

What is Developmental Psychology?

Developmental Psychology

- studies changes across the human lifespan
- uses scientific methods to describe, explain, and predict changes of infants' and children's psychological development
- includes a wide range of psychological processes
- needs to be consistent with what is known from other branches of science

The scientific method involves a consensus about how data is collected, how it is analyzed, and what conclusions are warranted based on the results.

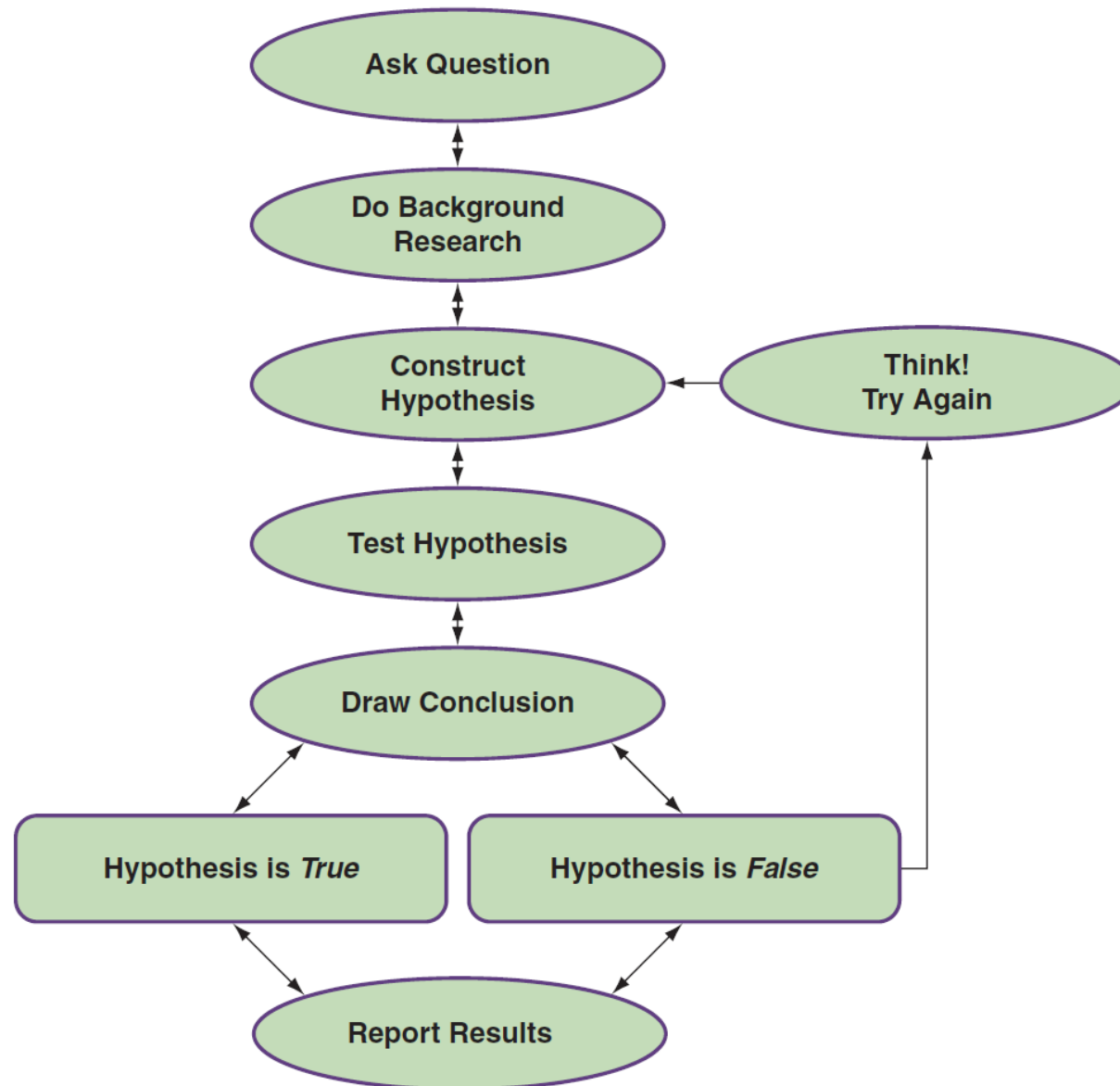
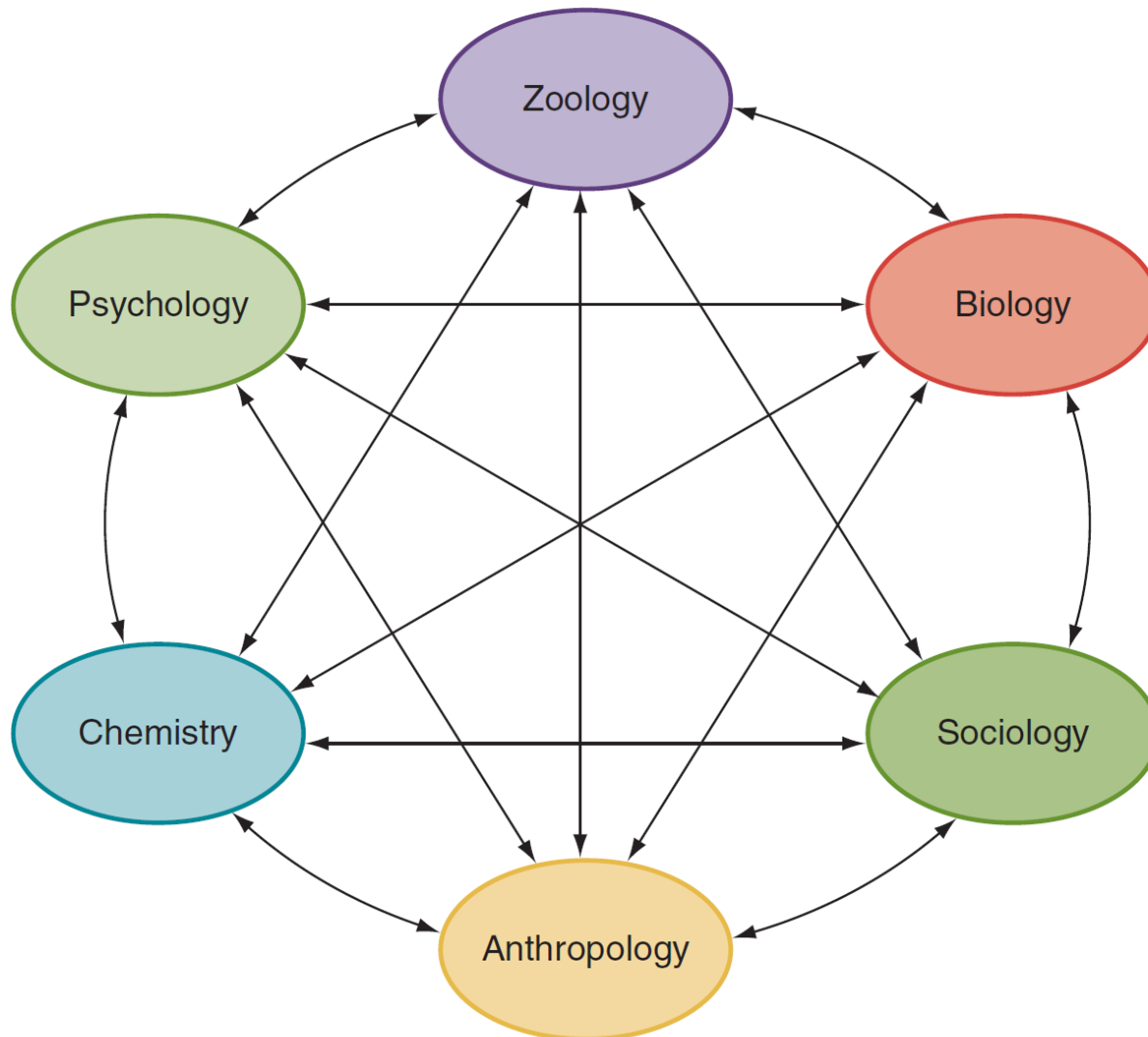


