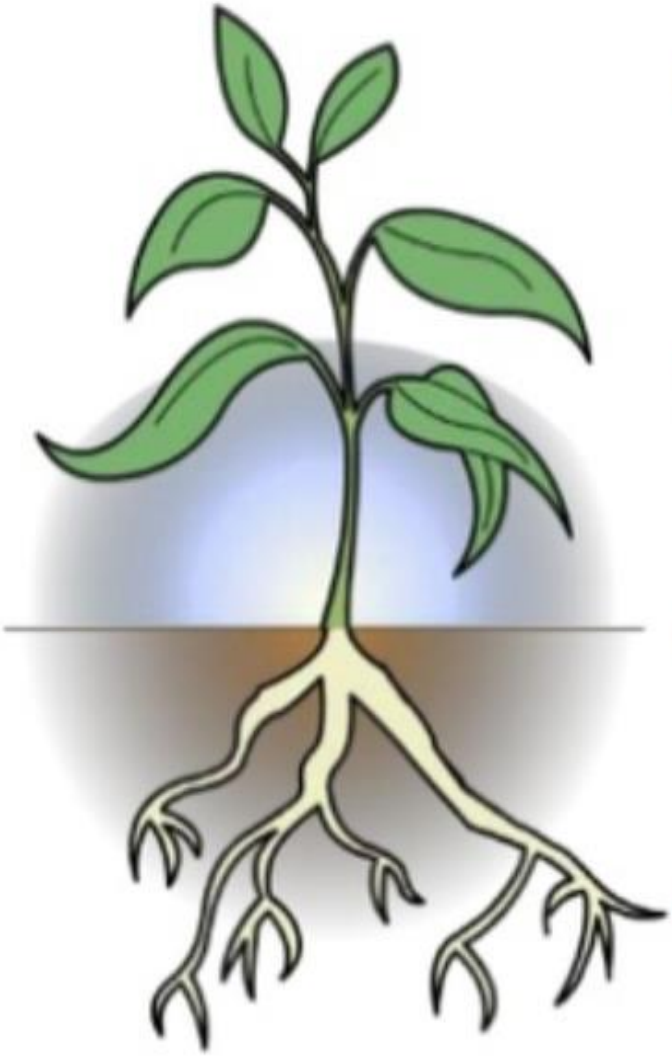
Geotropism

- Geotropism is the growth of the parts of plants in response to the force of gravity.
- Roots show positive geotropism.
- Stems show negative geotropism.





Plant stimuli affect certain parts of the plant in different ways.



- Shoots grow **towards** sunlight.
  They are **positively phototropic**.
- Shoots grow **away** from gravity.
  They are **negatively geotropic**.
- Roots grow **away** from sunlight.
  They are **negatively phototropic**.
- Roots grow **towards** gravity.
  They are **positively geotropic**.

TAXIS

- MOVEMENT OF AN ORGANISM OR A CELL IN RESPONSE TO STIMULUS
- DIRECTIONAL MOVEMENT
- BACTERIA
  INSECTS
  PROTISTA

KINESIS

- MOVEMENT OF AN ORGANISM OR A CELL IN RESPONSE TO STIMULUS
- NON DIRECTIONAL (RANDOM)
- INSECTS
  ARTHOPODS

TROPHISM

- GROWTH OR TURNING MOVEMENT OF AN ORGANISM IN RESPONSE TO STIMULUS
- DIRECTIONAL GROWTH/MOVEMENT OF A PART
- PLANTS OR BY PLANT PARTS

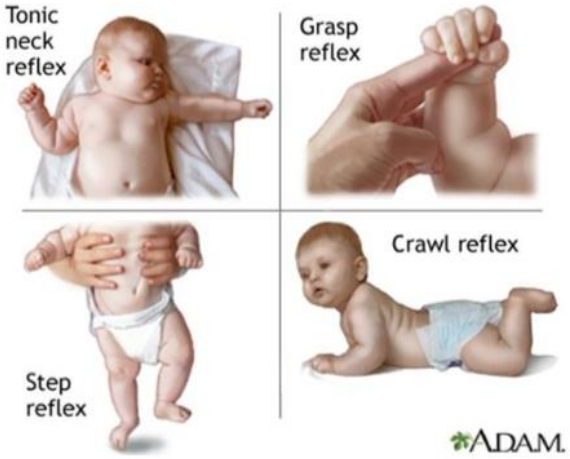
Reflexion / Reflex

Sudden or involuntary Response to a stimulus which occurs without conscious effort. The response is mediated by nervous system

