PSYC 1010
Exam-AID
Review Package 2

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Preface

This document was created by the York University chapter of Students Offering Support (York SOS) to accompany our PSYC 1010 Exam-AID session. It is intended for students enrolled in any section of Dr. Jubis' 2010/2011 PSYC 1010 course who are looking for an additional resource to assist their studies in preparation for the exam.

References

Weiten, W., & McCann, D. (2010). *Psychology: Themes and variations* (2nd Canadian ed.). Toronto, ON: Nelson.

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What is Students Offering Support?

Students Offering Support is a national network of student volunteers working together to **raise** funds to **raise** the quality of education and life for those in developing nations through **raising** marks of our fellow University students.

This is accomplished through our Exam-AID initiative where student volunteers run group review sessions prior to a midterm or final exam for a $20 donation.

All of the money raised through SOS Exam-AIDs is funnelled directly into sustainable educational projects in developing nations. Not only does SOS fund these projects, but SOS volunteers help build the projects on annual volunteer trips coordinated by each University chapter.

Tips for General Midterm Success

Use mnemonics to remember concepts better. An example of a mnemonic would be acronyms. For instance, knowing the word "ocean" can help you remember the Big Five personality traits: **o**penness to experience, **c**onscientiousness, **e**xtraversion, **a**greeableness and **n**euroticism.

Do practice multiple choice questions. Doing these practice questions can assess your understanding of what you've learned and can help you identify areas of weakness. Practice multiple choice questions are found in textbooks, on textbook companion websites, and/or provided by your professor. *Psychology: Themes and Variations* has practice questions in it and on its online companion website (http://www.themesandvariations2ce.nelson.com/student/chapter/).

Read a multiple choice question and try to answer it BEFORE looking at the possible answers. Having an answer in mind before looking at possible answers can reduce the chances of being fooled by wrong answers.

Use logic and process of elimination on multiple choice questions. For example, if you know that answer A is wrong, then logically an answer "A and B are correct" in the same question must also be incorrect. When you don't know the answer, eliminating wrong answers (as opposed to just random guessing) can increase your chances of getting the question right.

Practice writing answers to short answer questions. If you know ahead of time what the questions will be on the short answer section, make a list of essential points you want to include in each answer and practice writing the answer on paper. If you don't know what questions will be on the short answer section, you could try scanning the material to identify concepts that have enough content to be a possible short answer question. Again, you can make a list of essential points you want to include in each answer and practice writing the answer on paper. Even if the question you thought of doesn't show up on the short answer section, doing this can help solidify what you learned.

Don't spend too much time on a difficult question. It is better to move onto easier questions to ensure getting those marks than to get hung up on a difficult question, especially when time is limited.

Get adequate sleep the night before your test. Sleeping at night helps consolidate what you learned during the day into memory so that it is better remembered in future. Not only does staying up late the night before a test destroy your concentration during the test the next day, but your brain has not effectively learned the material.

Chapter 6: Learning

Learning: relatively durable change in behaviour or knowledge that is due to experience

- superstitions involves people repeating behaviour that they think will lead to a certain outcome (this is a type of operant conditioning)
- **phobias**: irrational fears of specific objects or situations
    - often the result of classical conditioning
- **conditioning**: learning associations between events that occur in an organism's environment
    - a specific kind of learning

Classical Conditioning

Classical conditioning: type of learning whereby after several pairings of a neutral stimulus and an unconditioned stimulus (which produces an unconditioned response), the neutral stimulus becomes a conditioned stimulus and gains the capacity to produce a conditioned response (which is similar to the unconditioned response)

- learning by association
- also called **Pavlovian conditioning** (pioneered by Ivan Pavlov)
- the term "conditioning" comes from Pavlov's determination to discover the "conditions" of this kind of learning
- **neutral stimulus** (**NS**): a stimulus that does not evoke a conditioned response
- **unconditioned stimulus** (**UCS**): a stimulus that evokes an unconditioned response without previous conditioning
- **unconditioned response** (**UCR**): an unlearned reaction to an unconditioned stimulus that occurs without previous conditioning)
- **conditioned stimulus** (**CS**): a previously neutral stimulus (NS) that has, through conditioning, acquired the capacity to evoke a conditioned response
- **conditioned response** (**CR**): a learned reaction to conditioned stimulus because of previous conditioning
- ex. in dogs:
    - meat powder (UCS) → salivation (UCR)
        - this is an *automatic, unlearned response*
    - a tone (NS) + meat powder (UCS) → salivation (UCR)
        - a neutral stimulus is paired with presentations of meat powder
    - a tone (CS) → salivation (CS)
        - the neutral stimulus becomes associated with the response of the meat powder, becoming the conditioned stimulus
        - when the tone is presented alone, it can produce the salivation response
- UCR and CR are usually the same, but there could be subtle differences
- classically conditioned responses are known as conditioned reflexes (formerly "psychic reflexes")
    - they are **elicited** (**drawn forth**)

- **trial**: consists of presentation of a stimulus or pair of stimulus
    - classical conditioning usually requires several trials, but sometimes needs only 1 trial

Classical Conditioning in Everyday Life

- **phobias**: conditioned fears
    - case studies of patients suffering from phobias suggest many irrational fears can be traced to experiences involving classical conditioning
    - fear (UCR) is associated with UCS and NS, new CS causes CR of fear
- classical conditioning works for *pleasant* emotions as well
    - advertising: attractive people in pleasant environment associated with products
    - e.g. attractive people and situation (UCS) elicit pleasant emotions (UCR) and products (CS) elicits pleasant emotions (CR)

Conditioning and Physiological Responses

- Robert Ader and Nicholas Cohen showed classical conditioning can lead to **immunosuppression**: decrease in production of antibodies
    - animal given chemical immunosuppression (UCS) with unusual-tasting liquid (NS), animal showed lowered immune response after taking liquid alone, liquid became CS
- studies show classical condition can elicit **allergic reactions**
- classical conditioning contributes to increased **drug tolerance**
    - *contextual cues* or *predrug cues* (e.g. park, swings = where a person used a drug) become conditioned stimuli that elicit **conditioned compensatory responses** (body processes that oppose drug effects)
    - therefore: if the situation elicits compensatory CRs that weaken drug effects, users will use more drugs to get the same effect (causing compensatory CR to grow in strength over time as well)
    - if users take drugs in a new context or situation, then this new environment won't elicit compensatory CRs and the person doesn't need to take as much drugs to get the same effect
- withdrawal symptoms present when cues present but not administering drug
- classical conditioning involved in **sexual arousal** and fetishes
    - in quails, red light paired (NS) with opportunities to copulate (UCS), red light became a conditioned response and elicited increased sperm release (CS)

Basic Processes in Classical Conditioning

- **acquisition**: initial stage of learning something
    - Pavlov theorized **stimulus contiguity**: stimuli are contiguous when they occur together in time and space
    - occurs when CS and UCS are paired, gradually resulting in a CR
    - evidence shows that stimuli which are unusual or intense have more potential to become CSs in conditioning
        - probably because these types of stimuli stand out more

- **extinction**: gradual weakening or disappearance of a conditioned response tendency
    - occurs after repeated presentation of CS alone without UCS
        - e.g. continuous tone with salivating dogs and no meat powder → dogs' salivation declines
    - does not lead to unlearning, rather suppression
- **spontaneous recovery**: reappearance of an extinguished response after a period of nonexposure to CS
    - e.g. dogs' salivation to the tone extinguished → later exposure to tone created a little salivation in the dog
- **renewal effect**: CR returns when reintroduced to original environment where it was acquired first (response was extinguished in a different environment)
- **stimulus generalization**: occurs when an organism that has learned a response to a specific stimulus responds in the same way to a new stimuli that is similar to the original stimulus
    - CR elicited by new stimulus resembles original CS
    - adaptive measure because we rarely experience the same stimulus twice
    - generalization declines as similarity decreases
        - *generalization gradients* quantify the degree of generalization across similar objects
- **stimulus discrimination**: occurs when an organism that has learned a response to a specific stimulus does not respond in the same way to new stimuli that are similar to the original stimulus
    - opposite of generalization (CR is not elicited by new stimulus that resembles original CS)
    - new stimuli are unpaired with original stimuli
    - adaptive measure, e.g. avoiding poisonous foods, recognizing friend from foe
    - less similar a stimuli is to the original the greater likelihood of discrimination
- **higher-order conditioning**: conditioned stimulus functions as if it were an unconditioned stimulus
    - natural UCS can be substituted with CS after response established in the CS
    - CS is paired with NS over trials, NS becomes a second CS

Operant Conditioning

Operant conditioning: form of learning where responses come to be controlled by their consequences

- developed by B.F. Skinner
- mainly regulates voluntary, spontaneous responses (e.g. studying)

Thorndike's Law of Effect

- operant conditioning a.k.a. instrumental learning

- **law of effect**: response in presence of a stimulus leads to *satisfying* effects, the association between stimulus and response is strengthened
    - e.g. experiment where cats were rewarded upon escape, the cats were escaping faster and faster

B.F. Skinner's Demonstration: It's All a Matter of Consequences

- **reinforcement**: occurs when an event following a response increases an organism's tendency to make that response
- **operant chamber** or **Skinner box**: small enclosure where an animal can make a specific response that is recorded while consequences of the response are systematically controlled
- operant responses tend to be **emitted** (sent forth, voluntary)
    - unlike **elicited** (drawn forth, involuntary)
- **reinforcement contingencies**: circumstances or rules that determine whether the responses lead to the presentation of reinforcers
- **cumulative recorder**: creates a graphic record of responding and reinforcement in a Skinner box as a function of time (dependent variable = rate of response)
    - steep slope = rapid response rate
    - shallow slope = slow response rate
    - line never goes down because it is cumulative

Basic Processes in Operant Conditioning

- same stages as classical conditioning
- **acquisition**: initial stage of learning some new pattern of responding
    - responding gradually increases because of reinforcement (possibly through shaping)
- **shaping**: consist of reinforcements of closer and closer approximations of a desired response
    - e.g. rewarding a child each time s/he gets closer and closer to tying their shoe correctly
- **extinction**: responding gradually slows and stops after reinforcement is terminated
    - organism will eventually cease to perform behaviour
- **resistance to extinction**: occurs when an organism continues to make a response after reinforcement termination
    - high resistance if response tapers off slowly
    - low resistance if response tapers off quickly
- **discriminative stimuli**: cues that influence operant behaviour by indicating the probable consequences (reinforcement or nonreinforcement) of a response
    - e.g. birds learn to hunt after it has rained because worms are easier to find
- **stimulus generalization**: responding increases (generalization) in the presence of a stimulus that resembles discriminative stimulus
- **stimulus discrimination**: responding decreases (discrimination) in the presence of a stimulus that does not resemble discriminative stimulus

Reinforcement: Consequences That Strengthen Responses

- strengthening of a response tendency after a favourable outcome
    - defined after effect, in other words after observation
- **primary reinforcers**: events that inherently reinforce because they satisfy biological needs
    - e.g. food, water, warmth, sex, etc.
- **secondary** or **conditioned reinforcers**: events that acquire reinforcing qualities by being associated with primary reinforcers
    - e.g. money, good grades, attention, flattery, praise, etc.

