

# What is Learned?

## Lecture 9

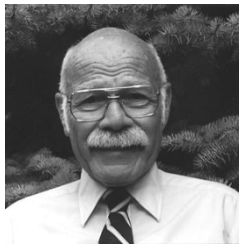
# Classical and Instrumental Conditioning Compared

## *Classical*

- Reinforcement Not Contingent on Behavior
- Behavior Elicited by US
- Involuntary Response (Reflex)
- Few Conditionable Behaviors

## *Instrumental*

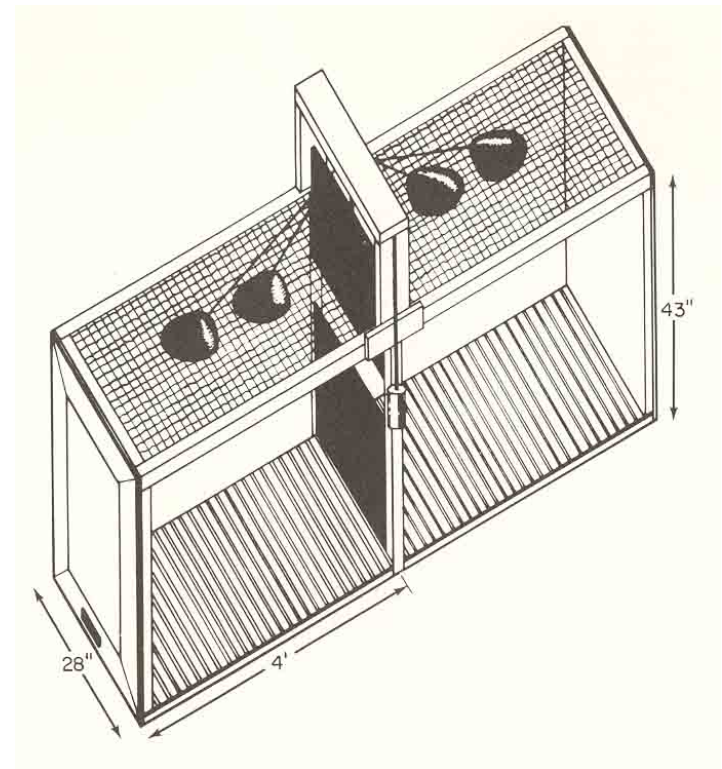
- Reinforcement Contingent on Behavior
- Behavior Emitted by Organism
- Voluntary Responses (“Spontaneous”)
- Many Conditionable Behaviors



# Avoidance Learning

Solomon & Wynne (1953)

- Dog Placed in One Side of Apparatus
- Overhead Lights Deliver CS
- Floor Grid Delivers US
  - After CS-US Interval
- Vault Barrier
  - Escape After US Onset
  - Avoidance Before US Onset



# Two-Factor Theory of Avoidance Learning

Mowrer (1947); critiqued by Seligman & Johnston (1973)

- Light ==> Shock
  - Respond During Shock ==> Escape
  - Respond Prior to Shock ==> Avoidance
- Classical Conditioning
  - Anticipatory Fear Conditioned to Light
- Instrumental Conditioning
  - Reinforce Escape/Avoidance
    - Cessation of Shock US
    - Cessation of Light CS



# The Stimulus-Response Theory of Learning

- Association between Stimulus and Response
  - Pavlov: CS = Bell; CR = Salivation
  - Thorndike: CS = Puzzle Box; CR = Paddle Press
  - Skinner: CS = (Illuminated) Key; CR = Keypeck
- Reinforcement
  - Pavlov: US = Meat Powder
  - Thorndike: Reward = Escape
  - Skinner: Reinforcement = Food Pellet

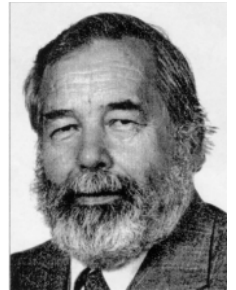
# Assumptions of S-R Learning Theory

- Association by Contiguity
  - Co-Occurrence in Space, Time
- Arbitrariness (Equipotentiality)
  - Any Stimulus, Any Response
- Empty Organism
  - Organism as “Black Box” Collecting Ss, Rs
- Passive Organism
  - Metaphor of “Conditioning”

# Taste-Aversion Learning

(Bait Shyness)