- Automatic Response to Adequate Stimulus
  - Patellar Reflex
  - Eyeblink Reflex
  - All "Spinal" Reflexes

- Involve Single Muscles
- Mediated by Spinal, Cranial Nerves
  - No Involvement of "Higher" Cortical Centers

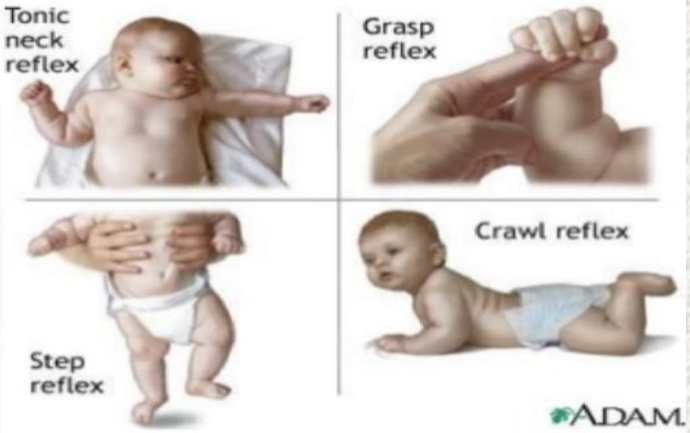
Developmental Reflexes



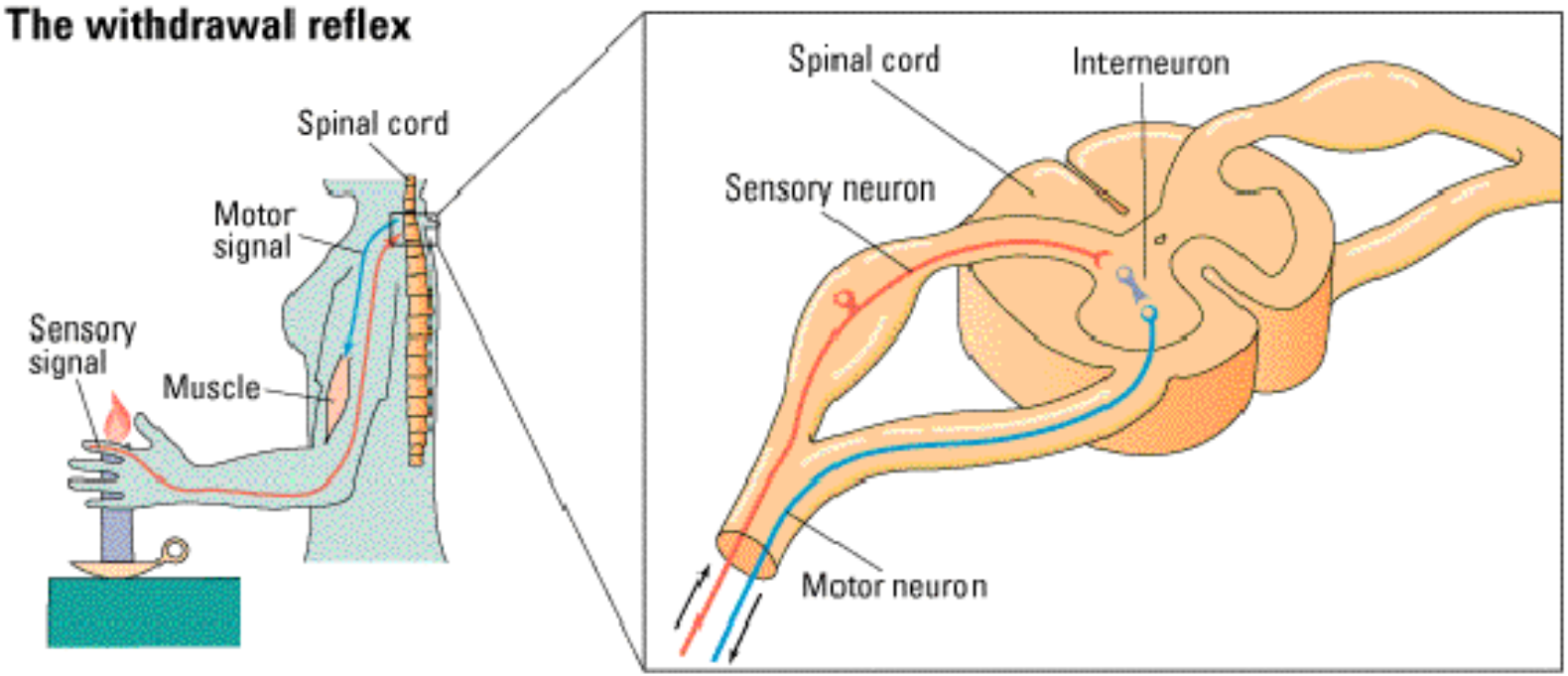
- There are many different reflexes that you are born with
- Babies are well known for their instincts and reflexes
- An example would be the suckling reflex
- If anything of a certain size is put in a babies mouth, they suckle on it
- This type of reflex is called a **Innate reflex**