Schedules of Reinforcement

- **schedule of reinforcement**: determines which occurrences of a specific response result in the presentation of a reinforcer
    - basically “how often is behaviour reinforced”
- **continuous reinforcement**: occurs when every instance of a designated response is reinforced
    - fast extinction if reinforcement ceased
- **intermittent** or **partial reinforcement**: occurs when a designated response is reinforced only some of the time
    - longer-lasting effects
- **ratio schedules** require organism to make designated response a certain number of times to fain each reinforcer
    - **fixed-ratio (FR) schedule**: reinforcer is given after a fixed number of non-reinforced responses
        - e.g. salesman receives bonus every 4 encyclopedias sold
    - **variable-ratio (VR) schedule**: reinforcer is given after a variable number of non-reinforced responses (varies around predetermined average)
        - e.g. slot machine pays off once every 6 tries on the average, number of non-winnings varies one time to the next
- **interval schedules** require time period to pass between presentation of reinforcers
    - **fixed-interval (FI) schedule**: reinforcer given for the first response that occurs after a fixed time interval has elapsed
        - e.g. man washing clothes periodically checks to see whether each load is finished
            - reward (clean clothes) available only after fixed intervals (checking responses is not reinforced)
    - **variable-interval (VI) schedule**: reinforcer given for the first response after a variable time interval has elapsed
        - e.g. person repeatedly dialing a busy phone number (getting through is reinforcer)
- ratio schedules produce more rapid responding because it leads to reinforcement sooner

Positive Reinforcement versus Negative Reinforcement

- **positive reinforcement**: occurs when a response is strengthened because it is followed by presentation of a rewarding stimulus

    - e.g. studying hard (response) earns good grades (rewarding stimulus)
- **negative reinforcement**: occurs when a response is strengthened because it is followed by the removal of an aversive (unpleasant) stimulus
    - e.g. giving in (response) to a demanding child (unpleasant stimulus)
    - leads to **escape learning**: organism acquires a response that decreases or ends some aversive stimulation
        - e.g. leaving a party when being picked on (ending unpleasantness)
        - e.g. turning on AC to get rid of stifling heat (decreasing unpleasantness)
    - leads to **avoidance learning**: organism acquires a response that prevents some aversive stimulation from occurring
        - e.g. quitting parties to avoid being picked on
        - e.g. turning on AC before entering a hot room
    - operant conditioning can work with classical conditioning
        - e.g. phobia: presentation of stimulus (CS) followed by avoidance behaviour (CR) is reinforced (operant response)

Punishment: consequences that weaken responses
- **positive punishment**: presentation of an aversive stimulus to reduce occurrence of response
    - e.g. spanking (aversive stimulus) a child
    - used a lot for disciplinary purposes
- **negative punishment**: removal of a rewarding stimulus
    - e.g. parent taking away child's TV time (rewarding stimulus) for misbehaving
- **side effects of physical punishment**:
    - Elizabeth Thompson Gershoff concluded physical punishment is associated with: poor-quality parent-child relations, elevated aggression, delinquency, behavioural problems in youngsters, increased likelihood of children being abused
    - studies show effects carry over into adulthood for those who were abused in childhood: increased aggression, criminal behaviour, mental health problems, child abuse
    - rebuttal: these relations are correlations and that levels of punishment was unaccounted for

Effective Punishment
1) Apply punishment swiftly: punish after immediately after unfavourable response or the effectiveness of it is loss
- delayed punishment can make ex. a child confused at why they were punished

2) Use punishment just severe enough to be effective
- more severe punishment can have undesirable effects

3) Make punishment **consistent**: punish the response very time, or else confusion is created in learning
4) Explain the punishment: punishment combined with reasoning is more effective than either alone

- [makes ex. a child realize clearly which stimulus (bad behaviour) their parents disapprove of]

5) Use noncorporal punishments (e.g. withdrawal of privileges)
   - withdrawing allows e.g. a child to contemplate the wisdom of changing their ways

Changing Directions in the Study of Conditioning

Instinctive drift: occurs when an animal's innate response tendencies interfere with conditioning
- e.g. raccoons can be conditioned to deposit 1 coin in a piggy bank, but couldn't be conditioned to deposit 2 or more coins (they would rub the coins together and keep them)
  - raccoons have an instinct to rub things together to clean them

Conditioned Taste Aversion: many people develop aversions to food followed by nausea, food poisoning and alcohol intoxication
- e.g. "sauce béarnaise syndrome": CS (sauce) + UCS (flu) elicit nausea (UCR + CR)
  - taste-nausea and odour-nausea associations form quickly despite CS-UCS delays
  - study: rats developed taste aversion when given radiation that causes nausea after eating, but not to electric shock
    - visual and auditory stimuli before induced-nausea did not create conditioned aversions
  - reason: natural selection favours those able to choose right foods to eat (evolutionary influences)

Preparedness and Phobias
- **preparedness**: species-specific predisposition to be conditioned in certain ways and not others
- evolutionary forces gradually programmed humans to easily acquire conditioned fears to common objects more easily and rapidly (e.g. dark, spiders, etc.)

Arbitrary Versus Ecological Conditioned Stimuli
- Domjan argues that in the real world, conditioned stimuli tend to have natural relationships to the unconditioned stimuli

Evolutionary Perspectives on Learning
- popular view: basic mechanisms of learning are similar across species but sometimes are modified due to different environmental demands on species
- radical view: there isn't *the* learning process, rather there are many learning processes sculpted by evolution for each particular species
  - no universal laws to learning

Recognizing Cognitive Processes in Conditioning

Signal Relations

- Robert Rescorla asserts environmental stimuli serve as signals and that some are better than others
    - a “good” signal is a CS that allows accurate prediction of UCS
    - more UCS-CS pairings, the stronger the CR

Response-Outcome Relations and Reinforcement

- people actively reason out relations between responses and outcomes
- response is more likely to be strengthened if it appeared to have *caused* the favourable outcome
- modern theory: conditioning is a matter of detecting contingencies (what causes what)
    - looks at contingencies of behaviour and the environment
    - stimuli are signals that help organism minimize unpleasant experiences and maximize pleasant experiences
    - departure from mechanical and mindless process of classical conditioning of old theory

Observational Learning

Observational Learning: occurs when an organism’s responding is influenced by the observation of others, who are called models (indirect experience)

- Albert Bandura’s research in observational learning has been pivotal
    - demonstrated that classical and operant conditioning can take place vicariously through observational learning

Basic Processes

1) *Attention*: paying attention to another person’s behaviour and its consequences
2) *Retention*: storage of a mental representation of what you have witnessed in memory
3) *Reproduction*: enacting a modelled response (depends on ability to convert memory to overt behaviour)
4) *Motivation*: encountering a situation where you believe the response will pay off

Acquisition versus Performance

- distinguishes acquisition of a learned response and performance of that response
- reinforcement affects which responses are actually performed more than which responses are acquired
- Bandura asserts reinforcement influences performance rather learning

Observational Learning the Media Violence Controversy

- media violence and aggression connection still debated
- Bandura performed experiments using the “Bobo doll”

    - children acted aggressively with the doll after seeing an adult model doing the same
    - supports idea of media violence and aggressiveness
- many studies support the finding that violence in media has short-term effects, ex. verbal aggression
- others argue that violence in the media is only one of many factors that determine a person's level of aggression
- physical punishment tends to increase aggression in children even when it is intended to do the opposite

Observational Learning and the Brain: Mirror Neurons

- **mirror neurons**: neurons activated by performing an action or seeing another monkey or person perform the same action
    - study: the brain activity of a monkey watching another monkey do something was the same
    - found in humans with fMRI

Featured Study: The Long-Term Effects of Watching Violence on TV

Method

- a study measured a group of children's aggression, amount of TV violence watched, and measured their aggressiveness 15 years later

Results & Discussion

- children's attitudes toward TV violence (ex. identifying with a violent TV character) related to level of aggression as adults
- this was especially true of boys, who identified with violent TV characters

Personal Application: Achieving Self-Control Through Behaviour Modification

Behaviour modification: systematic approach to changing behaviour through application of principles of conditioning

- specify target behaviour
    - can only target overt behaviours
- baseline target behaviour
    - initial level of target behaviour
- monitor the **antecedents**: events that typically precede a target response
- monitor the **consequences**: factors that maintain the undesirable behaviour
    - ex. smoking decreases someone's anxiety
- design a program that increases the desirable behaviour and decreases undesirable behaviour
    - break the link of problem behaviour to its antecedents and consequences
    - choose an appropriate reinforcer

        - can give a list of reinforcers for a person to seek out appropriate reinforcers
        - perhaps use a **token economy**: system for doling out symbolic reinforcers that are exchanged for a variety of genuine reinforcers
    - consider using punishment, but not alone and at a mild level
- execute and evaluate your program
    - look at the behavioural data to see if behaviour is improving
    - can increase compliance with the person with a **behavioural contract**: written agreement outlining a promise to adhere to the contingencies of a behaviour modification program

Critical Thinking Application: Manipulating Emotions: Pavlov and Persuasion

Classical Conditioning in Various Areas

- *advertising*: associating products with pleasant emotions
- *business negotiations*: fine dining and entertainment through major events elicit pleasant feelings as well as **reciprocity norm** (social rule of giving back the host in perhaps business deals)
- *politics*: politicians pairing themselves with positive events, so they in turn are associated with pleasant emotions
    - e.g. Nazis pairing Jewish people with repulsive imagery

Chapter 16:Social Behaviour

Social psychology: branch of psychology concerned with way individuals' thoughts, feeling and behaviours are influenced by others

Person Perception: Forming Impressions of Others

Person Perception: process of forming impressions of others
- people's personality often judged by physical appearance, often done in the blink of an eye
- more attractive people ascribed more positive characteristics and expected to lead more successful lives
- people with *baby-faced features* perceived as more honest, trustworthy, warm, submissive, helpless and naïve
- judgments of face associated with real-life outcomes
    - e.g. judging competence, predicted outcomes of elections surprisingly well

Cognitive Schemas: organized clusters of ideas about categories of social events and people
- help efficiently process and store wealth of information about others
- for events, e.g. dates can be dinner, a movie, etc.
- for people, e.g. frat boys drink a lot, are sociable, etc.

Stereotypes: widely held beliefs that people have certain characteristics because of their membership in a particular group
- ethnic stereotypes, e.g. all Germans are methodical
- cognitive process that is automatic and efficient for dealing with people
- broad generalizations that ignore diversity in a group
    - people acknowledge not everyone in that group is, but most are like the stereotype (slanted probabilities)
- often can be self-fulfilling if we adjust our actions accordingly that bring out the stereotypical behaviour

Subjectivity and Bias in Person Perception
- stereotypes bias perception such that they see what they expect to see
- **illusionary correlation**: occurs when people estimate that they have encountered more confirmations of an association between social traits than they have actually seen
    - e.g. "lawyers are always sneaky"
    - opposite is true, people tend to underestimate the number of disconfirmations that they have encountered
        - e.g. "I've never seen an honest lawyer"
- people tend to remember information about people that fit their stereotypes
- evolutionary reason: stereotyping was adaptive in ancestral environment

    - also to quickly identify **ingroup** (who we identify with) and **outgroup** (who we don't identify with)

Attribution Processes: Explaining Behaviour

Attributions: inferences that people draw about the causes of events, others' behaviour and their own behaviour

- people have a strong need to understand their experiences

Internal versus External Attributions

- **internal attribution**: ascribe causes of behaviour to personal dispositions, traits, abilities and feelings
- **external attribution**: ascribe causes of behaviour to situational demands and environmental constraints

Attributions for Success and Failure

- people focus on **stability** of causes of underlying behaviour, which cuts across internal-external dimension (4 types of attributions)

Bias in Attribution

- **actor-observer bias**: observers' bias in favour of internal attributions in explaining others' behaviour
    - a.k.a. **fundamental attribution error** (FAE)
    - situational factors impinging on actor not readily apparent or requires more effort (less convenient) to observer
    - observers also tend to feel situation is not that coercive
    - actors favour external attribution
- **defensive bias**: tendency to blame victims for their misfortune so that one feels less likely to be victimized in a similar way
    - maintained by **hindsight bias** ("I knew it would happen") and **belief in a just world** (world is safe and fair)
        - therefore, bad people get bad outcomes, whereas I'm a good person and I won't receive that bad outcome
- **self-serving bias**: tendency to attribute one's success to personal factors and one's failures to situational factors
    - bias grows stronger as time passes after the event

Culture and Attributional Tendencies

- **individualism**: putting personal identity ahead of group goals and defining one's identity in terms of personal attributes rather than group memberships
    - self-serving bias most prevent in individualistic cultures (exists in other cultures too though)
- **collectivism**: putting group goals ahead and of personal goals and defining one's identity in terms of the groups one belongs to
    - collectivistic cultures less prone to FAE

    - **self-effacing bias**: attribute success to help they received from others or ease of task, while downplaying the importance of their ability (found in Japanese students)
        - likely to take responsibility for failure and let it motivate self-improvement

Close Relationships: Liking and Loving

Interpersonal attraction: positive feelings toward another

Key Factors in Attraction
- attractive people enjoy greater mating success
- being more attractive seems to be more important for females than males
- **matching hypothesis**: males and females seek equally-attractive mates
    - married couples tend to be similar in level of physical attractiveness
- some research shows **similarity** fosters attraction
    - however could be due to **attitude alignment**: gradual modification of beliefs to match that of the partner
- **reciprocity**: we like those who like us
    - reciprocity includes positive feedback aimed at self-enhancement of the partner
- people routinely evaluate how well partners match ideals
    - the closer the match, the more attraction
    - however, people tend to view partners with behind rose-coloured glass (more favourably) than what's real

Perspectives on the Mystery of Love
- **passionate love**: complete absorption in another that includes tender sexual feelings and the agony and ecstasy of intense emotion
- **companionate love**: warm, trusting, tolerant affection for another whose life is deeply intertwined with one's own
- both types of love may coexist
- Robert Sternberg outlined divided companionate love into 2 types:
    - **intimacy**: warmth, closeness and sharing ideas in a relationship
    - **commitment**: intent to maintain a relationship in spite of the difficulties and costs that may rise
- passionate love found to stimulate dopamine circuits that would be stimulated by stimulants, suggests passionate love is like an addiction
- commitment is predictive of relationship stability
- people with anxious-ambivalent attachment in infancy will have romantic relationships marked by anxiety and ambivalence in adulthood
- **secure adults** found it easy to get close to others and have better relationships
    - tend to be secure with their sexuality
- **anxious-ambivalent adults** found their relationships as volatile and marked by jealousy