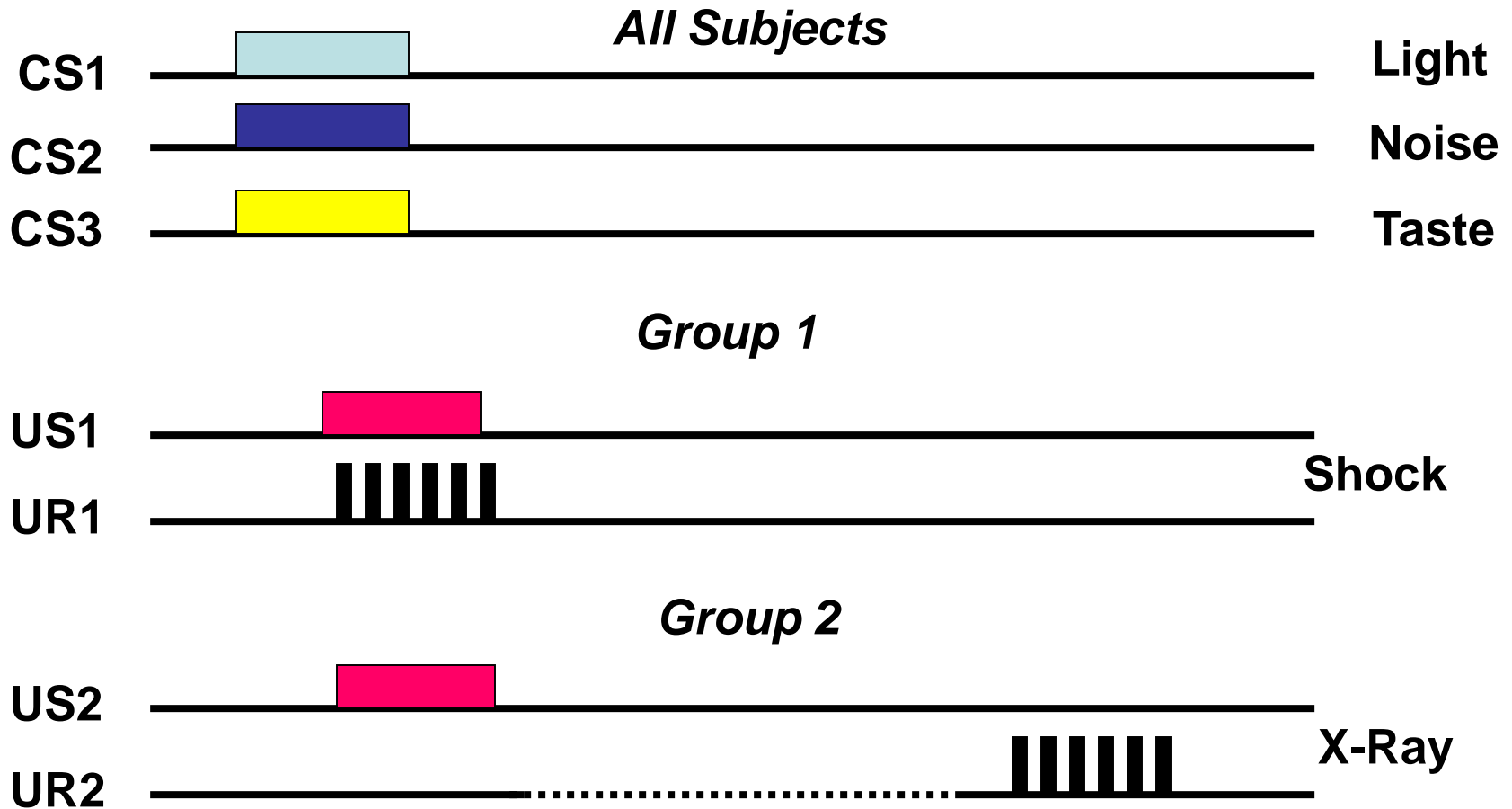
Garcia & Koelling (1966)



- Compound CS
  - “Bright, Noisy, Sweet” Water
- US
  - Foot Shock (Immediate Pain)
  - X-Rays (Delayed Nausea)
- Avoidance Test of Conditioning
  - Choose Water Source
    - Bright, Noisy Water
    - Sweet Water

# Taste-Aversion Learning

Garcia & Koelling (1966)