figure 1.2

Scientific knowledge is consistent throughout disciplines

Developmental psychology is a science, and what we believe to be true about developmental psychology needs to be consistent with what we know from other branches of science.



What is Development?

Development

- is a fundamental scientific field of inquiry throughout the field of biology (including psychology)
- is inevitable
- begins when the genome of a new individual is complete, which is marked by conception: the union of two gametes (sex cells)

The developing child was 'designed' by natural selection

- to make use of resources available
- to solve age-specific problems
- through creating complex adaptations

Why Study the Developmental Psychology of Children?

Studying the development of children

1. gives us insight into our universal human nature
 - Universals that are robust across species-typical environment
 - Information in environments interacts with child to bring about lasting changes
 - How deviations from environments may affect development
2. provides information about adult psychological processes
3. provides insight for parents and educators into how adult interactions with children affect child development

A Historical Look at Developmental Psychology and the Nature vs. Nurture Debate

Nativist

- One who views development as being driven primarily or exclusively by internal forces
- Information needed for development is assumed to exist within the developing child
- Often this information is thought to be preserved in the genes

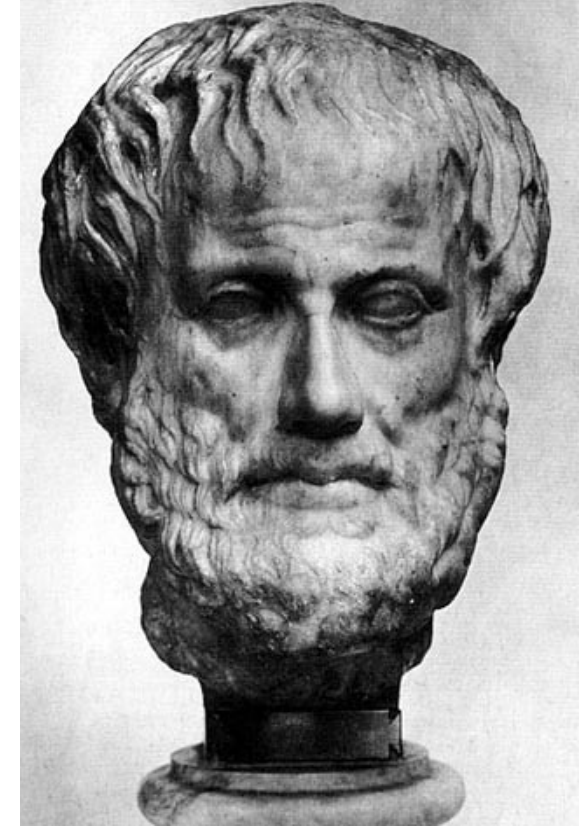
Empiricist

- One who believes that all knowledge depends upon direct experience or empirical observation
- The newborn's mind is a blank slate and requires exposure to information in order to gain knowledge



Plato

Nature or nurture?



Aristotle

- Nativist
- Innate knowledge
- No specific experience required

- Empiricist
- Blank slate
- Experience crucial

Views of the Child

- What is childhood?
- How should we treat children? What is good/ideal, what is bad/harmful?
- What do children need? Want?
- What should they get?
- Can we give them too much?
- Universal or specific to time/culture?

Views of Children

Medieval (6th-15th Century)

- Children seen as immature, vulnerable
- No idea of childhood? (Aries' art analysis; miniature adults)
- Childhood a nightmare? (deMause)
- Contradictory religious view (possessed vs. angelic)

Reformation (16th Century)

- Original sin, Puritan view
- Need to tame/civilize child
- Taught self-reliance/self-control, reason
- Tight clothing, corporal punishment
- Parents did love their children, too



Jean-Jacques
Rousseau
(1712-1778)

Enlightenment



John Locke
(1632-1704)

- Nativist
- Noble savage
- Freedom to explore
- Against formal education/
tutoring
- 12 years = age of reason

- Empiricist
- Tabula rasa (all equal)
- No innate knowledge
- Mould child; rewards,
example, instruction,
(punishment)

Locke

- Kinder, more compassionate view of children
- Influenced behaviourism
- Influenced US Constitution (equality, freedom)
- Child = flowing water; development = directing.

By “gentle application of the hand”...“they receive different tendencies” and end up “at very remote and distant places”

Locke

- Wear leaky shoes to “harden”; against illness
- Wear loose-fitting clothes
- Play in open air, swim
- Avoid too much meat
- Avoid fruits that taste good (melons, peaches, plums, grapes)
- Allow strawberries, cherries, gooseberries at meals, with bread

“On the other side, if the *Mind* be curbed, and *humbled* too much in Children; if their *Spirits* be abased and *broken* much, by too strict an hand over them, they lose all the Vigor and Industry, and are in a worse State than the former. For extravagant young Fellows, that have Liveliness and Spirit, come sometimes to be set right, and so make Able and Great Men: But *dejected Minds*, timorous, and tame, and *low Spirits*, are hardly ever to be raised, and very seldom attain to any thing. To avoid the danger, that is on either hand, is the great Art; and he that has found a way, how to keep up a Child’s Spirit, easy, active and free; and yet, at the same time, to restrain him from many things he has a Mind to, and to draw him to things that are uneasy to him: he, I say, that knows how to reconcile these seeming Contradictions, has, in my Opinion, got the true Secret of Education.”

Locke, *Some Thoughts Concerning Education*

Rousseau

- “Everything is good as it leaves the hand of the Author of things; everything degenerates in the hands of man” (Opening of *Emile*)
- All children develop along similar course
- Stages: infancy, childhood, late childhood, adolescence
- Maturation: natural growth

“Men, be humane. This is your first duty. Be humane with every station, every age, everything which is not alien to man. What wisdom is there for you save humanity? Love childhood; promote its games, its pleasures, its amiable instinct. Who among you has not sometimes regretted that age when a laugh is always on the lips and the soul is always at peace? Why do you want to deprive these little innocents of the enjoyment of a time so short which escapes them and of a good so precious which they do not know how to abuse? Why do you want to fill with bitterness and pains these first years which go by so rapidly and can return no more for them than they can for you? Fathers, do you know the moment when death awaits your children? Do not prepare regrets for yourself in depriving them of the few instants nature gives them. As soon as they can sense the pleasure of being, arrange it so that they can enjoy it, arrange it so that at whatever hour God summons them they do not die without having tasted life.”