    - *excessive reassurance seeking*: typically need reassurance from partners that they are worthy of love
    - tend to have sex to reduce insecurities
    - experience more negative emotionality after break-ups
    - tend to suffer from psychopathology
- **avoidant adults** found it difficult to get close to others and found their relationships lacked intimacy and trust
    - tend to have more casual sex to improve peers and more likely to use sex to manipulate partners
- new approach: attachment exists on continuums
    - **attachment anxiety**: how much people worry their partners will not be available when needed
    - **attachment avoidance**: degree to which people feel uncomfortable with closeness and intimacy, and thus emotionally distance
    - creates preoccupied subtype: high anxiety, low avoidance

Culture and Close Relationships

- some differences in love and relationships across cultures due to individualist-collectivist dimension
- all cultures seem to value mutual attraction, kindness, intelligence, emotional stability, dependability, good health (David Buss)
    - as well as male's emphasis on female's physical attractiveness and female's emphasis on male's social status and financial resources
- marriage based on love (especially passionate love) dominant in Western culture, while arranged marriages common in collectivist nations but decreasing in some due to Westernization
- romantic love less important in collectivist cultures

An Evolutionary Perspective on Attractive

- aspects of good looks (physical attractiveness) are signs of sound health, good genes and high fertility, which contribute to reproductive potential
- **facial symmetry** is key element of attractiveness across diverse cultures
    - asymmetry would be associated with bad genes or health
- **women's waist-to-hip ratio** found in many cultures
    - men prefer women with waist-to-hip ratio of 0.70-0.80, which appears to be a meaningful correlate of females' reproductive potential
- men place more value on youthfulness and physical attractiveness of females for mates, because they're associated with reproductive potential
- women place more value on ambition, social status and financial potential of males for mates, because they're associated with ability to invest in material resources for children
- however, women value physical attractiveness when seeking *short-term partner*
- attractive females want prospective male with both economic potential and physical attractiveness
- in middle of menstrual cycle (most fertile, approaching ovulation), women prefer masculine-looking men

    - men seem to recognize this shift, they see other masculine men as greater threats during this time
    - strippers tend to earn more tip money when they are most fertile
        - male patrons more aware of their heightened fertility or females more sexually motivated?

Attitudes: Making Social Judgments

Attitude: positive or negative evaluation of objects of thought

Components and Dimensions of Attitudes

- may include up to 3 types of components:
    - **cognitive component**: beliefs people hold about object
    - **affective component**: emotional feelings stimulated by object
    - **behavioural component**: predispositions to act in certain ways toward object
- **attitude strength**: strong attitudes resistant to change and durable over time, powerful impact on behaviour
- **attitude accessibility**: how often one thinks about it and how quickly it comes to mind
    - positively correlated with attitude strength
- **attitude ambivalence**: conflicted evaluations that include both positive and negative feelings about an object of thought
    - lower ambivalence, the more predictive of behaviour
- determinants of attitude strength:
    - **importance**: subjective sense of caring and significance that a person attaches to an attitude
    - **vested interest**: exists when an attitude relates to an issue that can affect an individual personal outcomes
    - **more knowledge** and **information** has about object

Attitudes and Behaviour

- attitudes are mediocre predictors of behaviour
- must consider:
    - attitude strength, accessibility and ambivalence into account
    - attitudes are usually measured in a *general*, *global* way, which isn't likely to predict *specific* behaviour
    - *situational constraints* may also affect behaviour

Trying to Change Attitudes: Factors in Persuasion

- **source**: person who sends a communication
    - more persuasive if **credible**: perceived as either **expertise** or **trustworthy**
        - expertise more useful when arguments are ambiguous
        - people tend to receive messages from trusted sources without scrutiny

    - **likeability** increases effectiveness of persuasive source
        - often as **physical attractiveness**
    - respond better to those who are **similar** to us in ways that are relevant to the issue at hand
- **receiver**: person whom the message is sent
    - **forewarning** decreases success because it sets circumstances for receiver develop counterarguments
    - **disconfirmation bias**: arguments that conflict with one's prior attitudes are scrutinized longer and subjected to more sceptical analysis than arguments that are consistent with one's prior beliefs
    - *stronger attitudes* more resistant to change and cause more biased and selective processing of persuasive arguments
    - *prior knowledge of issue* also promotes resistance to change and scrutinize issue-relevant knowledge more carefully
- **message**: information transmitted by the source and the channel is the medium through which the message is sent
    - **one-sided argument**: acknowledges only one side of an issue
    - **two-sided argument**: acknowledges both sides of an issue
        - two-sided more effective overall
    - best to concentrate on strongest arguments
    - weak arguments may raise doubts and hurt as opposed to help
    - repetition of message found to be effective
        - **validity effect**: repeating a statement causes it to be perceived as more valid or true
    - **arousing fear** can be effective, especially when advocating also the preventative measures

Theories of Attitude Change

- **learning theory**:
    - **classical conditioning**:
        - components of attitude can be learn through classical conditioning, just like emotional responses
        - pairing UCS with the NS associated with attitude
        - ex. advertising: pretty women + beer = more favourable attitude toward beer
    - **operant conditioning**:
        - others' agreeing with your attitude will reinforce your attitude and vice versa
    - **observational learning**: copy other peoples' attitudes
- **dissonance theory**: inconsistency of attitudes propels people in the direction of attitude change (Leon Festinger)
    - **cognitive dissonance**: related cognitions are inconsistent (contradictory), which creates an unpleasant state of *tension* whereby people are motivated to reduce dissonance

        - person paid $20 to say boring task was fun experiences *less* dissonance because there's more justification ($$$) to say it was fun
            - no or little attitude change
        - person paid $1 to say boring task was fun experiences *more* dissonance because there's less justification ($$$) to say it was fun
            - resolve dissonance by **effort justification**: changing attitude to justify exerted efforts (they found task fun)
- **self-perception theory**: people *infer* theirs attitudes from looking at their behaviour (Daryl Bem)
    - attitudes follow behaviour
    - person paid $1 resolves dissonance by thinking "$1 isn't enough to get me to say it was fun, the task must've *actually* been fun!"
- **elaboration likelihood model**: 2 basic routes to persuasion (Richard Petty & John Cacioppo)
    - **central route**: taken when people carefully ponder the content and logic of messages
        - leads to more enduring attitude change and more predictive of behaviour
    - **peripheral route**: persuasion depends on nonmessage factors, e.g. attractiveness and credibility of source, or on conditioned emotions

Conformity and Obedience: Yielding to Others

Conformity: occurs when people yield to real or imagined social pressure

- **Asch's conformity study**: participants conformed to vocalized wrong answers of others 37% of the time
    - **group size**: conformity increases until a certain point where it just levels off
    - if one accomplice "broke" unanimity of vocalized wrong answer (even accomplice's answer was wrong too), subject did not conform
- people more likely to conform in ambiguous situations

Obedience: form of compliance that occurs when people follow direct commands usually from someone in a position of authority

- **Milgram's obedience study**: see Featured Study
    - moved study from Yale University setting to a business setting, slight decrease found in obedience (48%)
    - added accomplice teachers:
        - if they obeyed experimenter, slight increase in subject obedience
        - if they defied experimenter, dramatic decrease in subject obedience
- controversy surrounding Milgram's experiment:
    - criticism: lab setting was very contrived and doesn't apply to real world
    - overall: evidence supports generalizability of the results

- ethics: no informed consent, extensive deception (subjects told it was a learning study), post-study stress

Cultural Variations in Conformity and Obedience
- Asch and Milgram experiments show replicable results in other cultures, but mostly to industrialized cultures
- higher levels of conformity found in collectivistic cultures
  - have a more positive view of conformity since they embrace group norms, cooperation and group harmony

Behaviour in Groups: Joining with Others

Group: 2 or more individuals who interact and are interdependent
- traditionally in-person, but telecommunications and Internet are changing that
- most have:
  - *roles*: allocate special responsibilities to members
  - *norms*: dictate suitable behaviour
  - *communication structure*: reflects who talks to whom
  - *power structure*: which members wield most influence

Behaviour Alone and in Groups: The Case of the Bystander Effect
- **bystander effect**: people less likely to provide needed help when they are in groups than when they are alone
  - first described by John Darley and Bibb Latané
  - people help 75% when alone, 53% when with others
  - occurs in ambiguous situations and due to diffusion of responsibility onto other people present
  - e.g. Kitty Genovese was murdered while 38 witnesses failed to come to her aid

Group Productivity and Social Loafing
- group productivity hindered by:
  - reduced efficiency from loss of coordination among workers' efforts
  - **social loafing**: reduction in effort by individuals when they work in groups as compared to when they work by themselves
- social loafing less likely to occur when:
  - individuals in group motivated to achieve
  - for people high on agreeableness or conscientiousness
  - individual's work can be readily identifiable
  - smaller and more cohesive group

Decision Making in Groups
- **risky shift**: groups arrived at riskier decisions than individuals did
- **group polarization**: group discussion strengthens group's dominant point of view and produces a shift toward a more extreme decision in that direction

- reasons for group polarization:
    - exposure to more persuasive arguments from other group members
    - people try to one-up another with a stronger view
- **groupthink**: occurs when members of a cohesive group emphasize concurrence at the expense of critical thinking in arriving at a decision (Irving Janis)
    - produces *ineffective* decision making, e.g. JFK + advisors' bad decision to invade Cuba in the Bay of Pigs
    - tend to overestimate group unanimity under a strong, dominating leader making the decisions
    - members withhold critical judgment
    - group censorship of any dissent
    - promotes incomplete gathering of information and confirmation bias (tendency to seek out only belief-supporting evidence)
    - contributed by **group cohesiveness**: strength of the liking relationships linking group members to each other and to the group itself
    - other factors: group insulation, high stress, illusion of invulnerability, self-appointed mind guards (blocks for thinking differently)
- favourable effects of groups:
    - more accurate
    - higher performance on tests

Social Neuroscience

Social Neuroscience: approach to research and theory in social psychology that integrates models of neuroscience and social psychology to study the mechanisms of social behaviour

- amygdala involved in fear responses
- higher amygdala activity when white participants shown pictures of black faces, especially in those more racially-biased

Featured Study: "I Was Just Following Orders"

Method

- 40 men recruited from local community
- experimenter instructed subject ("teacher") to administer increasing electric shocks each time an accomplice ("learner") answered incorrectly
- wanting to leave study, teachers were prodded with "it is absolutely essential that you continue" and 3 other vocal prods

Results

- 26 out of 40 administered all 30 levels of shock, despite showing considerable distress about harming learner

Discussion

- most psychologists had speculated only 1% would administer all 30 levels of shock
- pressure from authority figure can make decent people to harm others, which can be used to explain Nazi war crimes and other travesties

Comments
- obedience isn't inherently bad or wrong, since social groups sometimes need it to maintain order, e.g. police

Personal Application: Understanding Prejudice

Prejudice Not Equivalent to Discrimination
- **prejudice**: negative attitude held toward members of a group
- **discrimination**: behaving differently, usually unfairly, toward the members of a group

Stereotyping and Subjectivity in Person Perception
- prejudice equated with stereotype, but more recently attributed to a function of cognitive, behavioural and affective factors
- stereotypes can be negative or positive
- both prejudice and stereotypes are activated automatically
- stereotypes are highly resistant to change
    - members who don't fit the stereotype seen as unrepresentative of that group and put into their own unique *subtype* category of that group
- *memory biases* can confirm person's prejudice, creating *illusionary correlations*

Biases in Attribution
- observers tend to attribute women's success to luck, ease of task (external attribution), while men's success to outstanding ability (internal attribution)
- fundamental attribution error and defensive attribution used to explain ethnic peoples' negative situations and misfortunes (internal attributions = their fault)

Forming and Preserving Prejudicial Attitudes
- can come from copying others attitudes (observational learning) and having attitudes reinforced by others (operant conditioning)
- *belief in small numbers*: inordinate large influence of a single person to develop attitude

Explicit and Implicit Prejudice
- implicit prejudice: people unaware they are carrying around prejudice
- explicit prejudice: people consciously aware they are carrying around prejudice

Dividing the World into Ingroups and Outgroups
- **ethnocentrism**: tendency to view one's own group as superior to others as the standard for judging the worth of foreign ways

- people favour ingroup members over outgroup members
- derogating outgroup makes one feel superior
- tend to see ingroup as heterogeneous (diverse) while outgroup is homogeneous (which helps reinforce stereotypes that they're all the same)
- 10% of people overtly display prejudices
- Mindi Foster investigates factors that contribute to the tendency of disadvantaged individuals to take affirmative action to benefit group

Critical Thinking: Whom Can You Trust? Analyzing Credibility and Social Influence

