Ivan Petrovich Pavlov (1849—1936)

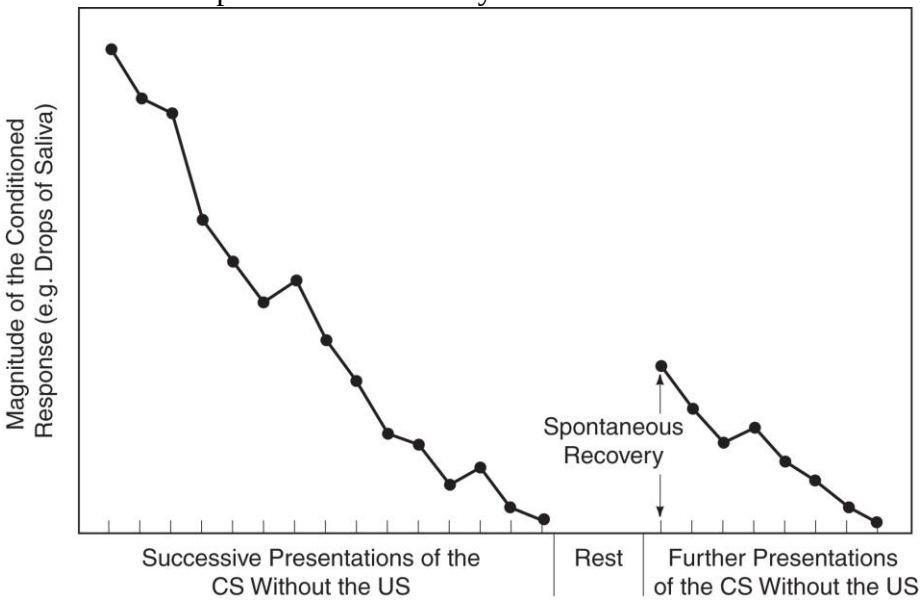
- **Pavlov's Discovery**
  - Lab animal could chew and swallow but food would fall through a surgically implanted tube.
  - Pavlov's important insight was that, although chewed food never actually stimulated stomach tissues, gastric fluids still flowed.
- **Development of a Conditioned Reflex**
- Basic Elements
  - ***Unconditioned Stimulus (US)***
    - elicits a natural and automatic response called the
  - ***Unconditioned Response (UR)***
  - ***US----------→UR***
    - Meat powder----------→Salivation or
    - Weak electric shock------→ withdrawal reflex
  - ***Conditioned Stimulus (CS)***
    - A "neutral" event that does not elicit the response of interest. A flashing light, for example, does not normally elicit salivation.
  - The ***CS*** is repeatedly paired with the ***US***.
    - ***CS*** (flashing light)

      \+ repeatedly paired with
    - ***US*** (meat powder)----→***UR*** (salivation)
  - Eventually, the ***CS*** is presented *without* the ***US***, and a response called the ***Conditioned Reflex*** or ***Conditioned Response (CR)*** is elicited.
  - ***CS----------→ CR***

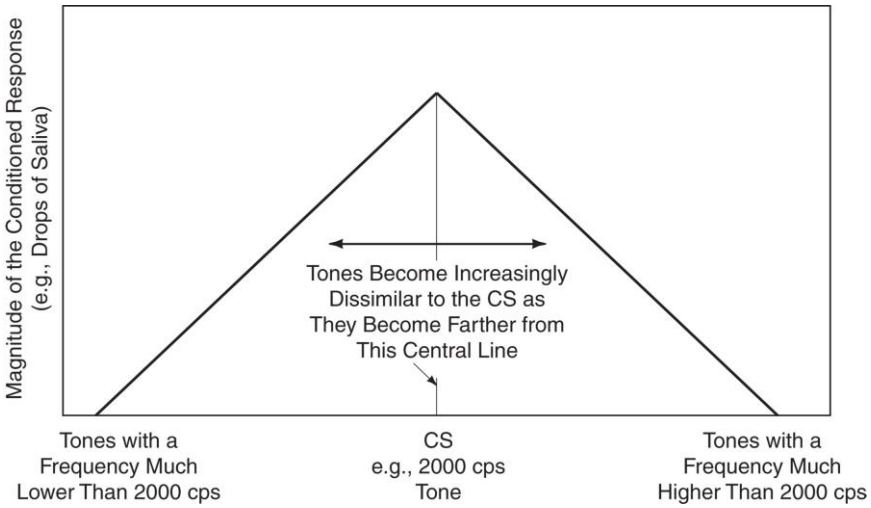
    (Flashing light) (salivation)