Rousseau, *Emile*

A Basic Issue in Development

Constructivism vs. Learning

- Are children active (constructive) or passive in their development and learning?

Modern Developmental Psychology

- Empirical, scientific approach
- Influenced by evolutionary theory
- Tested children as naturalists, sought norms

A Historical Look...cont.

Baby Biography

- An intensive study developed by Charles Darwin that describes the activities of an individual baby, typically the scientist's own child

M I N D

A QUARTERLY REVIEW

OF

PSYCHOLOGY AND PHILOSOPHY.

I.—A BIOGRAPHICAL SKETCH OF AN INFANT.

M. Taine's very interesting account of the mental development of an infant, translated in the last number of *MIND* (p. 252), has led me to look over a diary which I kept thirty-seven years ago with respect to one of my own infants. I had excellent opportunities for close observation, and wrote down at once whatever was observed. My chief object was expression, and my notes were used in my book on this subject; but as I attended to some other points, my observations may possibly possess some little interest in comparison with those by M. Taine, and with others which hereafter no doubt will be made. I feel sure, from what I have seen with my own infants, that the period of development of the several faculties will be found to differ considerably in different infants.

During the first seven days various reflex actions, namely sneezing, hickuping, yawning, stretching, and of course sucking and screaming, were well performed by my infant. On the seventh day, I touched the naked sole of his foot with a bit of paper, and he jerked it away, curling at the same time his toes, like a much older child when tickled. The perfection of these reflex movements shows that the extreme imperfection of the voluntary ones is not due to the state of the muscles or of the co-ordinating centres, but to that of the seat of the will. At this time, though so early, it seemed clear to me that a warm soft hand

“A biographical sketch of an infant” (Darwin, 1877)



A Historical Look...cont.

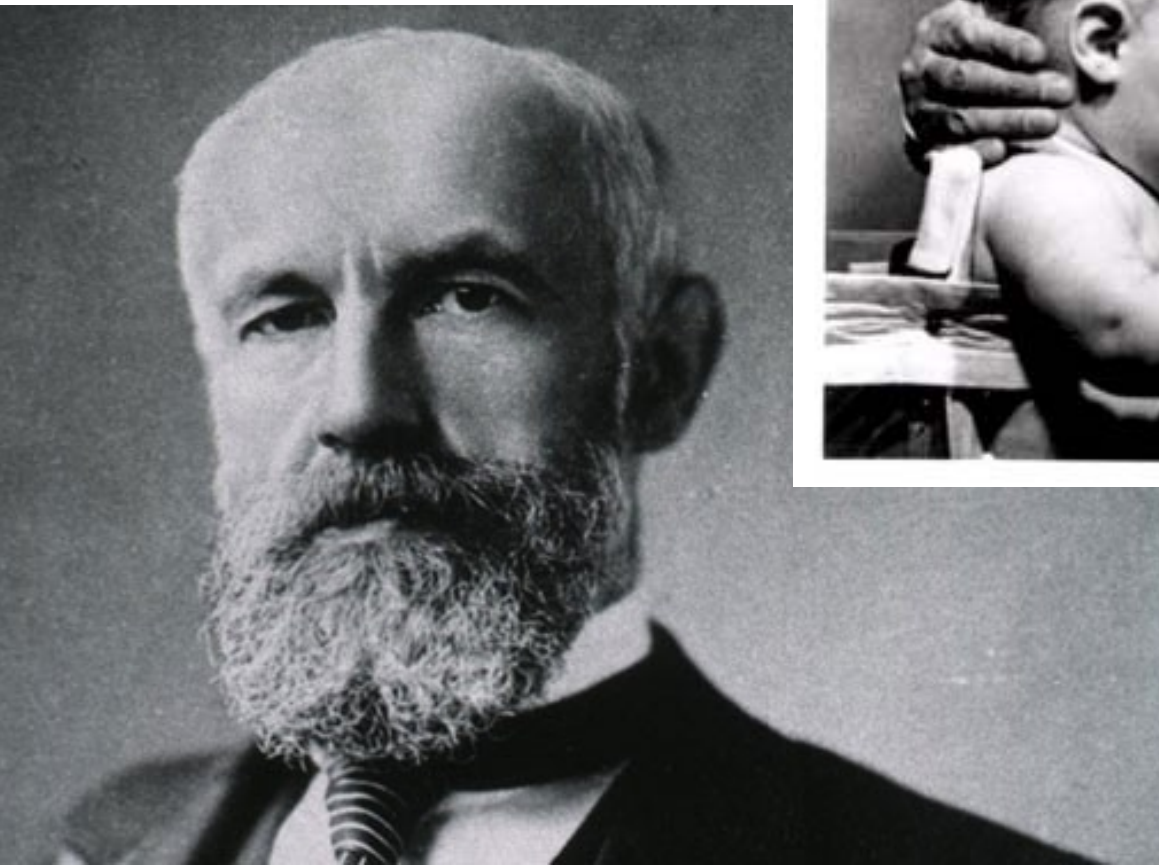
Normative Approach

- The study of development in which norms or averages are computed over a large population
- Individual development is compared to these norms
- Age-related averages are used to represent typical development
- G. Stanley Hall (1844–1924)
- Arnold Gesell (1880–1961)