Evaluating Credibility

- someone who does not have financial gain in their vested interest is usually credible
- someone with credentials and appropriate expertise, e.g. special training is usually credible
    - not credible when experts are paid to advocate products
- good methodology promotes credibility

Recognizing Social Influence Strategies

- **foot-in-the-door technique**: getting person to agree to small request to increase the chances that they will agree to a larger request later
- **reciprocity norm**: rule that we should pay back in kind what we receive from others
- **lowball technique**: getting someone to commit to an attractive proposition before its hidden costs are revealed
- **feigned scarcity**: giving impression a product is scarce in supply increases its desire

Chapter 5: Variations in Consciousness

The Nature of Consciousness

Consciousness: awareness of internal and external stimuli
- some degree of consciousness remains during sleep and sometimes under anesthesia
- **stream of consciousness**: consciousness is constantly changing
    - term coined by William James
    - some entering thoughts are the result of intention

Variations in Awareness and Control
- **mind wandering**: people's experience of task-unrelated thoughts
    - people estimated to spend 15%-50% in mind wandering
    - less likely to occur in cognitively-demanding task
    - less aware of external world
    - possible connection to creativity in some contexts
- **controlled processing**: mental processes are voluntary and effortful
- **automatic processing**: mental processes are involuntary and lack effort
- **blink**: judgments are made quickly and effortlessly
    - used by Malcolm Gladwell in book *Blink* (2005)

Consciousness and Brain Activity
- consciousness arises from activity in distributed networks of neural pathways
- variations in consciousness can be measured by **electroencephalograph** (**EEG**): device that monitors electrical activity of brain over time by using electrodes attached to scalp surface
    - summarizes rhythm of cortical activity as line tracings called **brain waves**
    - brain waves vary in **amplitude** (height) and **frequency** (cps: cycles per second)
- cortical activity divided into 4 principal bands primarily associated with different states of consciousness:
    - **beta** (13-24 cps): normal waking thought, alert problem solving
    - **alpha** (8-12 cps): deep relaxing, blank mind, meditation
    - **theta** (4-7 cps): light sleep
    - **delta** (<4 cps): deep sleep
- changes in EEG activity closely related to variations in consciousness
    - recall: correlations don't determine causations
    - mental state and brain waves could be due to third factor (e.g. signals from subcortical structures)

Biological Rhythm and Sleep

Introduction

- initially thought to be too subjective for serious biomedical investigation (Kenton Kroker)
- in the past 3 decades, sleep connected to important processes people engage in everyday (Joseph De Koninck)
- **biological rhythms**: periodic fluctuations in physiological functioning (internal biological clocks
    - connected to planetary rhythms (e.g. night and day, seasons, etc.)
    - found in humans, animals and plants
    - monitor passage of time

The Role of Circadian Rhythms

- **circadian rhythm**: 24-hr biological cycles in humans and other species
    - influential in sleep regulation
- daily cycles also produce rhythmic variations in blood pressure, urine production, hormonal secretions and other physical functions
    - e.g. body temperature: people generally fall asleep as body temperature drops and vice versa
        - optimal temperature varies from person to person
        - ideal temperature important for sleep quality, which supports quality over quantity argument
- study found isolated subjects had longer circadian rhythm (24.2 hours)
- natural light readjusts peoples' biological clocks
    - specific receptors in retina send direct inputs to **suprachiasmatic nucleus** (**SCN**) in hypothalamus
    - SCN sends signals to **pineal gland** to secrete hormone **melatonin** which has a key role in adjusting clocks (Ralph Mistlberger and Mary Harrington)
- research has supported central circadian pacemaker, but Benjamin Rusak suggests more complex and multifaceted structure responsible for mammalian circadian systems
- human circadian rhythm regulated by multiple internal clocks with central pacemaker in SCN

Ignoring Circadian Rhythms

- quality of sleep suffers
- **jet lag**: occurs when flying across time zones, internal clock needs time to adjust to new official time
    - chronic jet lag associated with deficits in cognitive performance
    - each person's clock adjustment time varies, usually 1 day/time zone crossed
    - direction of travel influences speed of adjustment
        - flying west lengthens day is *easier* to adjust to
        - flying east shortens day is *harder* to adjust to
        - sizable impact on performance of sports teams
- **shift workers**:
    - studies show workers get less total sleep and poor-quality of sleep
    - increases accident proneness and affects mental and physical health

    - workers report more stress and lower sense of mastery or control
- Daylight Savings Time in spring shift associated with increased traffic accidents for the week after the switch (Stanley Coren)

Melatonin and Circadian Rhythms
- **melatonin** can reduce effects of jet lag by readjusting clock (inconsistent findings, mainly due to timing of administering melatonin doses)
- **timed exposure to bright light** can realign clocks of shift workers (modest and inconsistent findings)
- can plan rotation of schedules for shift workers to move through progressively *later* starting times so there is longer periods between shift changes

The Sleep and Waking Cycle
- widely misunderstood as a state of physical and mental inactivity
    - sleepers experience quite a bit of physical and mental activity
- sleep laboratories: subjects come to sleep so their sleep can be studied
    - subjects hooked up to EEG, EMG, EOG, heart rate, breathing, pulse rate, body temperature
    - **electromyograph** (**EMG**): records muscular activity and tension
    - **electrooculograph** (**EOG**): records eye movements

Cycles through the Stages of Sleep
- onset of sleep is gradual
- time to fall asleep varies person to person (depends on age, level of boredom, etc.)
- **non-REM** (**NREM**) **sleep**: consists of stages 1 through 4, marked by the absence of rapid eye moments, relatively little dreaming and varied EEG activity
- **stage 1**: brief transitional stage of light sleep (lasts 1-7 minutes)
    - breathing and heart rate slow as muscle tension and body temperature decline
    - theta waves prominent (transition from alpha waves)
    - **hypnic jerks**: brief muscle contractions
- respiration rate, heart rate, muscle tension, body temperature decline through stages 2 to 4
- **stage 2**: mixed EEG activity (lasts 10-23 minutes)
    - **sleep spindles**: brief bursts of higher-frequency brain waves
- **stage 3** and **4** constitute **slow-wave sleep** (**SWS**): high-amplitude, low frequency delta waves become prominent
    typically reach SWS in 30 minutes and stay in SWS for roughly 30 minutes
- cycle reverses itself moving backwards toward lighter stages
- **REM sleep**: **rapid eye movements** (REM) dominant
    - coined by William Dement
    - occurs when sleeper returns to stage 1
        - instead of stage 1, it is now REM sleep
    - EOG used to record lateral movements beneath eyelids (ripples visible)
    - discovered accidentally in Nathaniel Kleitman's lab

        - machine thought to be defective after detecting REM initially
    - "deep" stage of sleep, hard to awake (arousal rate varies person to person)
    - irregular breathing and pulse rate
    - muscle tone is extremely relaxed, sleeper is virtually paralyzed
    - paradox: deep stage of sleep but EEG activity dominated by high-frequency beta waves like when one is awake and alert
        - paradox probably related to association of REM and dreaming
- most dreams reported in REM stage (dreams do occur in non-REM stages)
- Tore Nielsen examined similarities and differences of REM and non-REM dreaming
    - examined whether 1 or 2 dream generators is better in explaining phenomena
- Carlyle Smith examines relations between brain functioning in sleep and memory
    - suggests brain activity during sleep central to consolidation of information acquired during the day
    - suggests different stages of sleep implicated in memory for different types of tasks or information
- different types of sleep may be important for different types of learning
- sleep cycle repeated about **4** times during the night
    - REM periods get progressively longer, peaking at 40-60 min
    - NREM intervals get shorter
    - descents into NREM get *shallower* (less SWS)
- adults spend 15%-20% of sleep in SWS and 20%-25% in REM sleep

Age Trends in Sleep

- newborns sleep 6-8 times in a day
    - spend more time in REM than adults, around 50% in REM sleep
- REM portion declines to 30% during remainder of 1st year
    - continues to decline to 20%
- in adulthood:
    - time in SWS declines dramatically, time spent in stage 1 increases slightly (stronger trend in men)
    - shift towards lighter sleep, which may contribute to more nighttime awakenings in elderly
    - average total sleep declines with advancing age, however a substantial number of elderly experience sleep increases

Culture and Sleep

- **co-sleeping**: practice of children and parents sleeping together
    - the norm looking at the whole world
    - discouraged by urban Western world
- napping practices exist in "siesta cultures" where shops close, activities halt for afternoon 1-2 hour nap
    - mostly found in tropical regions
    - practical: allows people to avoid working during hottest part of day

Neural Bases of Sleep

- rhythm of sleep and waking regulated by subcortical structures deep in brain
- **reticular formation** (found at core of brainstem) important for sleep
- **ascending reticular activating system** (**ARAS**): consists of afferent fibres running through reticular formation that influence physiological arousal
    - cutting these fibres induces sleep (in cats)
    - electrical stimulation causes arousal and alertness
- **pons** and adjacent areas critical for generation of REM sleep
- specific areas in medulla, thalamus, hypothalamus and limbic system have role in controlling sleep and waking
- serotonin and GABA play an important roles in sleep regulation
- norepinephrine, dopamine, acetylcholine and other chemicals influence sleep regulation
- therefore: sleep and walking regulated by *constellation* of interacting brain centres and no single “sleep centre" or “sleep chemical”

Doing Without: Sleep Deprivation

- trend: people cutting down on sleep to squeeze more time into day
- sleep deprivation associated with increased brain sensitivity to negative emotional stimuli
- sleep deprivation associated with increased accident proneness, immune impairment of regulation impairment and metabolic control, irritability, emotional difficulties, cognitive difficulties and psychopathology
- schools having a later start time have found better behaviour, grades and emotional well-being in students
- **partial deprivation** or **sleep restriction**: people receive substantially less sleep than normal over a period of time
    - negative effects most likely when subjects asked to perform long, difficult, or monotonous tasks or when subjects restrict their sleep to under 5 hours for many nights
- study showed sleep-deprived subjects showed impairment on task but they felt their performance was fine
- major disasters blamed on lapses in judgment arising from sleep deprivation, e.g. Chernobyl
- **selective deprivation**: special type of partial sleep deprivation
- deprivation of REM sleep:
    - no effect on daytime functioning
    - subject spontaneously shifts into REM more frequently during sleep
    - **rebound effect**: more REM in future sleep to make up for REM loss
- deprivation of SWS sleep:
    - subject spontaneously shifts into SWS more frequently during sleep
    - **rebound effect**: more SWS in future sleep to make up for SWS loss
- REM and SWS important for **memory consolidation**: firming up learning and promoting different types of memory
    - time spent in REM and SWS correlate with increments in learning

    - theoretical meanings of findings still debated

Problems in the Night: Sleep Disorders

1) Insomnia: chronic problems in getting adequate sleep
- basic patterns:
    - difficulty in falling asleep initially (young people)
    - difficulty in remaining asleep (middle-aged, elderly)
    - persistent early-morning wakening (middle-aged, elderly)
- associated with daytime fatigue, impaired functioning, depression, elevated risk for accidents, reduced productivity, work absences and increased health problems
- prevalence:
    - 34%-35% of adults report insomnia (about half suffer from severe or frequent insomnia)
    - problem: people can occasionally experience sleep difficulties
    - increases with age
    - 50% more prevalent in women than men
    - **pseudo-insomnia** or **sleep state misperception**: people think they get inadequate sleep
        - many people underestimate how much sleep they get
- causes:
    - excessive anxiety or tension
    - side effect of emotional problems, such as depression and stress
    - pack pain, ulcers, asthma can lead to insomnia
    - use of cocaine and amphetamines may lead to problems in sleeping
- treatment:
    - **benzodiazepine medications** (sedative) exert effects at GABA synapses
    - sleep experts argue overuse of sleep drugs, which has led to significant decline of its usage
    - 5%-15% of adults use sleep medication regularly
    - sleeping pills are a bad long-term solution for insomnia
        - carryover effects make people drowsy and sluggish the next day and lead to memory decrements
        - can cause overdose in combination with alcohol or opiate drugs
        - increased dosages creates more sluggishness (vicious circle of dependence)
        - most sedatives decrease portion of time in SWS and older drugs reduced time in REM
            - *zolpidem* (trade name Ambien): new drug reduces these problems
    - **melatonin**: mild sedative with some value in insomnia treatment
    - behavioural treatments have shown to provide more long-lasting benefits than drugs
    - **cognitive behavioural therapy** (CBT) found to have real benefits for insomniacs

        - emphasize recognizing and changing negative thoughts and maladaptive beliefs

2) Narcolepsy: disease marked by sudden and irresistible onsets of sleep when awake
- usually sleep for 10-20 minutes
- people appear to be genetically predisposed to disease
- prevalence: 0.05% of population
- potentially dangerous when driving
- stimulant drugs treat condition with modest success

