Note: These are just the topics that have been covered since Exam 1. The exams are cumulative, so all the material that we have covered in this course can be included in Exam 2. Additionally, Anti-predator Behavior may or may not be included in this exam. It will depend on how much material we get through in the lectures this week. If it will not be covered in the exam, I will announce this in class on Thursday.

Communication:

Communication definition
Signal
Cue
Eavesdropping – and trying to prevent it
Auditory communication
Chemical
Visual
Tactile
Seismic
Electrical
Pros and cons and situations in which one uses these modalities
Information encoded in signals – info about sender, info about environment
Functions of signals
Recognition of neighbors, reproduction, etc
Bee waggle dance
Alarm calls
Referential signals in vervets
How to test the function – structure of the signal, behavior of animals, stimuli that elicit signal, response to the signal
Aiding in conservation

Behavioral Development:

Nature-Nurture debate
Genes, environment, and genes x environment influences on behavior
Phenotypes – broadly variable, highly canalized, polyphenism
Food-induced polyphenism, socially induced polyphenism, predator-induced polyphenism
Phenotypic plasticity
Reaction Norms

Personality:

Definition of personality
Methods of studying/determining personality
Novel object testing
Bold shy personality dimension
Cost and benefits of personality
Applied aspects of personality
“Fast” vs. “slow” personality types

**Signal Evolution:**

How does natural selection shape signals?  
Must benefit senders and receivers on average  
Habitat structure also shapes signal structure  
Signals send information between individuals with conflicting interests without needing physical contact.  
Signals impose costs on signalers and receivers potentially  
Signalers are selected to exploit the receivers and receivers are selected to develop resistance to signalers.  
Coevolutionary arms race  
Red queen effect  
Receivers face trade-off between success in non-signaling context and avoiding trickery by signalers  
Imposes selection for improved sensory systems and better discrimination  
Exerts selection on signalers to exaggerate their signals further  
Why do we have honest signals?  
Aligned interests of signaler and receiver  
Signals will be accurate when they cannot be faked  
Signals will be accurate when they are costly to produce or maintain  
Amotz Zahavi and the handicap principle  
- High-quality individuals are more able to bear the cost of signals, which maintains honesty  
Dishonesty can be stable in certain situations (such as brood parasitism) – maintained by frequency-dependent selection  
Mimicry (Bateson mimicry, Aggressive mimicry)  
Cuckoos – costs to hosts of rejecting and accepting

**Cognition:**

Social intelligence hypothesis  
Ecological complexity hypothesis  
Learning  
Learning evolves in worlds of intermediate complexity and predictability  
Learning is adaptive  
Learning is associated with neurological changes  
Release of neurotransmitters is associated with learning and memory and imprinting in chicks  
Neural plasticity  
Dendritic spines  
Caching  
Neural adaptations for caching  
Episodic memory
Hippocampus
Brain studies as evidence for hypotheses for evolution of intelligence
Tool use
Cause and effect, causality
Insight
Associative learning
Tool use in different environments
Picking the right tool for the job in capuchins
Trap tube test – what does it tell us?
Neural changes that are experience dependent
Evidence that caching birds use memory to retrieve caches
Caching as evidence for episodic memory
Adaptive value of learning
Law of equipotentiality
Biased learning
Preparedness
Garcia’s bright noisy water experiments
Social cognition
Audience effect
Bystanders – eavesdroppers
Social awareness
Theory of mind

Social Learning and Culture:

Social learning
Social facilitation
Local or stimulus enhancement
Copying
Imitation
MRI studies, mirror neurons
Methods for studying social learning
Traditional demonstrator-observer pairings
Transmission chain / diffusion studies
Field studies – geographical variation
Natural diffusions
Mathematical and statistical approaches
Public information
Adaptive specializations in social learning in sticklebacks
Transmission chain experiments
Diffusion studies and social networks
Field studies of social learning
Social learning theory
Vertical transmission
Oblique transmission
Horizontal transmission
Biological Rhythms:

Know definitions of the following:
Biological rhythms
Rhythm
Period
Know definitions, causes, time periods, and be able to identify and give examples of the following:
- Ultradian rhythms
- Circalunidian rhythms
- Circadian rhythms
- Infradian rhythms

Nocturnal
Diurnal
Crepuscular
Zugunruhe – migratory restlessness
Exogenous rhythms – environment dependant
Endogenous rhythms – environment independent, internal clock
You should also know how to test whether a rhythm is exogenous or endogenous
Entrainment vs. Free-running
Zeitgeber – predictable environmental cue
You should also understand how a free-running rhythm becomes entrained
Suprachiasmatic nucleus (SCN) – the ‘master’ clock
Pineal gland
Melatonin
The adaptive benefits of endogenous rhythms
Whether or not biological rhythms are fixed or flexible

Foraging:

Mechanoreceptors
The lateral line system
Search image
Optimality theory
Optimal foraging theory
Optimal diet model – types of food to include in diet
- assumptions
- profitability
- handling time
- if given sufficient information, you should be able to say how many, and/or which, food types an animal should include in its diet
Zero-one rule
Constraints on the optimal diet model, when are the assumptions not met?

Optimal patch use model
- assumptions
- diminishing returns
- instantaneous harvest rate
- travel time
- giving up density (GUD)
- if given sufficient information, you should be able to say how long an animal should stay in a food patch

Constraints on the optimal patch use model, when are the assumptions not met?
- Brown’s patch use model

Optimal foraging theory
- Costs and benefits
- Criticisms

Generalists
Specialists
Omnivore
Herbivore
Carnivore

**Anti-predator behavior**

Prey acquisition strategies
- Sit and wait (including examples)
- Active predators (including examples)

Group foraging and when it would be adaptive

Social transfer of information about food
- Passive recruitment
- Active recruitment

Ways that prey avoid predators, including avoiding detection, attack, capture, and consumption

Cryptic coloration
Behavioral trade-offs

Vigilance
Ways that prey avoid predators, including avoiding attack, capture, and consumption

Aposematic coloration
Batesian mimicry
Stotting
Group defense
- Many eyes
- Selfish herd
- Dilution effects
- Tonic immobility