Arnold Gesell
(1880-1961)



G. Stanley Hall
(1844-1924)



G. Stanley Hall

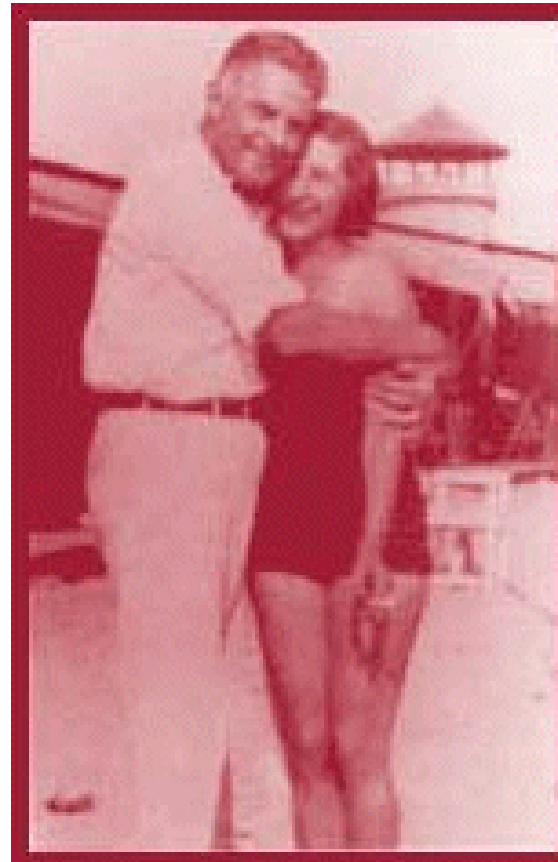
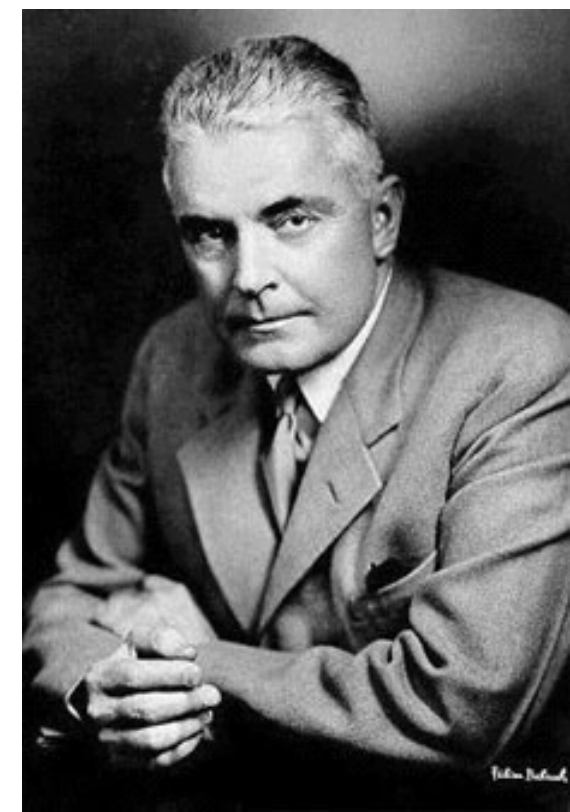
- Founded modern child study movement
- Influenced by Darwin/evolution
- Development: a maturational process
- Recapitulationism: individual development follows species development
- Used large sample to find norms for 'typical' development (normative approach)
 - Children's views of self, friends, interests, etc.
 - Motor, social, personality milestones from interviews with parents
- Interested in educational psychology
- Founded journals, APA, and trained first developmental psychologists

Arnold Gesell

- Student of Hall
- Began Yale Clinic of Child Development (1911)
- Development unfolds predictably in motor, social, and personality areas
- Informed parents of milestones (cf., Benjamin Spock, *Baby and Child Care*)


Strengths

- Detailed norms
- Methodological innovations (behavioural interview, apparatus, photography)
- Welfare of child, clinical intervention
- Advice to parents to promote 'mental hygiene' positive influence on child rearing?
- Wrote for a general audience



Watson (1878-1958)
and Rosalie Rayner

BEHAVIOURISM



"Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select – doctor, lawyer, artist, merchant-chief, and, yes, even beggarman and thief, regardless of his talents, penchants, tendencies, abilities, vocations, and race of his ancestors. I am going beyond my facts and I admit it, but so have the advocates of the contrary and they have been doing it for many thousands of years."