3) Sleep Apnea: frequent, reflexive gasping for air that awakens a person or disrupts sleep
- person wakes up hundreds of times of times at night
- person literally stops breathing for minimum of 10 seconds
- accompanied by loud snoring
- found in 2% of women, 4% of men between 30–60
- can be treated surgically or through drug therapy

4) Nightmares: anxiety-arousing dreams that lead to awakening, usually from REM sleep
- nightmares associated with measures of well-being (high neuroticism, trait anxiety, state anxiety and depression)
- 10% of adults have occasional nightmares
- mainly a problem with children
- in children, persistent nightmares shows emotional disturbance
    - counselling is helpful, otherwise nightmares go away

5) Night Terrors (**sleep terrors**): abrupt awakenings from NREM sleep accompanied by intense autonomic arousal and feelings of panic
- usually occur during stage 4 of the sleep cycle
- victims usually let out a piercing cry, bolt upright and stare into space
    - do not recall a coherent dream, but recall a frightening image
- can occur in adults, but mostly in children 3–8
    - often temporary, not a result of emotional disturbance

6) Somnambulism (**sleepwalking**): person arises and wanders about while remaining asleep
- tends to occur in the first 2 hours of sleep, when in SWS
- last from 15 seconds to 30 minutes
- sleepwalker may awaken during episode or return to bed with no recollection next day
- cause unknown, but has genetic predisposition
- sleepwalkers are prone to accidents
- it is safe to wake up sleepwalkers
- can be dangerous, like the cases of Peter Polansky and Ken Parks

7) **Somniloquy**: talking during sleep

World of Dreams

Introduction

- many events inspired by dreams (e.g. Ghandi's strategy of non-violent protest)
    - dreams have an impact on society and culture
- conventional view: dreams are mental experiences during REM sleep
    - storylike quality
    - vivid visual imagery (usually bizarre)
    - experienced perceptually as real
- new ideas:
    - NREM stages can still have dreams, though less vivid, visual and storylike
    - people are more aware they are dreaming than previously thought

The Contents of Dreams

- most dreams are mundane (Calvin Hall)
- similar themes found in dreams
    - e.g. in first year students: being chased but not injured, sexual experiences, etc.
- significant differences between males and females
    - positive themes dominant in males
    - negative themes dominant in females (e.g. phobias and anxieties)
- differences in location of the subject
    - McGill students had theme of "being half awake and paralyzed"
    - University of Alberta students had theme of "finding money"
- study showed consistency in dreams concerning age, region and gender
- dreams of children different from adults
    - e.g. dream recall rate is 20%-30% until age 9-11, adult level = 80%
- children under 5 have bland dreams with no storyline
- children 5-8 have dream narratives, not well-developed and lack adult themes of aggression and misfortune
- dreams are related to cognitive ability
    - gradual development of cognitive skills lead to more detailed dreams

Links between Dreams and Waking Life

- dreams affected by what's going on in your life
    - research shows not all stressors are equally influential of dreams
    - e.g. imminent surgery is more powerful than an upcoming exam
- **day residue**: content of waking life that spilled into dreams (Freud)
- external stimuli experienced can influence dreams simultaneously
    - e.g. water sprayed on hand, 42% of subjects reported water incorporated water into their dream
    - e.g. sound of alarm clock led to loud engine in dream
- **lucid dream**: dreamer aware that he/she is dreaming

    - dreamer can exert some control over actions
    - lucid dreaming can be useful in nightmare treatment
        - therapists must be able to control the onset of the lucid dream

Culture and Dreams

- Western societies view dreams as imaginary, therefore insignificant and meaningless
- many non-Western cultures view dreams as important sources of information
    - e.g. Australian aborigines view dreams as focal point of traditional aboriginal existence and change their lifestyle accordingly to it
- some themes are universal to cultures (e.g. being chased, having sex)
- contents of dream vary culture to culture due to the different environments people live in
- cultures will have a different set of views of judging dreams

Theories of Dreaming

- purpose still a mystery
- theory 1: Freud proposed purpose of dreams was **wish fulfillment**
    - not always apparent because dreams can be disguised
    - little evidence to support
- theory 2: Rosalind Cartwright proposes dreams are opportunity to work through everyday problems
    - allows one to engage in creative thoughts about problems because dreams have no restrictions
    - e.g. women going through divorce dream about divorce-related issues
    - critics argue dreams do not always come up with solutions
    - support comes from recent research showing sleep can enhance learning
- theory 3: J. Allan Hobson and Robert McCarley dreams are by-product of bursts of activity emanating from subcortical areas in the brain
    - **activation-synthesis model** proposes dreams are side effect of neural activation that produces “wide awake” beta brain waves during REM sleep
    - firing neurons in lower brain centres send random signals to cortex
    - cortex synthesizes a dream to make sense of signals
    - does not assume dreams are meaningless
    - dreams are important as they can be under adverse working conditions of the brain in REM sleep
    - no emotional determinants like in Freud or Cartwright
    - criticism: model can’t explain NREM dreaming

Hypnosis: Altered Consciousness or Role Playing?

History

- Franz Anton Mesmer claimed to be able to cure people with illnesses using “laying on of hands” by harnessing animal magnetism
    - by our standards, really was using power of suggestion

    - was eventually run out of town
    - spawned followers of mesmerism
    - survives in the word mesmerized: caught under a spell
- James Braid popularized term **hypnotism** (borrowed from Greek for sleep)
    - thought hypnotism could be used for anesthesia for surgery
    - but when chemical anesthetics discovered, hypnotism tossed aside
- dual existence of hypnotism: used as a clinical tool and as entertainment

Hypnotic Induction and Susceptibility

- **hypnosis**: systematic procedure that typically produces a heightened state of suggestibility
    - also passive relaxation, narrowed attention, enhanced fantasy
- **hypnotic induction**: hypnosis induced by a swinging pendulum or hypnotist talking to the subject (e.g. tell them to relax, etc.).
- Ernest and Josephine Hilgard did research on hypnotic susceptibility
    - not everyone can be hypnotized (10-20% of population doesn't respond well)
    - 10-15% of population responds very well
    - susceptibility measured by *Stanford Hypnotic Susceptibility Scale* (SHSS) or it's derivative the *Harvard Group Scale of Hypnotic Susceptibility*
- high hypnotizability depends on:
    - **absorption**: capacity to block peripheral awareness and narrow the focus of one's attention
    - **dissociation**: ability to separate aspects of perception, memory or identity
    - **suggestibility**: tendency to accept directions and information relatively uncritically
- research shows hypnotic-susceptible individuals are just as susceptible without hypnosis
    - hypnotic susceptibility is not unique to hypnosis and is part of broader trait of imaginative susceptibility

Hypnotic Phenomena

1) *Effect 1*: Anesthesia
- patients can withstand pain during treatment after being hypnotized (drugs more reliable)
- effective anesthetic in treatment of acute and chronic pain

2) Effect 2: Sensory distortions and hallucinations
- hearing or seeing stimuli not present or misinterpreting actual stimuli
- subjects can be hypnotized to react to stimuli in different manners
    - e.g. tasting sweet when it's really sour

3) *Effect 3*: Disinhibition
- reduce inhibitions that would normally prevent subjects from acting in certain ways that is socially undesirable

    - e.g. subject induced to throw nitric acid at researcher's face
- may occur because people feel they are not accountable for their actions while hypnotized

4) *Effect 4*: Posthypnotic suggestions and amnesia
- suggestions made during hypnosis may influence a subject's later behaviour
    - most common: posthypnotic amnesia, however when pressed, subjects acknowledge they have not forgotten

Theories of Hypnosis

1) Hypnosis as Role Playing
- Theodore Barber and Nicholas Spanos proposed hypnosis produces normal mental state where people act out the role of a hypnotized subject (subject's expectations produces hypnotic effects)
- evidence:
    1) many amazing effects of hypnosis have been duplicated by nonhypnotized subjects or have been shown to be exaggerated
        - e.g. body acting as human plank can be done not under hypnosis
        - hypnotized patient's memory is not enhanced, studies show subjects make more errors in memory than normally
        - therefore: no special state of consciousness explains hypnotic feats
    2) demonstrations are often the hypnotized subject acting out a role
        - age-regressed subjects usually inaccurate in their account (asked parents about the true account from when they were young)
        - subjects recall their distant past in a fancy manner, rather than factual
        - therefore: situational factors lead some subjects to act out a certain role in a highly cooperative manner

2) Hypnosis as an Altered State of Consciousness
- argue even the most cooperative patient is unlikely to do surgery without anesthetic drug, just to live up to a role?
- some studies showed that subjects continued to act hypnotized when they thought they were alone, why not drop the act if it is role play?
- recent brain-imaging studies show hypnotized subjects experience changes in brain activity consistent with hallucinations or pain suppression
- Ernest Hilgard suggests hypnosis creates **dissociation**: splitting off of mental processes into 2 separate, simultaneous streams of awareness
    - hypnosis splits consciousness into one stream in communication with hypnotist and external world and one stream is a difficult-to-detect "hidden observer"
    - therefore: pain is not felt because pain is not registered to communication with external world stream
- divided consciousness is normal

    - e.g. highway hypnosis: consciousness divided between driving and personal thoughts, as well there is amnesia because driving stream cannot be recalled

Meditation: Pure Consciousness or Relaxation?

Meditation: family of practices that train attention to heighten awareness and bring mental processes under grater voluntary control

- most widely practices in North America: yoga, Zen, transcendental meditation (TM)
    - religious roots, but practiced today not by only religious people
- TM:
    - person sits in comfortable position with eyes closed
    - silently focuses attention on a mantra: assigned Sanskrit word
    - twice a day, 20 minutes long
    - believe it's an altered state "pure consciousness"

Physiological Correlates

- alpha and theta waves more dominant in meditative state
- heart rate, skin conductance, respiration rate, oxygen consumption, carbon dioxide elimination drop
    - body arousal suppression is beneficial
- increased prefrontal cortex activity found, which reflects active process of meditation (e.g. willful and intentional concentration)

Long-Term Benefits

- research shows it reduces stress, improves mental health, reduces anxiety and drug use, as well as beneficial effects on blood pressure, self-esteem, mood, sense of control, happiness, physical health and well-being
    - another report showed increased creativity and intelligence in high school students
- regular meditation associated with lower levels of some stress hormones and enhanced immune response
- criticism: simple relaxation may be cause
    - methodological problems in many of their studies

Altering Consciousness with Drugs

Introduction

- **drug abuse** or **recreational drug use**: drugs for nonmedical usage
- illicit drug use increasing since 60s

Principal Abused Drugs and Their Effects

- **psychoactive drugs**: chemical substances that modify mental, emotional, or behavioural functioning
- people generally prefer drugs that elevate mood or are pleasurable
- Canadian Addiction Survey (CAS) released by Health Canada and Canadian Centre of Substance Abuse (CCSA)
    - shows prevalence and use of various drugs
    - drug use increased over past decade
        - e.g. cannabis use doubled since 1994
    - 30% of those over 15 who drink create personal harm

1) Narcotics (**opiates**): drugs derived from opium that can relieve pain
Principal medical use: pain relief
Main drugs: heroin, morphine
- less potent opiates: codeine, Demerol, methadone

Method of ingestion: injected, smoked, oral
Effects: sense of euphoria or well-being, relaxation, anxiety reduction, pain relief
Side effects: lethargy, drowsiness, nausea, impaired mental and motor functioning, constipation

2) Sedatives: sleep-inducing drugs that tend to decrease central nervous system (CNS) activation and behavioural activity
- "downers" consume more than prescribed dosage
- principal medical use: sleeping pills, anticonvulsant

Main drugs: barbiturates (e.g. Seconal), nonbarbiturates (e.g. Quaalude)
Method of ingestion: injected, oral
Effects: euphoria similar to that of drinking large amounts of alcohol like relaxed, pleasant state of intoxication, loosened ambitions
Side effects: lethargy, drowsiness, impaired mental and coordination, emotional swings, dejection

3) Stimulants: drugs that tend to increase CNS activation and behavioural activity
- range from mild (nicotine, caffeine) to stronger (cocaine)
- principal medical use: hyperactivity and narcolepsy treatment, local anesthetic (cocaine)

Main drugs: amphetamines, cocaine
- **cocaine** from coca shrub → causes briefer high than amphetamines
- **amphetamines** synthesized in pharmaceutical labs
- both cause a different euphoria than sedatives and narcotics
- **crack**: by-product of freebasing (chemical treatment of extracting pure cocaine)
    - consists of chips of pure cocaine that are smoked
- **crank**: amphetamines as crystalline powder (snorted or injected)
- **ice**: smokable form of methamphetamine

Method of ingestion: oral, sniffed, injected, freebased, smoked
Effects: elation, excitement, increased energy and alertness
Side effects: increased blood pressure and heart rate, increased urination, talkativeness, restlessness, irritability, aggressiveness, etc.