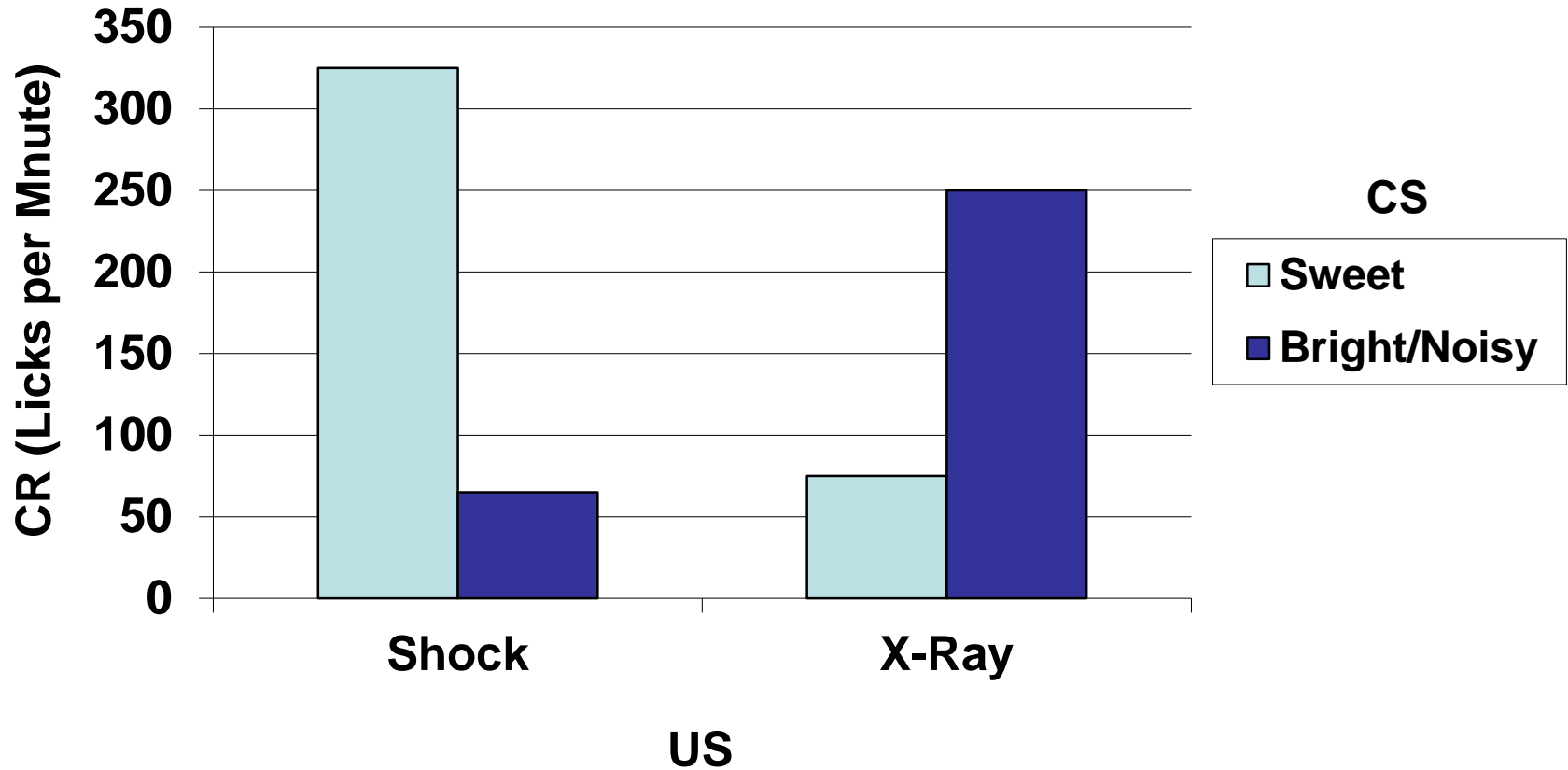




# Preference Test of Conditioned Fear

(Avoidance of Water Source)

Garcia & Koelling (1966)



# Implications for S-R Learning Theory

- ~~Arbitrariness~~
  - Taste-Nausea, Sight/Sound-Shock
- ~~Empty Organism~~
  - Internal Structure Shaped by Evolution
- ~~Association by Contiguity~~
  - CS, CR Distant in Space, Time
- ~~Law of Exercise~~
  - One-Trial Taste-Aversion Learning

# Species-Specific Defense Reactions

Bolles (1970)

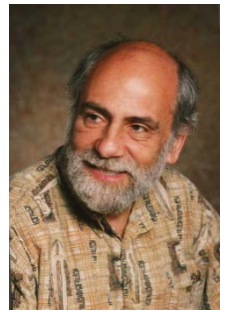
- Escape/Avoidance Learning in Pigeons
  - Easy: Flap Wings, Stretch necks
  - Impossible: Key Peck
- Escape/Avoidance Learning in Rats
  - Easy: Jump Up, Run
  - *Hard*: Lever Press
- Avoidance Learning Capitalizes on Species-Specific Repertoire of Defensive Reactions
  - Built In by Evolution

# The Preparedness Principle (Belongingness)

Seligman (1970); Rozin & Kalat (1971)

By Virtue of Its Evolutionary History,  
Each Species is Predisposed  
to Learn Certain Associations

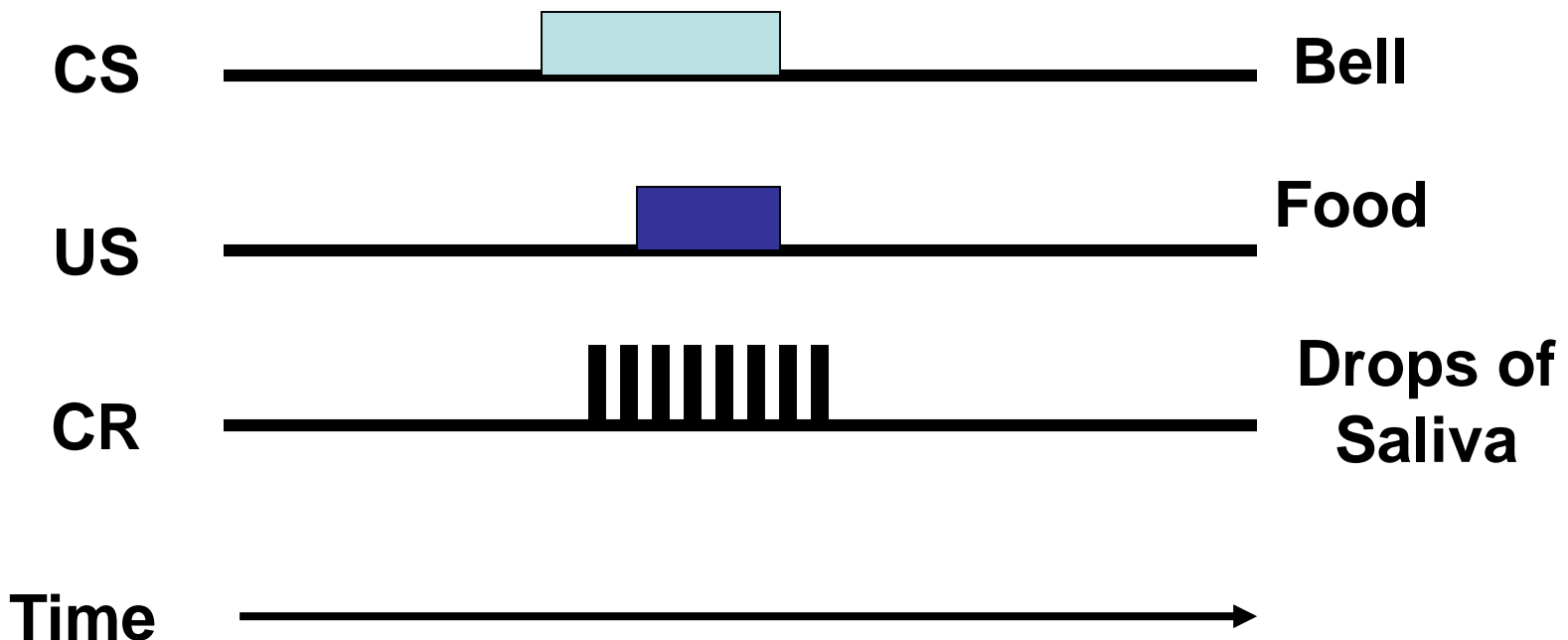
- Prepared
- Unprepared
- Contraprepared