John B. Watson, *Behaviorism*, 1930



‘The Little Albert Experiment’
on www.youtube.com

“Our laboratory studies show that we can bring out a love response in a newborn child by just one stimulus—by *stroking its skin*. The more sensitive the skin area, the more marked the response. ... Nurses and mothers have learned this method of quieting an infant by the trial and error process. ...

The *love life* of the child is *at birth* very simple as is all of its other emotional behaviour. Touching and stroking of the skin of the young infant brings out a love response. Not other stimulus will.

This means that there is no ‘instinctive’ love of the child for the parents, nor for any other person or object. It means that all affection, be it parental, child for parent or love between the sexes, is built up with such bricks and mortar. A great many parents who have much too much sentiment in their makeup, feel that when the behaviourist announces this he is robbing them of all the sacredness and sweetness in the child-parent relationship.

...

... *Loves* are home made, built in. In other words loves are *conditioned*. ... It requires no instinct, no ‘intelligence,’ no “reasoning” on the child’s part for such responses to grow up. “

Watson, in Kessen, 1965, pp. 241-242

“Now over conditioning in love is the rule. ...

But even granting that the mother thinks she kisses the child for the perfectly logical reason of implanting the proper amount of affection and kindness in it, does she succeed? The fact I brought out before, that we rarely see a happy child, is proof to the contrary. The fact that our children are always crying and always whining shows the unhappy, unwholesome state they are in. Their digestion is interfered with and probably their whole glandular system is deranged.

Should the Mother Never Kiss the Baby?

There is a sensible way of treating children. Treat them as though they were young adults. Dress them, bathe them with care and circumspection. Let your behavior always be objective and kindly firm. **Never hug and kiss them, never let them sit in your lap. If you must, kiss them once on the forehead when they say good night. Shake hands with them in the morning. Give them a pat on the head if they have made an extraordinarily good job of a difficult task. Try it out.** In a week's time you will find how easy it is to be perfectly objective with your child and at the same time kindly. You will be utterly ashamed of the mawkish, sentimental way you have been handling it.”

Watson, in Kessen, 1965, pp. 243-244

John B. Watson (1878–1958)

- Founder of Behaviourism
- Variations between individuals are not due to any inherent differences but are entirely due to how they are reared
- Any behaviour is a result of conditional processes
 - Classical Conditioning (association of two events)
 - Operant Conditioning (association of a behaviour and an outcome)
- Watson made lasting contributions to developmental psychology
 - He insisted on objective methods and rigid experimental designs

Piaget's Theory of Cognitive Development



Jean Piaget
(1896-1980)



Jean Piaget (1896-1980)

- Genetic epistemology: how knowledge changes during development
- Theoretical and methodological contributions remain important

Theory of Cognitive Development (Stage Theory)

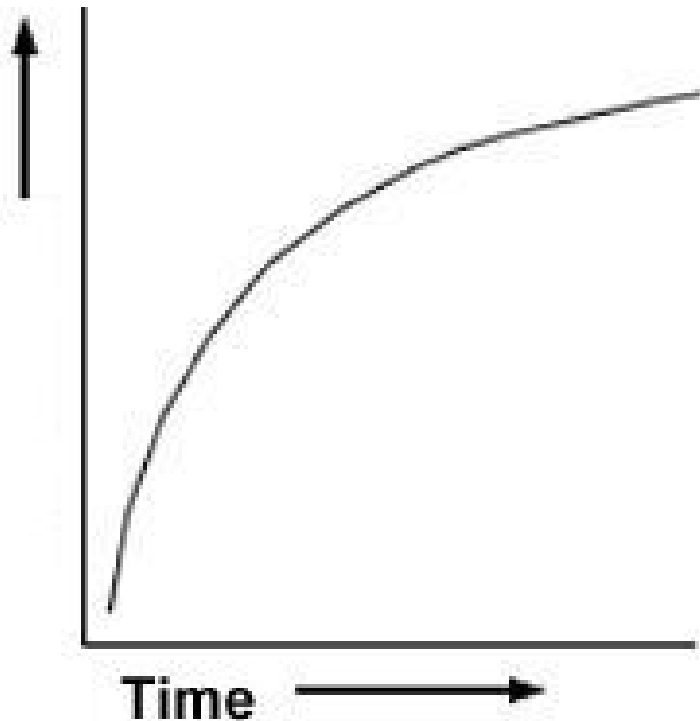
- Children attain a certain stage of cognitive development and are limited to the skills characterized by that stage until they reach the next stage, at which point a whole new set of cognitive skills are available to them