4) Hallucinogens: diverse group of drugs that have powerful effects on mental and emotional functioning, marked mostly by distortions in sensory and perceptual experience

- lead to euphoria, sometimes "mystical" feeling
- can cause nightmarish feelings of anxiety and paranoia ("bad trip")

Principal medical use: none
Main drugs: LSD, Mescaline, Psilocybin (all vary in potency)
Method of ingestion: oral
Effects: increased sensory awareness, euphoria, altered perceptions, hallucinations, etc.
Side effects: dilated pupils, nausea, panic reaction, anxiety, jumbled thought process, etc.

5) Cannabis: hemp plant from which marijuana, hashish, THC are derived

- marijuana is mixture of dried leaves, flowers, stems, seeds from hemp plant
- hashish comes from plant's resin
- **THC**: active ingredient in cannabis

Principal medical use: glaucoma treatment, chemotherapy-induced nausea and vomiting, etc.
Method of ingestion: smoked, oral
Effects: mild euphoria, relaxation, altered perceptions, enhanced awareness
Side effects: reduced short-term memory, sluggish motor and mental functioning, etc.

6) Alcohol: variety of beverages containing ethyl alcohol

- beers, wines, distilled spirits
- varies from 4%-40%, plus more in hard liquor
- most widely used recreational drug

Principal medical use: none
Effects: mild euphoria, relaxation, anxiety reduction, reduced inhibitions
Side effects: severely impaired coordination, increased urination, depression, hangover, etc.

7) MDMA ("**ecstasy**"): compound drug related to both amphetamines and hallucinogens (especially mescaline)

- widely used since 1990s in raves and dance clubs, became "ecstasy"

Effects: short-lived high, euphoric feeling, alert, energetic, etc.
Side effects: increased blood pressure, muscle tension, sweating, blurred vision, insomnia, transient anxiety

Factors Influencing Drug Effects

- drug effects vary person to person
    - depends on age, mood, motivation, personality, previous experience, body, weight, physiology
    - as well as dose and potency, method of ingestion, setting
    - therefore: **multifactorial causation**, **subjectivity of experience**

- drug effect changes as person develops **tolerance**: progressive decrease in a person's responsiveness to a drug
    - leads to person consuming larger amounts to attain desired effect
    - tolerance depends on drug (alcohol → slow, heroin → fast)

Mechanisms of Drug Action

- psychoactive drugs primarily work by altering neurotransmitter activity in brain
- amphetamines mainly increase activity and block reuptake of monoamines: dopamine (DA) and norepinephrine (NE)
- cocaine shares similar actions: blocks reuptake at DA, NE and serotonin synapses
- elevated activity of **dopamine circuits** crucial to pleasurable feeling
- narcotic drugs bind to specific subtypes of endorphin receptors
    - indirectly elevate activity of DA pathways controlling reward
- 2 types of **cannabinoid receptors**: receptors for THC
    - **endocannabinoids** (similar to THC) found to activate these receptors too
    - THC "hijacks" the brain's cannabinoid receptors
- virtually all drugs activity in **mesolimbic dopamine pathway**: runs from midbrain, though **nucleus accumbens** and on to prefrontal cortex
    - characterized as **reward pathway**: principal source of reinforcing effects of most abused drugs

Drug Dependence

- **physical dependence**: person must continue to take a drug to avoid withdrawal illness (occurs with narcotics, sedatives, alcohol, stimulants)
    - withdrawal illness specific to drug
    - e.g. withdrawal from heroin, barbiturates or alcohol produces fever, chills, tremors, convulsions, etc.
    - e.g. withdrawal from stimulants produces fatigue, apathy, depression, etc.
- some withdrawal symptoms are conditioned from drugs the past
    - **classical conditioning**: type of learning where stimulus has acquired capacity to evoke a response that was originally not evoked by it
    - e.g. injecting drug in certain room (room paired with drug) will create future withdrawal symptoms on revisits to the room
    - situational specificity of tolerance: situational cues contribute to tolerance
- **psychological dependence**: person must continue to take a drug to satisfy intense mental and emotional craving for it
    - more subtle than physical dependence
    - e.g. cocaine creates overwhelming cravings for continued use
    - rare for hallucinogens

Drugs and Health

- humans (like the rats in an experiment) don't deter from continuing drug abuse after serious aversive effects
- recreational drug use affects health in:
    - triggering overdose

- physiological damage (direct effects)
- health-impairing behaviour (indirect effects)

1) Overdose
- drugs that are CNS depressants (sedatives, narcotics, alcohol) carry greatest risk
- usually include heart attack, stroke, or cortical seizure
- stimulant overdose originally infrequent, but cocaine overdoses increasing

2) Direct Effects
- drugs cause damage to tissue
- e.g. cocaine causes damage to nasal membranes, also increases risk for heart attack and stroke
- e.g. crack smoking associated with respiratory problems
- e.g. long-term excessive alcohol leads to wide range of serious health issues

3) Indirect Effects
- negative effect of drugs on physical health are indirect results of the drugs' impact on attitudes, intentions, behaviour
- e.g. stimulants cause people to not eat or sleep properly
- sedatives cause increase risk of accidental injuries
- research shows intoxicated students showed increased favour of unprotected sex
- physical abuse also associated with alcohol (not all at risk of course)
- alcohol contributes roughly to about 40% of all auto fatalities
- intravenous drug users can contract infectious diseases from unsterilized needles
  - e.g. acquired immune deficiency syndrome (AIDS)
- alcohol causes the most diverse negative effects, ironic that it is only legal recreational drug

Controversies Concerning Marijuana
- some evidence suggests heavy use of marijuana probably increases risk for respiratory and pulmonary disease (like lung cancer)
- marijuana's effect on immune system is too small to have any practical importance
- marijuana produces small, reversible decline in sperm account in males and temporary effects on hormone levels
- marijuana associated with impairments in attention and memory, but deficits found to vanish after a month or so

New Findings Regarding Ecstasy
- psychological dependence is a problem
- users typically consume ecstasy with contaminants, so it's hard to study
- chronic, heavy use associated with sleep disorders, depression, elevated anxiety, hostility, subtle effects on cognitive functioning
- ecstasy may be more harmful than previously thought

- more research required

Featured Study: Our Wandering Thoughts

Method

- researchers assessed mind wandering by attaching digital beepers to participants, which beeped at random times during the day prompting participants to report whether they were experiencing mind wandering

Results

- mind wandering occurred 33% of the time and in higher frequency in certain contexts (e.g. schoolwork as opposed to leisure)
- in task-challenging contexts, participants low in cognitive ability (WMC) engaged in more mind wandering
    - researchers speculate they have less executive control to sustain attention

Personal Application: Addressing Practical Questions about Sleep and Dreams

Answers to Common Questions about Sleep

- adults need an average of 7.5 hours of sleep (sleep varies person to person)
- naps are usually inefficient but have some beneficial effects like increasing alertness, reducing sleepiness
    - negative effect: may disrupt nighttime sleep
- stimulants make it difficult to sleep
- most depressants that facilitate sleep actually disrupt normal sleep cycle
- yawning associated with boredom and sleepiness (association with sleep unknown)
- snoring frequent in men more than women and in overweight people
- dream recall is best after awakening during or shortly after the dream
- exercise, avoiding stimulants, setting regular bedtime schedules and selecting favourable sleep environments can be used to avoid sleep problems
- everyone dreams, but not everyone remembers them
- forgetting dreams is natural and not due to repression
- dreams are not instantaneous
- Freudian view on dream interpretation:
    - **manifest content**: plot of a dream on surface level
    - **latent content**: hidden or disguised meaning of the events in the plot
    - **lucid dreams**: person can think clearly about circumstances of waking life and the fact that they are dreaming, yet they remain asleep in the midst of a vivid dream

Critical Thinking: Is Alcoholism a Disease? The Power of Definitions

Power to Make Definitions and Circular Reasoning

- alcoholism has been defined under a variety of categories
- disease?:
    - alcoholics should be viewed with sympathy, should receive treatment under medical insurance and have it delivered by health care professionals
- personal failure or moral weakness?:
    - not viewed with sympathy
- **definition of disease**: defined as an impairment in the normal functioning of an organism that alters its vital functions (defined by medical community)
    - alcoholism fits definition of disease (however, there is still debate)
- label of alcoholism does not give causation, which is the **nominal fallacy**: naming something with explaining

Chapter 3: The Biological Bases of Behaviour

Communication in the Nervous System

Nervous Tissue: The Basic Hardware

- **neurons**: individual cells in the nervous system that receive, integrate and transmit information
    - most communicate with other neurons, a minority receive signals from outside world or carry information that move muscles
- **soma** (**cell body**): contains cell nucleus and common cell chemical machinery
- **dendrites**: specialized parts of a neuron that receive information from other neurons
    - many dendrites together make a dendritic tree
- **axon**: long, thin fibre that transmits signals away from soma to other neurons or muscles or glands
    - can be quite long, sometimes over 1 metre
    - wrapped in **myelin sheath**: insulating material that speeds transmission of a signal through the axon
        - degeneration of myelin sheath results in multiple sclerosis [easy to remember: notice initials MS in both terms]
- **terminal buttons** (bouton): small knobs at the end of the axon that secrete neurotransmitters
    - neurotransmitters are used to activate neighbouring neurons
- **synapse**: junction where information is transmitted from one neuron to another
- summary: information is received at dendrites, goes through soma and along axon, and is transmitted to dendrites of another neuron via the synapse (by means of neurotransmitters released at the terminal button)
- diversity of neurons: ex. some neurons have multiple or no axons

Glia: cells found throughout the nervous system that provide various types of support for neurons

- much smaller than neurons, but outnumber them 10:1
- supply nourishment to neurons, remove neurons' waste, provide insulation around axons, orchestrate development of nervous system in human embryo
    - myelin sheaths derived from special types of glial cells
- new research suggests that glial cells play a role in sending and receiving chemical signals and may be implicated in diseases like amyotrophic lateral sclerosis (ALS) and Parkinson's disease
- possible role in chronic pain
- impaired-glial communication may play a role in schizophrenia
- bulk of neural communication still handled by neurons

Neural Impulse

- Alan Hodgkin and Andrew Huxley did experiments with axons from squids (because they're larger than human axons = easier to study)
    - inserted microelectrodes into the squid's axons

Neuron at Rest: A Tiny Battery

- neuron has a semipermeable membrane, since sodium, potassium, chloride ions are flowing back and forth (at different flow rates)
    - difference of flow rates leads to a higher concentration of negative inside cell
- **resting potential** of a neuron (stable) is negative charge when cell is inactive
    - -70 millivolts

Action Potential: very brief shift in neuron's electrical charge that travels along an axon

- stimulation of neuron allows sodium ions to flow in (the inside becomes less negatively charged)
    - enough sodium let in results in an action potential
- during the action potential, potassium gates open and potassium ions flow out
- after an action potential is fired, the ion channels close and the neuron gradually goes back to its resting state
- **absolute refractory period**: minimum length of time after an action potential for another action potential to start
- **relative refractory period**: where neuron can fire, but threshold energy required is greater
    - longer time-wise than absolute refractory period

All-or-None Law

- all action potentials are the same sized
- a neuron either fires an action potential or not, there's no in between
- neurons still can convey information on strength of stimulus
    - stronger stimulus will create a faster rate for firing of action potential (and vice versa)
- thicker axons transmit neural impulses faster than thinner axons

Sending Signals: Chemicals as Couriers

- neurons are separated by a **synaptic cleft**: gap between terminal button of one neuron and cell membrane of another neuron
- **presynaptic neuron** sends signal and a **postsynaptic neuron** receives signal
- action potential triggers release of **neurotransmitters**: chemicals that transmit information from one neuron to another neuron
    - neurotransmitters stored in **synaptic vesicles**
- the vesicles fuse with presynaptic neuron's cell membrane, whereby neurotransmitters spill into synaptic cleft
- neurotransmitters diffuse across synaptic cleft to the postsynaptic neuron's cell membrane
    - may bind with special molecules at various receptor sites on membrane that are 'tuned' to recognize and respond to specific neurotransmitters

Receiving Signals: Postsynaptic Potentials

- when a neurotransmitter and receptor molecules combine, this causes a **postsynaptic potential** (**PSP**): voltage change at a receptor site on a postsynaptic cell membrane
- PSPs are graded: they vary in size and increase or decrease probability of a neural impulse in the postsynaptic neuron in proportion to the amount of voltage change
- 2 types of messages: excitatory and inhibitory PSP
    - **excitatory PSP**: positive voltage shift that increases the likelihood that the postsynaptic neuron will fire action potentials
    - **inhibitory PSP**: negative voltage shift that decreases the likelihood that the postsynaptic neuron will fire action potentials
- direction of PSP depends on which receptor site is activated by neurotransmitters
    - basically: some receptors activate excitatory PSP, some activate inhibitory PSP
- after finishing their job, neurotransmitters drift away from receptor sites or inactivated by enzymes
    - most neurotransmitters are reabsorbed by presynaptic neuron though the process of **reuptake**: neurotransmitters are sponged up from the synaptic cleft by presynaptic membrane
        - basically: sponging up the neurotransmitter decreases neurotransmitter activity in the synapse
        - [some types of antidepressants block reuptake of some neurotransmitters in order to prolong their effects on the postsynaptic neuron]