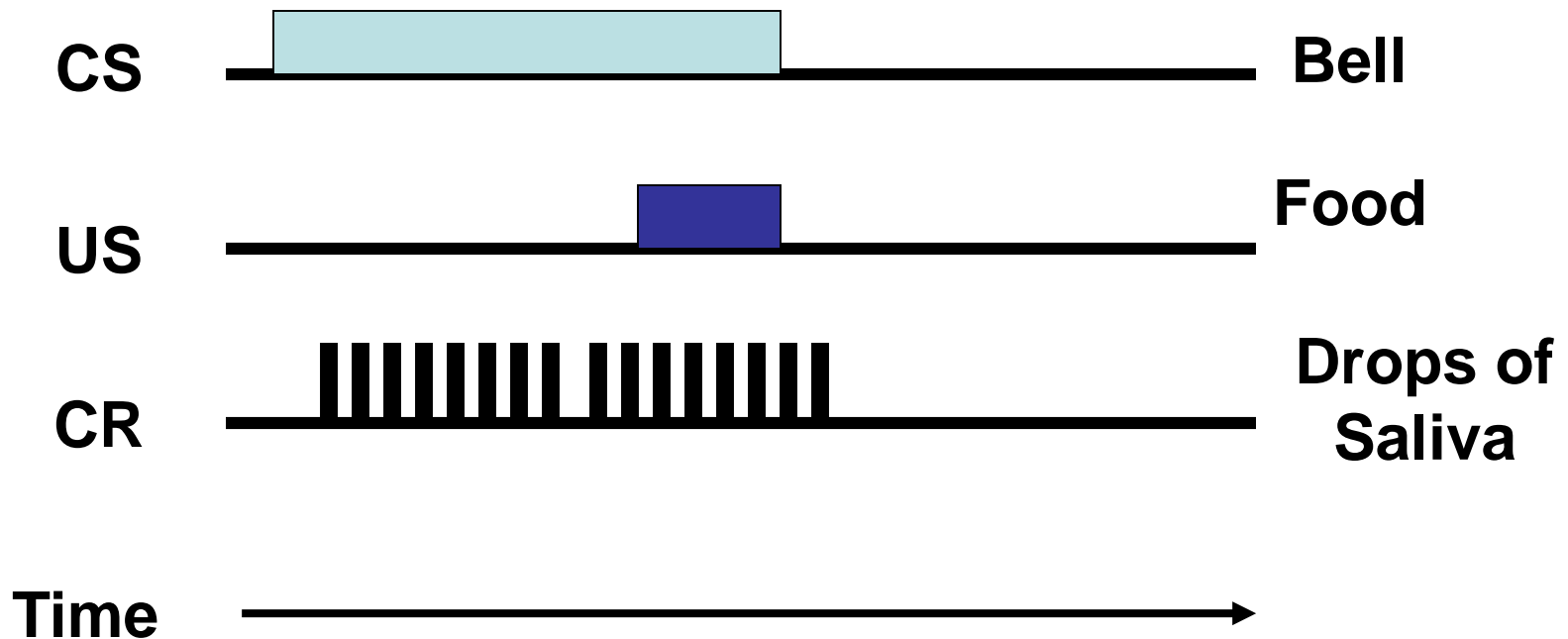
# Constraints on Learning

- Biological
  - Evolutionary History
- Cognitive
  - Internal Representation of CS → CR