    \+

    (no US)
- **Experimental Methods**
  - ***Experimental Extinction***
    - After CR develops, the CS is repeated without the US, and the CR gradually disappears.
  - ***Spontaneous Recovery***
    - After extinction, the CS can be presented and the CR will temporarily reappear.
  - Extinction and Spontaneous Recovery



- ***Higher-Order Conditioning***
  - After a CS has been paired repeatedly with a US, it can be used much like a US.
- CS is temporarily a ***secondary reinforcer***. Because secondary reinforcement cannot develop without the US, the US is called a ***primary reinforcer***.
- ***Generalization***
  - Stimuli similar to the CS will also elicit the CR
- ***Discrimination***
  - With prolonged training, generalization decreases and only the original CS elicits the CR.
- Generalization



- **Comparison Between Classical and Instrumental Conditioning**
  - ***Instrumental and Operant Conditioning***
    - Reinforcer follows response.
    - There is debate about necessity of reinforcers.
  - ***Classical (Pavlovian) Conditioning***
    - The reinforcer (US) precedes response (UR).
    - The US is essential for classical conditioning.
- **Research After Pavlov**
  - CRs Are Not Necessarily Little URs
  - CRs may actually be the opposite of the UR.
  - Possibly a homeostatic response to return the organism to a state of balance.
  - Extinction Involves Interference
    - ***Renewal effect***: when a response conditioned in one context is extinguished in another. When the subject is returned to the original setting and the CS presented, the CR is readily elicited.
  - Extinction Involves Interference
    - ***Reinstatement***: when experimental extinction seems to be complete, after a few *unpaired* presentations of the US, the original CS again elicits a CR.
- **The Rescorla-Wagner Theory of Classical Conditioning**
  - A maximum level of conditioning can be attained. This maximum is called λ ***(lambda)***.
  - The theory describes how the level of learning on a given trial approaches the maximum λ.
  - The amount of learning on any trial (n) is ΔV_n
  - The "strength" of a CS is designated α.
  - The "strength" of a US is designated β.
  - α and β combine when the CS and US are presented.
  - The change on a trial (ΔV_n) starts with the amount conditioned on the previous trial V_{n-1} and brings the amount of learning closer to λ.

- $\Delta V_n = \alpha\beta (\lambda - V_{n-1})$
- The amount conditioned on any trial ΔV_n is some portion of what was already conditioned previously and the maximum that can be conditioned.
- That portion is large if α and β are large, and vice versa.
- What happens if α x β = 1.00?

- **Martin Seligman and Learned Helplessness**
  - When animals are exposed to unpredictable and unavoidable electric shocks as US, they "give up."
  - They appear helpless when later challenged with learning problems.
- **Research After Pavlov**
  - ***Conditioned Taste Aversion***
    - Garcia and Koelling exposed rats to strong X-rays while they were drinking saccharine-sweetened water (CS). X-ray treatment causes nausea (US).
    - Subsequently, the rats refused to drink saccharine-sweetened water.
  - Applications in Clinical Psychology
    - Extinction
    - Countercondtioning
    - Flooding
    - Systematic Desensitization
  - Applications in Medicine
  - The immune system can be classically conditioned.
  - Application in autoimmune disorders, implant rejection, or AIDS