Integrating Signals: Neural Networks

- neuron balances inhibitory and excitatory influences, if excitatory PSPs add up to enough then the electrical current builds up until threshold energy is achieved and action potentials fire
- millions of neurons must fire in unison to produce the most trifling thought
- perception, thought, actions depend on patterns of neural activity
- neurons are part of an interconnected network
    - formed from processes of elimination of old synapses than the creation of new synapses
    - **synaptic pruning**: gradual elimination of less active neurons (begins after age 1)
- Donald Hebb:
    - neurons don't act alone, they are in complex networks or cell assemblies
    - *Hebbian Learning Rule* specifies how neural linkages work
        - if neuron A successfully excites neuron B, then there is change in that synapse = that process is made more effective by metabolic changes or growth [sort of like operant conditioning]
            - **this is learning**

Neurotransmitters and Behaviour

- 9 classic transmitters, 40 additional, handful of "novel" transmitters

    - scientists continue to re-evaluate criteria for what qualifies as a neurotransmitter
- each neurotransmitter binds to a certain receptor site on neurons (precise communication)
- **agonist**: chemical that mimics the action of a neurotransmitter
- **antagonist**: chemical that opposes the action of a neurotransmitter (blocks site)

1) Acetylcholine (**ACh**)
- only neurotransmitter found between motor and voluntary muscles
- activates motor neurons controlling skeletal muscles, contributes to attention, arousal, perhaps memory
- associated with Alzheimer's disease
- agonist: *nicotine* (from tobacco)
- antagonist: *cucare*, has paralysing effect

2) Monoamines
- **dopamine** (**DA**)
    - controls voluntary movement, pleasurable emotions
    - decreased levels associated with Parkinson's disease (reduced control over voluntary movement)
    - overactivity at DA synapses associated with schizophrenia (irrational thought, hallucinations, poor contact with reality, etc.)
    - cocaine and amphetamines elevate activity of DA synapses
- **norepinephrine** (**NE**)
    - contributes to modulation of mood and arousal
- **serotonin** (**5-HT**)
    - involved in regulation of sleep and wakefulness, eating, aggression
    - abnormal levels may contribute to depression, eating disorders and obsessive-compulsive disorder
    - anti-depressants affect serotonin circuits

3) Gamma-aminobutyric acid (**GABA**)
- widely distributed inhibitory transmitter (glycine does this as well)
- valium and similar antianxiety drugs work at GABA synapses
- suggested it plays a role in regulating anxiety and seizures
- found in 40% of all synapses

4) Glutamate
- always has excitatory effects
- contributes to learning and memory
- a subset of glutamate circuits involved in *long-term potentiation* (LTP): involves durable increases in excitability at synapses
    - LTP is involved in memory
- recently implicated in schizophrenia

5) Endorphins: internally produced chemicals that resemble opiates in structure and effects

- produce pain relief and perhaps pleasurable emotions
- *morphine* works by binding to specialized receptors of the brain

Organization of Nervous System

Peripheral Nervous System (**PNS**): made up of all those nerves that lie outside of the brain and spinal cord

- contains somatic and autonomic nervous systems
- **nerves**: bundles of neuron fibres (axons) that are routed together in the PNS
- **somatic nervous system**: made up of nerves that connect to voluntary skeletal muscles and to sensory receptors (skin, muscles, etc.)
    - **afferent nerve fibres**: axons that carry information inward to CNS from body's periphery
    - **efferent nerve fibres**: axons that carry information outward from CNS to body's periphery
    - somatic nerves are "two way streets" (afferent and efferent lanes)
- **autonomic nervous system** (**ANS**): made up of nerves that connect to the heart, blood vessels, smooth muscles, and glands
    - controls automatic, involuntary, visceral functions (heart rate, digestion, perspiration, etc.)
    - autonomic arousal: increased heart rate, goosebumps, etc. when afraid
    - **fight or flight response**: organisms can either respond to flight by attacking or fleeing (Walter Canon)
    - Hans Selye suggests prolonged autonomic arousal leads to physical disease
    - **sympathetic division**: branch of ANS that mobilizes body's resources for emergencies
        - e.g. increase blood pressure, increase breathing rate, slowing of digestive system
        - hormones released from adrenal gland readies the body for exertion
    - **parasympathetic division**: branch of ANS that generally conserves bodily resources
        - e.g. slow heart rate, reduce blood pressure, increase digestive processes
        - processes that allow body to store and save energy

Central Nervous System (**CNS**): consists of brain and spinal cord

- protected by sheaths called the *meninges*
    - meningitis: inflammation of meninges
- **cerebrospinal fluid** (**CSF**): nourishes brain, provides protective cushion
    - 4 hollow ventricles in brain where CSF flow
- **spinal cord**: extension of brain, from base of brain to below waist

    - connects brain to rest of body through PNS
    - enclosed by meninges and bathed in CSF
    - transmits signals from the brain to motor neurons that move the body's muscles
    - paralysis associated with spinal cord damage
- **brain**:
    - weighs about 1.5 kg
    - contains billions of interacting cells that integrate information from inside and outside the body, coordinate body's actions, enable humans to think, talk, plan, dream, etc.

Looking Inside the Brain: Research Methods

Introduction

- mapping brain structure is easy, mapping brain function is hard
- neuroscientists conduct research on the brain
    - neuroscientists must collaborate with different disciplines, ex. anatomy, biology, psychiatry, etc.
    - rely on electrical readings, lesioning, electrical stimulation, brain-imaging techniques

Electrical Recordings

- **electroencephalograph** (**EEG**): device that monitors brain's electrical activity over time by means of recording electrodes attached to surface of scalp
    - created by German psychiatrist Hans Berger
    - EEG recordings translated into line tracings called *brain waves*
    - different brain patterns associated with different mental activity
    - used to diagnose brain damage and neurological disorders
    - used in research of behaviour (e.g. correlations between anxiety and brain pattern)

Lesioning: destroying a piece of brain

- typically done with electrodes inserted to specific brain structures and disabling it through high-frequency electric current
- stereotaxic instrument used to implant electrodes at precise locations
- animals are anestheticized
- Brenda Milner studied H.M who suffered from epilepsy as a child, attributed to childhood biking accident
    - as treatment, H.M had medial temporal lobe removed, as well as substantial portions of hippocampus and amygdala
        - started suffering from anterograde amnesia: could not form new long-term memory (remembers events before surgery)
    - had normal short-term memory (maintain unrehearsed information for about 20 sec)

    - Milner's research established role of temporal lobes in memory and existence of multiple memory systems

Electrical Stimulation of Brain (**ESB**): sending weak electric current into brain structure to stimulate it
- weakness: current sent through electrodes do not duplicate normal signals in the brain
- stereotaxic techniques used to implant deep electrodes
- primarily used on animals
- used in humans in brain surgery (avoid critical areas, everyone is unique)
- Wilder Penfield, a gifted neurosurgeon, mapped out many functions of the brain

Transcranial Magnetic Stimulation (**TMS**): new technique that permits scientists to temporarily enhance or depress activity in a specific area of the brain
- coil mounted on a small paddle is held over a specific area of a subject's head, whereby the coil generates a magnetic field
- noninvasive procedure
- been used to investigate brain function by suppressing activity in different areas of the brain and seeing effect on performance
- disadvantage: can't reach deeper areas of the brain

Brain-Imaging Procedures
- **computerized tomography** (**CT**): computer enhanced X-ray of brain structure
    - least expensive
    - image slices of brain are combined to create a full 3-D picture
- **positron emission tomography** (**PET**): maps brain activity
    - radioactively tagged chemicals introduced to brain that can be seen with X-ray
    - scans can provide map of brain where activity is present by having patient perform a certain activity
    - scientists can pinpoint areas of brain associated with specific mental processes
    - can be used to study activity of neurotransmitters
- **magnetic resonance imaging** (**MRI**): uses magnetic fields, radio waves, computerized enhancements to map out brain structure (higher resolution than CT scans)
- **functional magnetic resonance imaging** (**fMRI**): monitors blood and oxygen flow into brain to identify areas of high activity
    - provides structural and functional information in real time

The Brain and Behaviour

Hindbrain: includes cerebellum, medulla, pons
- **medulla**: attaches brainstem to spinal cord

    - responsible for unconscious, vital functions (e.g. blood circulation, breathing, regulating reflexes like sneezing, coughing, etc.)
- **pons**: bridge of fibres that connects brainstem to cerebellum
    - involved with sleep and arousal
- **cerebellum**: deeply folded structure located in back surface of the brainstem
    - coordination of movement, sense of equilibrium or physical balance
    - organizes sensory information
    - depressed by alcohol (e.g. drunkenness disrupts motor skills)

Midbrain: segment of brainstem between hindbrain and forebrain
- integrates sensory information, e.g. vision and hearing
- Parkinson's disease associated with degeneration of a certain structure in midbrain with regards to a decline in dopamine
- **reticular formation**: involved in modulation of muscle reflexes, breathing, pain perception
    - regulation of sleep and arousal
        - activity in ascending fibres in reticular formation leads to arousal

Forebrain: largest and most complex part of the brain that encompasses the thalamus, hypothalamus, limbic system, and cerebrum
- **cerebral cortex**: wrinkled surface of cerebrum
- **thalamus**: way station of all sensory information (made of somas)
    - relays sensory information to parts of the cortex
    - role in integrating information from various senses
- **hypothalamus**: regulation of basic biological needs
    - controls ANS
    - link between brain and endocrine system
    - basic biological drives to surviving (the "four Fs"): fighting, fleeing, feeding, mating
    - lesion lateral hypothalamus = animal starves
        - [lateral hypothalamus = LH = lack hunger]
    - activate hypothalamus = animal gets hungry
- **limbic system**: loosely connected network of structures between cerebral cortex and deeper subcortical areas
    - contains parts of thalamus, hypothalamus, hippocampus, amygdala, etc.
    - regulation of emotion, memory, motivation, and recently optimism in life
    - **hippocampus**: associated with memory
        - might be involved in consolidating memories of factual information
    - **amygdala**: may play role in learning fear responses and the processing of other emotions
        - new research suggests not only negative emotions, but positive emotions
    - an area rich with emotion-tinged "pleasure-centre"
        - James Old and Peter Milner study: rats kept pressing button for pleasure emotion when a planted electrode kept stimulating this site

        - **medial forebrain bundle**: heaviest self-stimulation site
            - dopamine-releasing neurons may be the reason, but not the only reason
- **cerebrum**: largest part of brain
    - associated with mental activities: learning, remembering, thinking, consciousness
    - **cerebral cortex**: convoluted outer layer of cerebrum
        - 1400 cm^2, large
    - **cerebral hemispheres**: left and right halves of the cerebrum (separated by a longitudinal fissure)
    - **corpus callosum**: connects both cerebral hemispheres
    - each hemisphere divided into 4 lobes
    - **occipital lobe** (at the back of the head): includes cortical area where most visual signals and visual processing begins (*primary visual cortex*)
    - **parietal lobe** (in front of occipital and above temporal)
        - area that registers touch (*primary somatosensory cortex*)
        - integrates visual input and monitors body position in space
        - Doug Crawford suggests parietal cortex mediates visual control of reaching
    - **temporal lobe** (below parietal)
        - devoted to auditory processing (*primary auditory cortex*)
        - damage to temporal lobe on left side can impair comprehension of speech and language
    - **frontal lobe**: largest
        - principal areas control movement of muscles (*primary motor cortex*)
        - applying ESB caused muscle contractions
        - more parts of motor cortex devoted to small movement (lips, finger) than large
        - **prefrontal cortex** (28% of brain): thought to be complex, disclosed
            - recent studies suggest higher-order functions
            - recent studies suggest it to be “executive control system”
            - damage to this area: symptoms lead to deficit in planning, paying attention, getting organized

Plasticity of Brain

- brain is more malleable than previously thought
- Bryan Kolb (behavioural neuroscientist): brain plasticity refers to brain’s ability to change structure and function
    - experience affects dendritic length, synapse formation, altered metabolic activity
- studies have shown experience affecting brain structure
    - area in somatosensory cortex that receives input from fingers of left hand is enlarged in left-handed string musicians
    - scientists find more dendritic branching and synaptic density in rats raised in rich than in dull environment