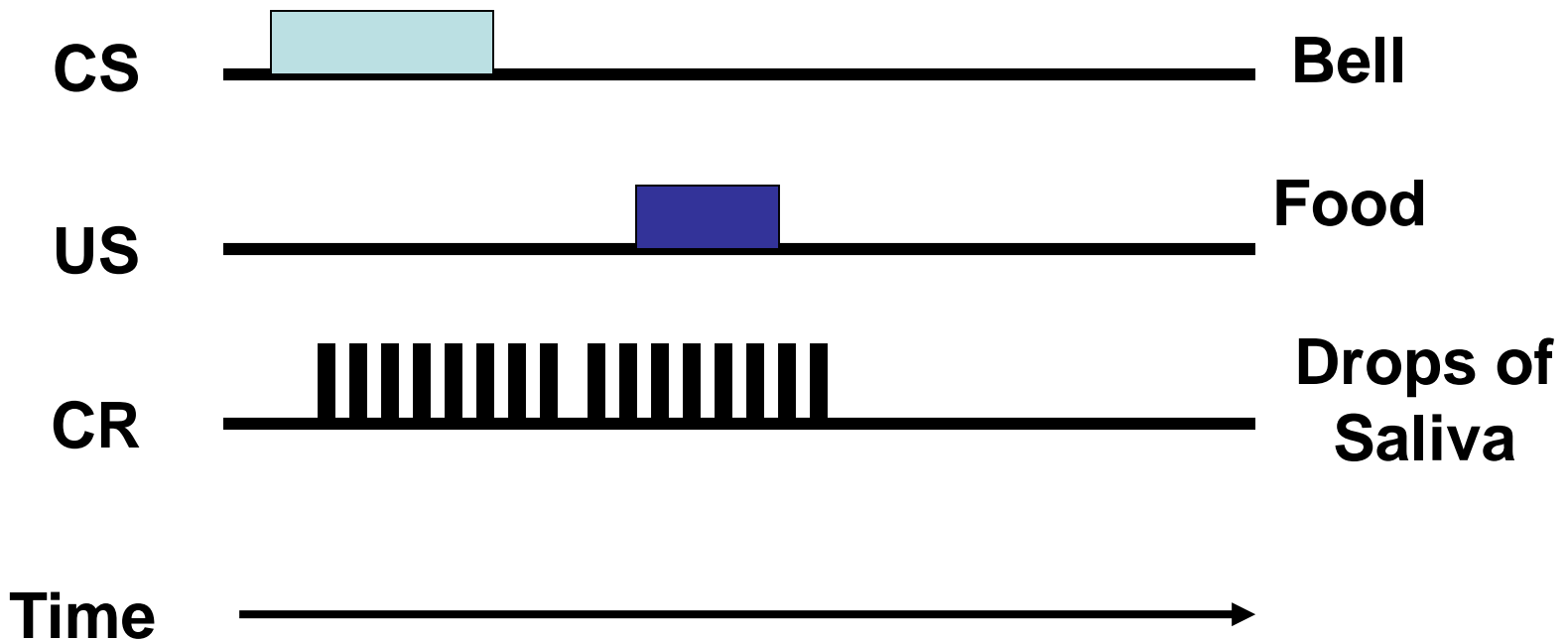
# “Standard Paradigm” for Classical Conditioning



# Delay Conditioning

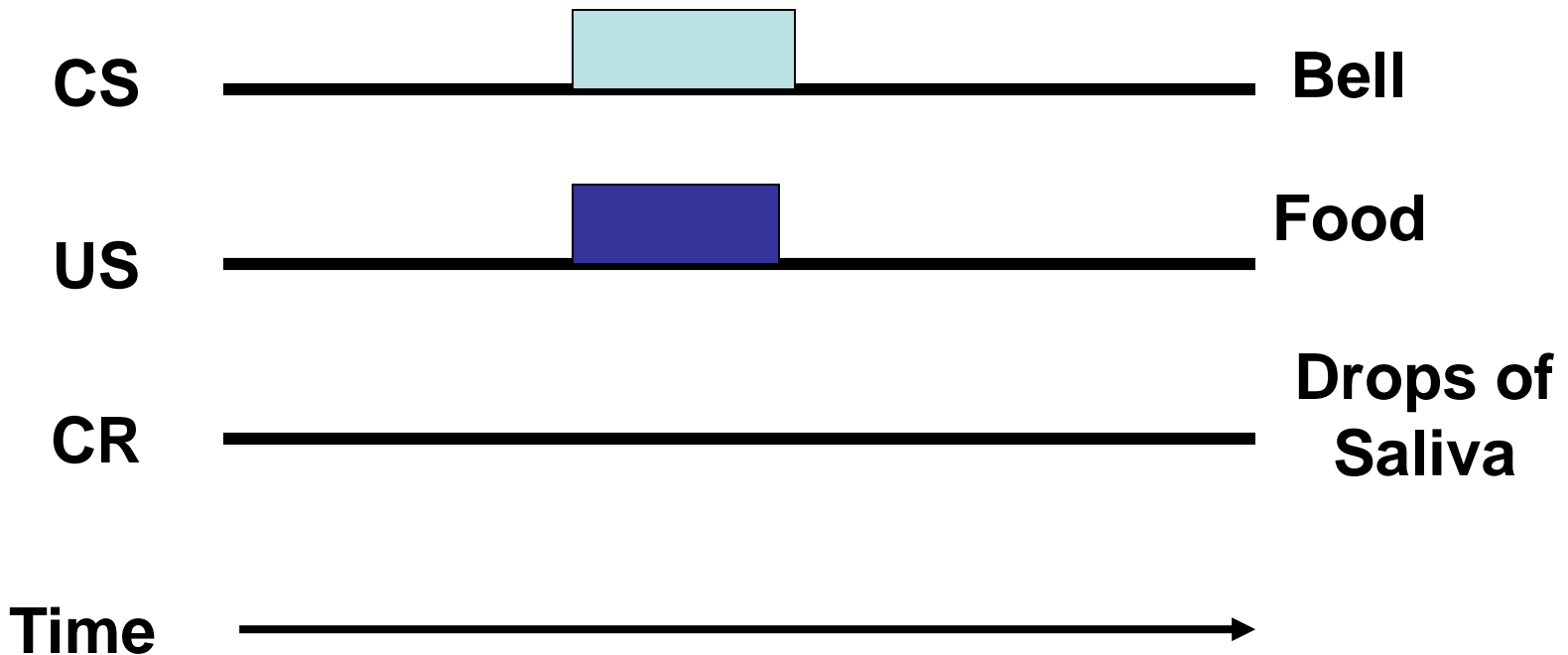


# Trace Conditioning





# Simultaneous Conditioning



# Backwards Conditioning



# Conditioned Inhibition in Backwards Conditioning

- Fear Conditioning
  - Tone ==> Shock
  - CR = Heart Rate Acceleration
    - Physiological Index of Fear
- Standard Paradigm
  - HR Acceleration During Tone
    - Conditioned Fear Response
- Backward Paradigm
  - HR *Deceleration* During Tone
    - Inhibition of Fear Response