Examples of reflexes

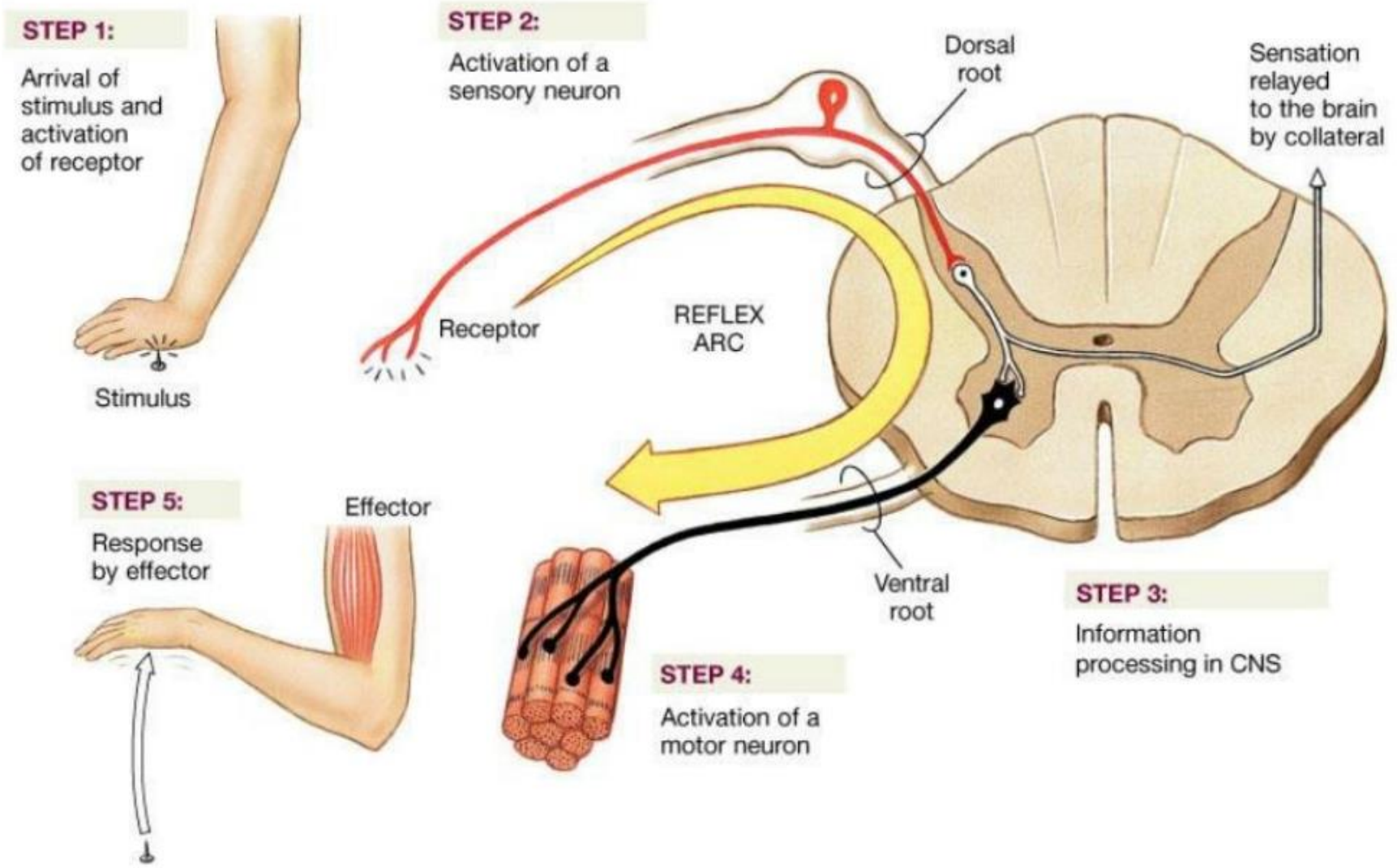
- Withdrawal (nociceptive) reflex
- Knee-jerk (patellar) reflex
- Gag (pharyngeal) reflex
- Blink (corneal) reflex
- Pupillary reflex



The Withdrawal Reflex



Review of reflex arc.



Revise