- studies have shown damage to incoming sensory pathways or destruction of brain tissue can lead to neural reorganization
    - e.g. owl monkey's 3rd finger amputated, part of its cortex that responded to 3rd finger became responsive to 2nd and 4th finger
- studies indicate adult brain can generate new neurons in hippocampus and olfactory bulb
    - **neurogenesis**: formation of new neurons
    - Elizabeth Gould and others found adult monkeys form thousands of new brain cells each day in deep subcortical areas that migrate to areas in cortex to form new synapses with existing neurons
- younger brains more malleable than older brains
- human brain does try to mend itself after damage
- stem cells are unspecialized cells that renew themselves through cell division and that can, under special circumstances, be induced to become cells suitable for other specialized purposes such as beating cells of the heart and neurons
    - raised controversial debate

Right Brain/Left Brain: Cerebral Laterality

Introduction

- *Broca's area*: left side, frontal lobe, role in speech production
    - named after patient Paul Broca
- *Wernicke's area*: left side, temporal lobe, role in speech comprehension
- left hemisphere characterized as "dominant" to right because thoughts are usually coded in terms of language
- studied by Roger Sperry, Michael Gazzaniga and others

Bisecting the Brain: Split-Brain Research

- **split-brain surgery**: bundle of fibres connecting hemispheres [corpus callosum] is cut to reduce severity of epileptic seizures
- left hemisphere controls right side of body and vice versa
- stimuli in right half of visual field registered by left halves of eyes, which project to the left hemisphere
- stimuli in left half of visual field registered by right halves of eyes, which project to the right hemisphere
- auditory stimuli go to both hemispheres, but connection to opposite hemisphere is stronger or more immediate
- "crisscrossed" organization is unapparent, hemispheres readily share info via corpus callosum
    - Gazzaniga, Bogen, Sperry experiment with split-brain patients
        - subjects couldn't name objects when picture presented in the left visual field, but could be if placed in the right visual field
        - supported left hemisphere stores language
        - right hemisphere was better at copying pictures and assembling little puzzles

        - right hemisphere found to be better than the left in visual-spatial tasks, including discriminating colours, arranging blocks, recognizing faces

Hemispheric Specialization in the Intact Brain

- theorists couldn't base conclusions from split-brain experiments since a human has an intact brain
- Maryse Lassonde: researched effects of agenesis (partially formed or absent corpus callosum) in corpus callosum
    - studied people callosotomized (corpus callosum severed surgically) and acallosal (born without intact corpus callosum)
    - acallosal subjects had limitations to their brain plasticity
    - with colleague Elaine De Guise studied children 6 to 16 with intact corpus callosum
        - younger children had limitations in their hemispheric communication
    - another study:
        - older (12 older) children did better on a visuomotor test (requires both hemispheres) because their callosum had reached functional maturity
        - younger children showed limitations in hemispheric communication, they showed deficits in learning a task that involved integration of information of both hemispheres
- **perceptual asymmetries**: left-right imbalances between hemispheres in the speed of visual or auditory processing
    - e.g. seeing which hemisphere detects stimuli faster than other
    - left is better on tasks with verbal processing (language, speech, writing, reading)
    - right is better on many tasks with nonverbal processing (spatial, musical, visual recognition)

The Endocrine System: Another Way to Communicate

Endocrine System: consists of glands that secrete chemicals into bloodstream that help control bodily function

- body's second communication system
- **hormones**: chemical substances released by endocrine glands
    - diffuse through bloodstream and bind to special receptors on a target cell
    - some act as both hormone and neurotransmitter (e.g. norepinephrine)
    - slower than neurotransmitters
- Doreen Kimura (neuroscientist) suggests males' greater spatial ability and females' greater verbal fluency may be caused by early effects of sex hormones on brain organization
    - environment works on differently wired brains of boys and girls
- endocrine glands:

    - e.g. stomach and intestines release hormones to control digestion
    - e.g. kidney hormones help regulate blood pressure
    - e.g. pancreatic hormone, insulin helps cells use sugar from blood
    - hormones released tend to be *pulsatile*: released several times a day in brief bursts or pulses that last a few minutes
- **pituitary gland**: releases a great variety of hormones that fan out around body, stimulating actions in other endocrine glands (master gland)
    - secretes gonadotrophin which affect gonads
    - sex hormones direct formation of external sexual organs before birth
        - at puberty, these sex hormones form secondary sex characteristics
- in times of stress, the hypothalamus sends signals to 2 different pathways:
    - autonomic nervous system (ANS)
    - adrenal gland (via the pituitary gland)
- chronically high levels of stress hormones increases vulnerability to disease and can suppress neurogenesis in the hippocampus
- **testosterone**: male sex hormone produced by the testes; women secrete smaller amounts of testosterone from the adrenal cortex and ovaries
    - testosterone and anger positively correlated (weak though)
    - no reliable connection to cognitive ability

Heredity and Behaviour: Is It All in the Genes?

Behavioural Genetics: interdisciplinary field that studies influence of genetic factors on behavioural traits

Basic Principles of Genetics

- **chromosomes**: strands of DNA that carry genetic information (23 pairs in humans)
    - found in the nucleus of a cell
- **zygote**: single cell formed by the union of a sperm and an egg
    - sex cell (sperm or egg) has 23 chromosomes
    - the union of sperm and egg brings the total to 46 chromosomes (23 pairs)
- **genes**: DNA segments which are key functional units in hereditary transmission
- **mutation**: a change in genetic code
- within a parent, sex cells of different genetic makeups are produced from the process of **crossing over**: interchange of material between chromosomes
    - this creates *millions* of possibilities for sex cells, and *trillions* of possibilities for a zygote when the sex cells (egg and sperm) of two parents unite
    - this explains why all children of two parents don't all look alike (save identical twins)
- genes operate as pairs, one gene coming from each parent
    - genes determine traits
        - simplest scenario: 1 pair of genes determines a trait
    - **homozygous**: both genes are the same
    - **heterozygous**: both genes are different

    - **dominant gene**: one gene that is expressed when a pair is different
        - ex. brown eye colour gene is dominant compared to the blue eye colour gene
    - **recessive gene**: one gene that is masked when a pair is different
        - ex. blue eye colour gene is recessive compared to the brown eye colour gene
    - **phenotype**: ways a person's genotype is physically observed
        - ex. eye color
    - **genotype** : person's genetic makeup
        - [ex. brown eye colour expressed in genetic code as BB or Bb]
    - **co-dominance**: each characteristic of the gene pair show in the phenotype as a blended type
        - [ex. a white flower gene and a red flower gene produce a pink flower phenotype]
    - **polygenic traits**: characteristics are influenced by more than 1 pair of genes
        - e.g. 3-5 genes are thought to influence skin colour
- children are 50% genetically related to their biological parents

Investigating Hereditary Influence: Research Methods

- **selective breeding**: breeding animals with known genetic variables

1) Family Studies

- examining blood relatives to see how much one resembles another on a specific trait
    - e.g. schizophrenia, first-degree relatives have 9% of exhibiting it
- however, families and sometimes relatives live in same environment, which promote likelihood for similar phenotypes
    - closer relatives also more likely to live with family over distant relatives

2) Twin Studies

- comparing the resemblance of identical twins and fraternal twins with respect to a trait
- **identical twins** (monozygotic): zygote splits for unknown reason (100% related)
- **fraternal twins** (dizygotic): two eggs are fertilized simultaneously (50% related)
- since identical twins are much more alike than fraternal genetically and both types of twins share the same environment, any differences can be attributed to genetics
- however, there are differences (intelligence and personality) between identical twins regardless, suggests environment still has influence

3) Adopted Studies

- examining resemblance between adopted children and biological and adoptive parents
- if adoptees match their biological parents (never had contact with them), this is evidence for genetic factors

- found similar correlation between intelligence of adoptee with both biological and adoptive parents
    - both heredity and environment influence intelligence

The Cutting Edge: Genetic Mapping
- process of determining location and chemical sequence of genes and DNA
- Human Genome Project mapped human genome
- researchers have isolated disorders to target genes
- challenge is locating constellation of genes responsible for certain aspects of behaviour

The Interplay of Heredity and Environment
- Robert Plomin suggests both influence behaviour
    - suggests people inherit a degree of vulnerability to a disease

The Evolutionary Bases of Behaviour

Charles Darwin
- British naturalist
- published *The Origin of Species*
- **natural selection**: heritable characteristics that provide survival or reproductive advantage are more likely than the alternative characteristics to be passed onto subsequent generations and thus be "selected" over time
    - works on gene pool changes of population not organism
- 4 crucial insights:
    - organisms vary in endless ways (e.g. size, strength, etc.)
    - some characteristics are heritable
    - organisms tend to produce more offspring than the food supply can support (Thomas Malfus Curve)
        - population is exponential, food is constant, surplus population dies off
        - Darwin thought variations in hereditary traits affect organism's ability to obtain resources
        - those with better traits start to become dominant (reproductive or survival advantage), which leads to evolutionary change
- **fitness**: reproductive success of an individual organism relative to average reproductive success in population
    - therefore, variations in reproductive success fuel evolutionary change
- controversial points:
    - diversity is unplanned, not divine creation
    - humans are not unique, we share common ancestry with all life

Subsequent Refinements to Darwin's Theory
- gene pool is shaped by:
    - **genetic drift**: random changes in allele frequencies

    - **gene flow**: emigration and immigration of population
        - minimal gene flow contributes to divergent populations
    - **mutation**: spontaneous, heritable change in a piece of DNA
        - variability changes gene pool, gives natural selection new material
- **adaptation**: inherited characteristics that increased in a population because it helped solve a problem of survival or reproduction during a time it emerged
    - when environment changes, adaptive traits can become obsolete
- paradox of self-sacrifice explained by **inclusive fitness**: sum of an individual's own reproductive success plus effects the organism has on the reproductive success of related others
    - paradox: why would an individual member of a species sacrifice their life to protect other unrelated members of its species? = wouldn't live to pass on his/her genes
    - protecting offspring becomes protecting others of the same genetic makeup
    - decreases as relatedness declines of helper and those it saves

Behaviour as Adaptive Traits

- natural selection recognized not only physical characteristics, but *behavioural* too
    - hard because fossil evidence gives more structural information
    - e.g. grasshopper will camouflage to escape predator
    - e.g. gazelle "stotting" behaviour at a cheetah = message: "I've seen you, you should just give up because I'm ready to run"
- adaptive behavioural manoeuvres improve reproductive success
    - one type of moth that demands males collect sodium for her larvae

Featured Study: Searching for the Self in the Brain

Depth of Processing Information: ways to better encode for memory

- theory: deeper encoding leads to better memory
    - encoding: process of forming a memory code (putting things in memory)
- deep level: semantic encoding (meaning of the word)
- middle level: phonemic encoding (sound of the word)
- shallowest level: structure encoding (physical characteristics of the word)
- deepest level: self-referent encoding (relate to-be-remembered material to yourself)

Method

- subjects asked to encode lists of traits as it relates to themselves, a famous person (other), in terms of socially desirability, and phonemically
- look at brain activity using PET

Results and Discussion

- subjects in the 3 semantic encoding tasks had better memory than those in the phonemic condition

- self-task condition had the best memory recall
    - deeper encoding = better memory
- semantic encoding all increased activity in the left prefrontal cortical activity, but only the self-task condition had additional activity in the right prefrontal cortex

Personal Application: Evaluating the Concept of "Two Minds in One"

Cerebral Specialization and Cognitive Processes & Complexities and Qualifications

- both hemispheres are specialized to different types of cognitive tasks to a certain degree
- each hemisphere has its own independent stream of consciousness, but usually there's considerable overlap between both hemispheres in terms of unifying consciousness
    - even some split-brain patients demonstrate this
- both hemispheres have different modes of thinking
    - plausible, but no strong evidence
- people vary on their reliance of both hemispheres
    - inconclusive at best
- school should work more in exercising the right half
    - wild speculation
- left-handed people are more bilateral than right-handed people

Critical Thinking Application: Building Better Brains: The Perils of Extrapolation

Key Findings on Neural Development

- **critical period**: limited time span in the development of an organism when it is optimal for certain capacities to emerge because the organism is especially responsive to certain experiences
    - e.g. certain visual input is necessary during critical period or blindness results (in kittens)
    - rats raised in impoverished environments had poorer performance on problem-solving tasks than rats raised in enriched environments
        - impoverished rats also had heavier brains and thicker cerebral cortices in some area

The Risks of Extrapolation

- **extrapolation**: methods to enhance brain development
- the studies used to support the importance of early experience have used very extreme conditions to make their comparisons, ex. complete sensory deprivation
- **Mozart effect**: listening to Mozart will enhance spatial reasoning for 10-15 min
    - this literature has motivated the idea of exposing infants to classical music at a young age to enhance their brain development

        - but there is no empirical evidence to support this (showing lasting effects)
- belief: brain is malleable during critical period
    - counterargument: brain is malleable throughout entire life
- belief: more synapse does not mean more intelligence
    - synaptic pruning aims to get rid of synapses, so more may not be better