# Contiguity vs. Contingency in Conditioning

Rescorla (1967, 1988)



- **Contiguity**
  - CS *Co-Occurs* with US
- **Contingency**
  - CS *Predicts* US
- **Standard Paradigm**
  - CS, US both **Contingent** and Contiguous
- **Delay, Trace Conditioning**
  - CS, US **Contingent** but Not Contiguous
- **Simultaneous Conditioning**
  - CS, US Contiguous but not Contingent
- **Backwards Conditioning, Extinction (Below Zero)**
  - CS Predicts *Absence* of US

# Informational Value of the CS

- When the US is Contingent on the CS, then the CS Provides Information About the US
- Conditioning Occurs Because the CS Provides Information about US
- Conditioning Does Not Occur When the CS is Not Informative

What Happens When  
the Information in the CS is *Redundant*?

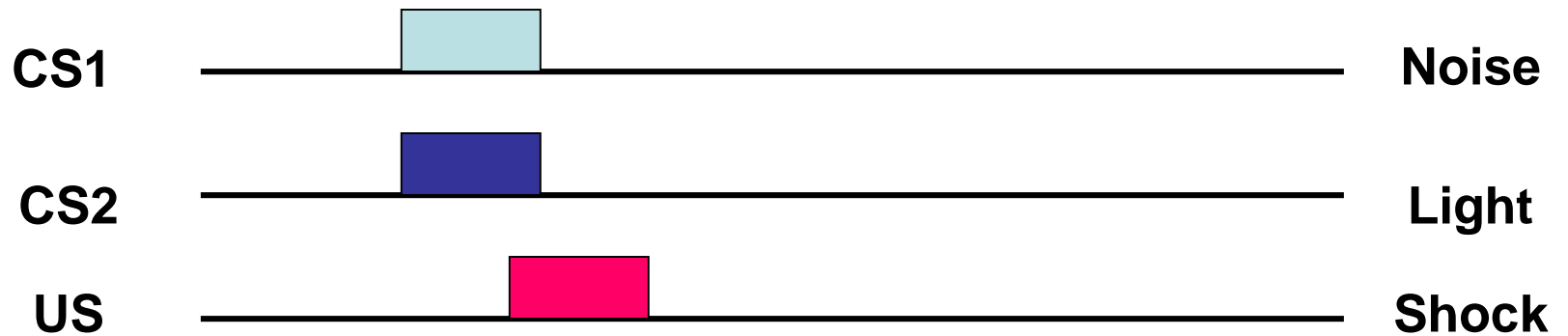
# Conditioned Emotional Responses

- Tone CS → Footshock US
- CR: Heart Rate Acceleration
- Paradigmatic Variations
  - Standard Paradigm
  - Delay, Trace Paradigms
  - Simultaneous Paradigm
  - Backwards Paradigm
    - Safety Signal

# The Blocking Experiment (1)

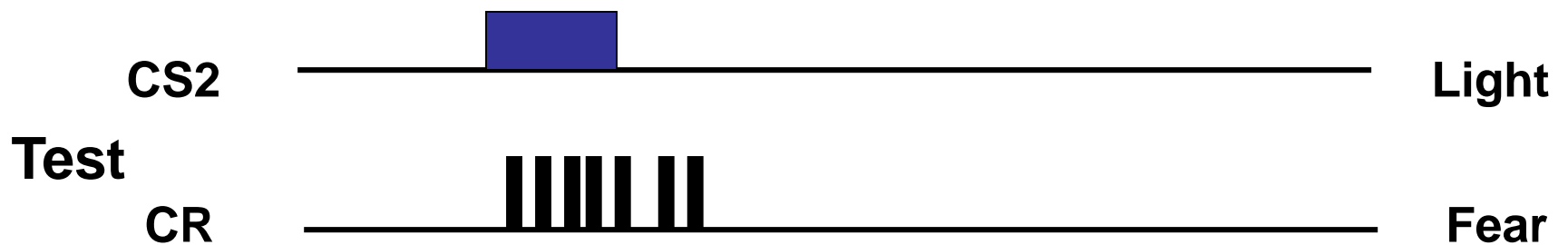
Kamin (1969)

## Initial Conditioning with Compound CS



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## Test Conditioning with Light CS Alone