Clinical Method

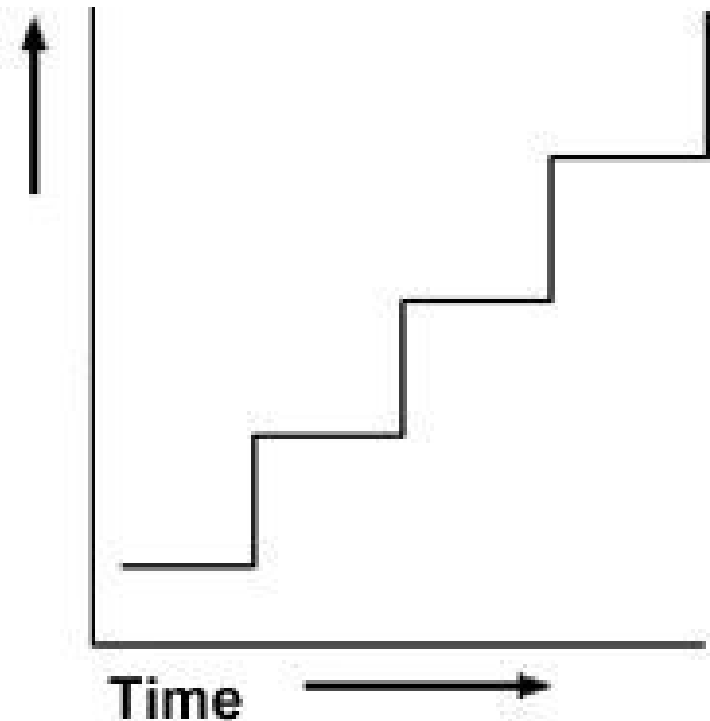
- Semi-structured interview, including a planned set of questions, which are followed up on or probed depending upon the child's responses