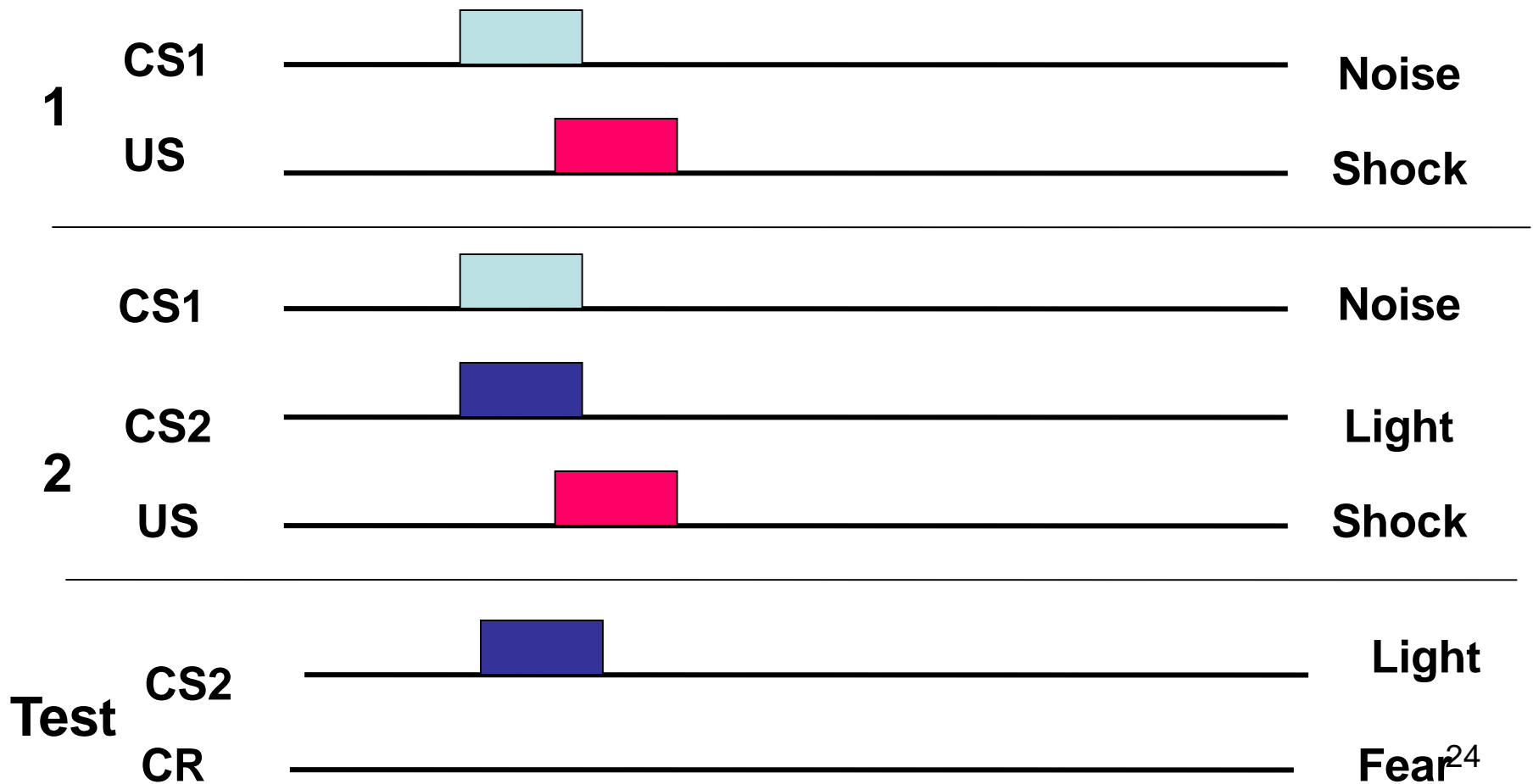


# The Blocking Experiment (2)

Kamin (1969)

**Phase 1: Conditioning with Noise CS1 (1)**

**Phase 2: Add Light CS2 *Simultaneous* with CS1 (2)**

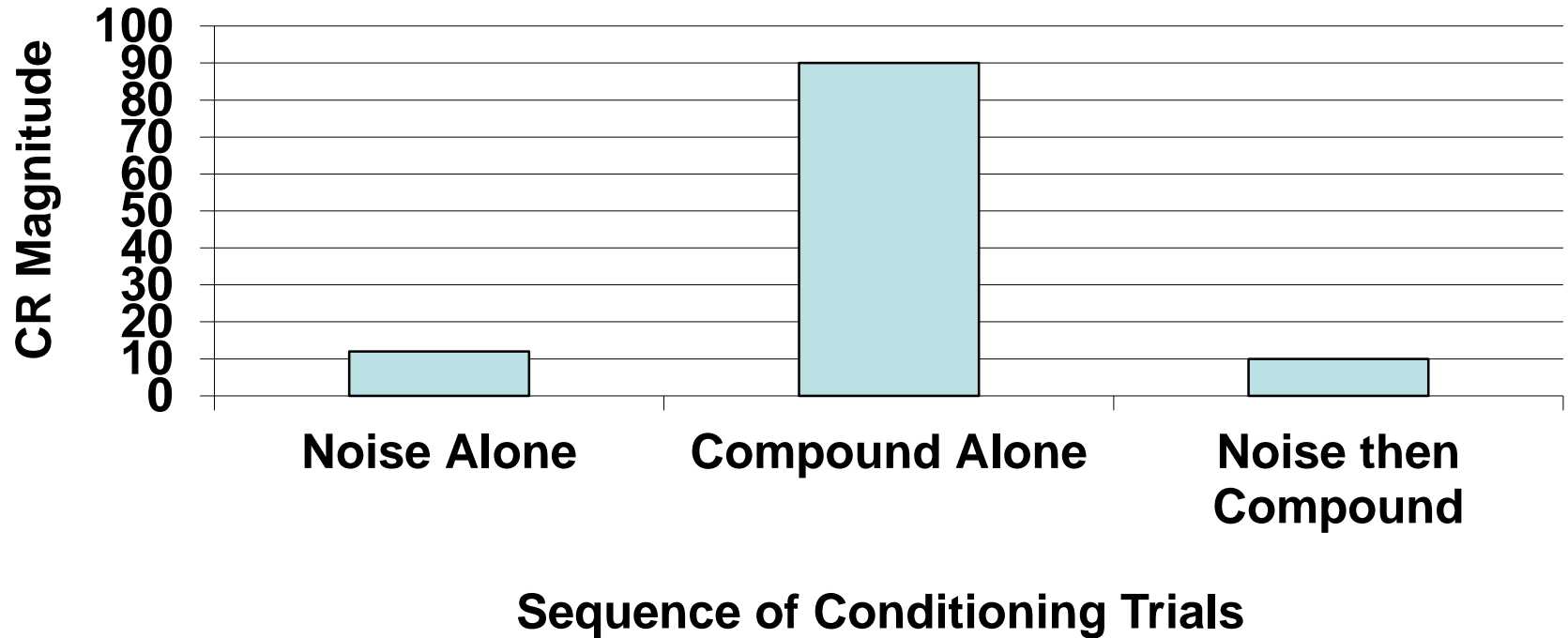




# The Blocking Effect

Kamin (1969)

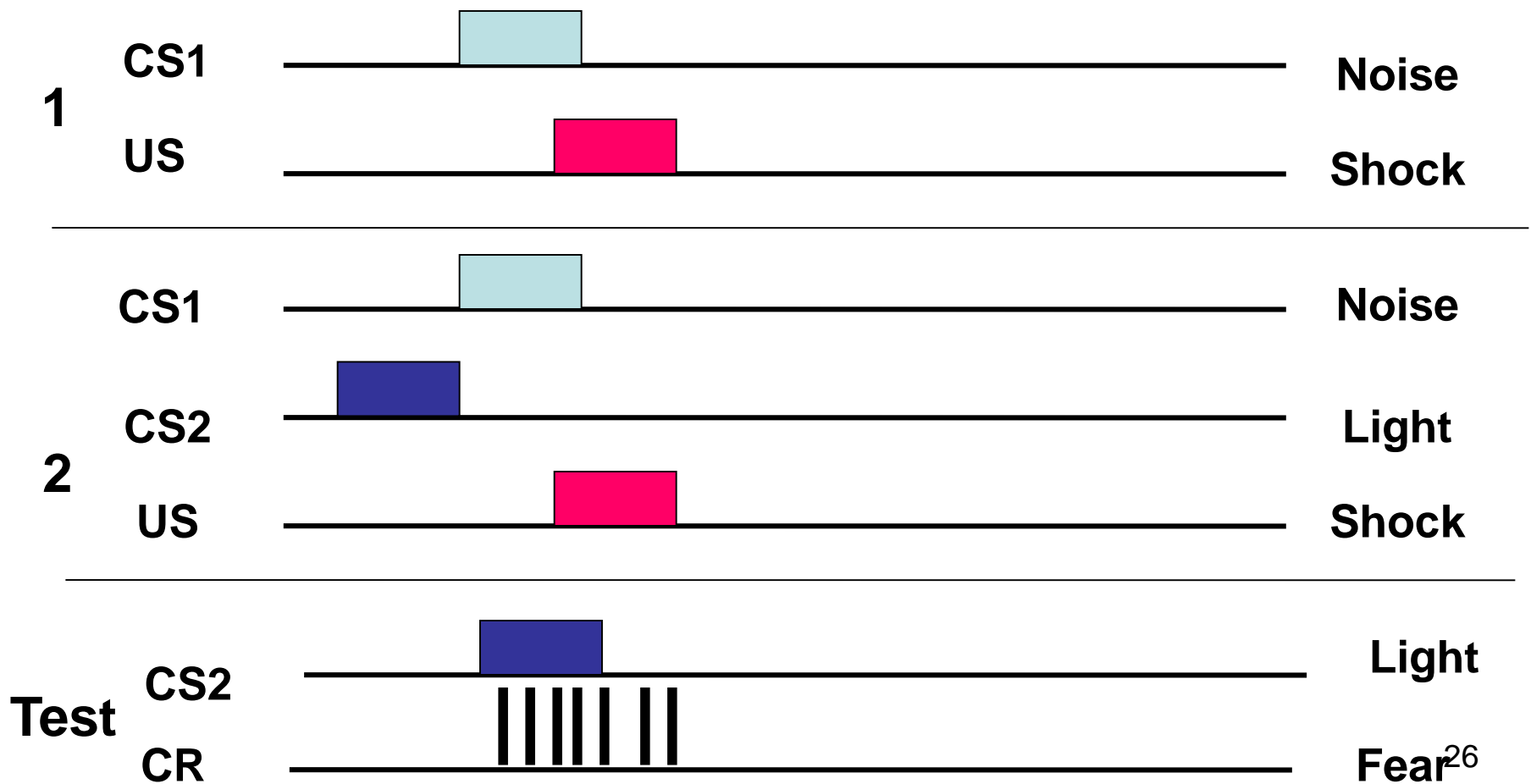
## Test Response to Light



# “Unblocking” the Blocking Experiment

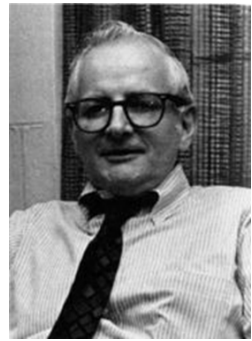
**Phase 1: Conditioning with Simple CS**

**Phase 2: Add Light CS2 *Preceding* CS1**



# Predictability, Surprise, and Conditioning

Kamin (1969)



- Conditioning Only Occurs When the US Surprises the Organism
- Organism Searches Environment for Predictors of US
- Irrelevant, Redundant Stimuli are Ignored
- Classical Conditioning Involves the Formation of Expectations
  - CS predicts US

# Implications for S-R Learning Theory

- ~~Association by Contiguity~~
  - Association by *Contingency*
- ~~Empty Organism~~
  - Expectations, Surprise
- ~~Passive Organism~~
  - Actively Engaged in Predicting Events