Stage Theory

Continuous or discontinuous development

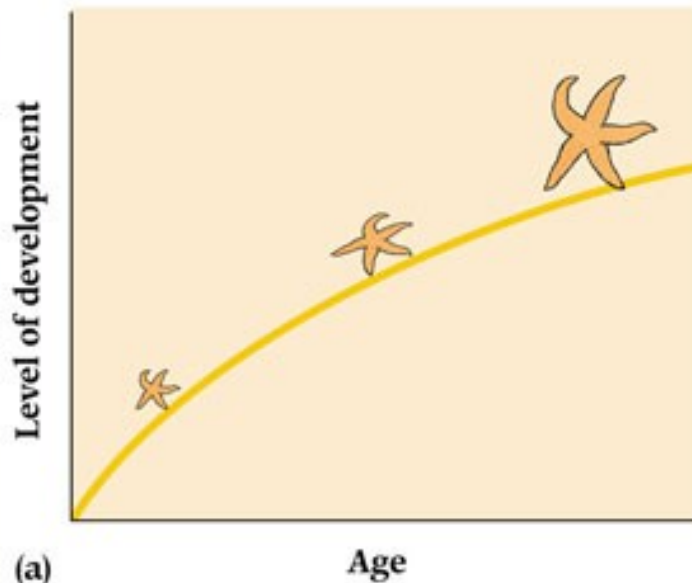


Continuous Development

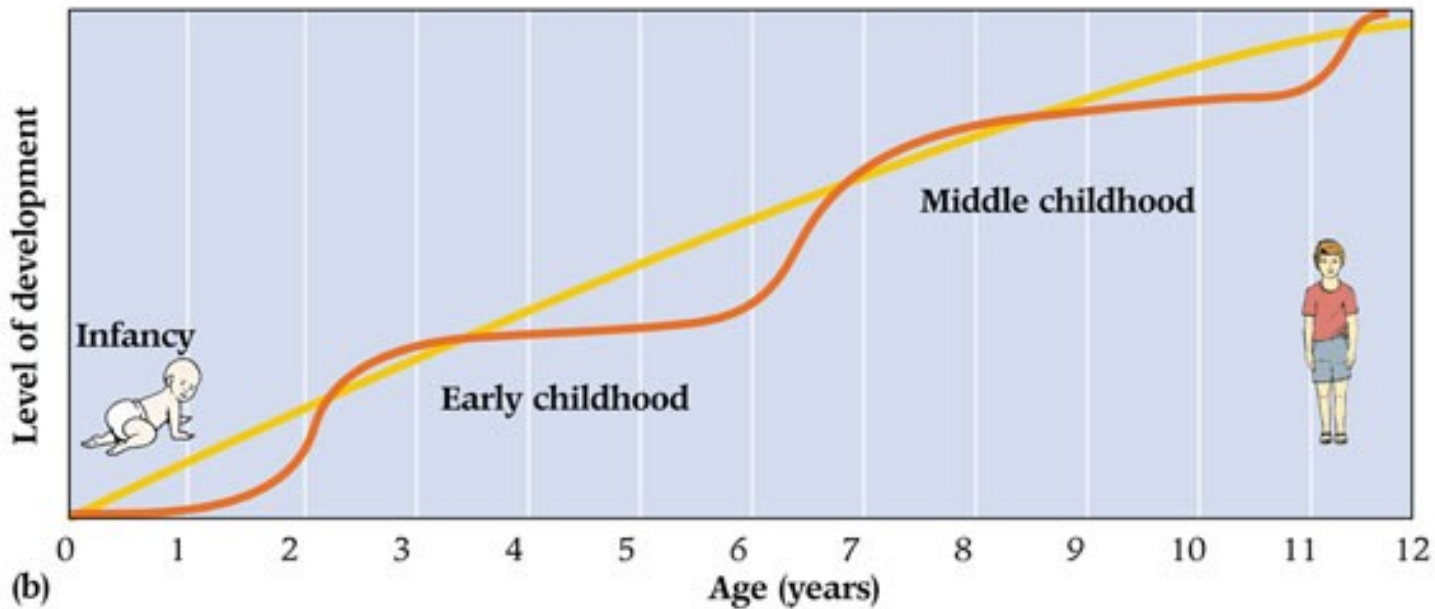
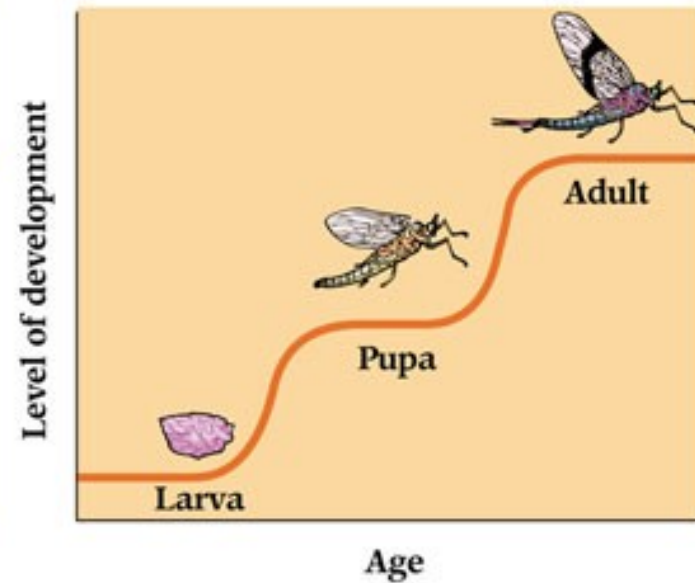


Development in Stages

Starfish: developmental continuity



Dragonfly: developmental discontinuity



Periods of development?

- Periods/phases of development
 - Prenatal
 - Infancy and toddlerhood (birth to 2 years)
 - Early childhood (2-6 years)
 - Middle childhood (6-11 years)
 - Adolescence (11-18 years)
 - Early adulthood
 - Middle adulthood
 - Late adulthood

Lev Vygotsky
(1896-1934)



Lev Vygotsky

- Biography (see WWW)
- Lawyer, literary criticism, education
- Russian Revolution, 1917
- Marxist theory, historical materialism:
 - Historical changes in material life and society produce changes in human nature (mind and behaviour)

Lev Vygotsky (1896–1934)

- Focused on the relationship between language and development of thought
- ‘Social Constructivist’

Theory of Social Development

- Emphasizes the influence of culture and of other people on a child’s development, knowledge, and thinking
- Zone of proximal development
 - Space between what child can do independently (actual) and with help (potential); where development occurs.
 - Buds, flowers vs. fruits

Nature and Nurture, Working Together to Make a Person

Nature **vs.** Nurture

- This question is untenable
- This dichotomy might be appealing, but is not a fruitful approach to human development

Nature **and** Nurture

- Emphasizes that every person and every trait of a person is a result of genetic **and** environmental input
- Without genes, nothing develops, and without the necessary environmental input, nothing develops

An Evolutionary Perspective on Development

Evolutionary Psychology

- An approach to the study of psychology that holds that being well informed about the processes of evolution, as well as the circumstances in which our ancestors lived during our evolutionary history, will aid us in understanding the function and design of the human mind
- Children develop as a result of an intricate interaction between the environment and the child and they do so as a result of developmental demands that recur in the environment
- Bidirectional relation of evolutionary psychology and developmental psychology

Evolutionary Perspective...cont.

Evolutionary Psychology's Contribution to Developmental Psychology

- It promotes research that is consistent with what is known about evolution by natural selection
- It provides guidance in terms of hypothesis testing

Evolutionary Perspective...cont.

Developmental Psychology's Contribution to Evolutionary Psychology

- It provides insight into how an adult comes into being
- It allows an opportunity to examine how changes in the environment during development lead to changes in the adult
- It buffers evolutionary psychologists from accusations of 'genetic determinism'
- It allows evolutionary psychologists to study non-adult adaptations

Adaptationism and Functionality

- Evolution by natural selection is the only scientific theory capable of explaining complex adaptations
- Over many generations of natural selection, individuals become better and better suited to their environment, with adaptations that are more
 - complex
 - efficient
 - effective
 - reliably developing

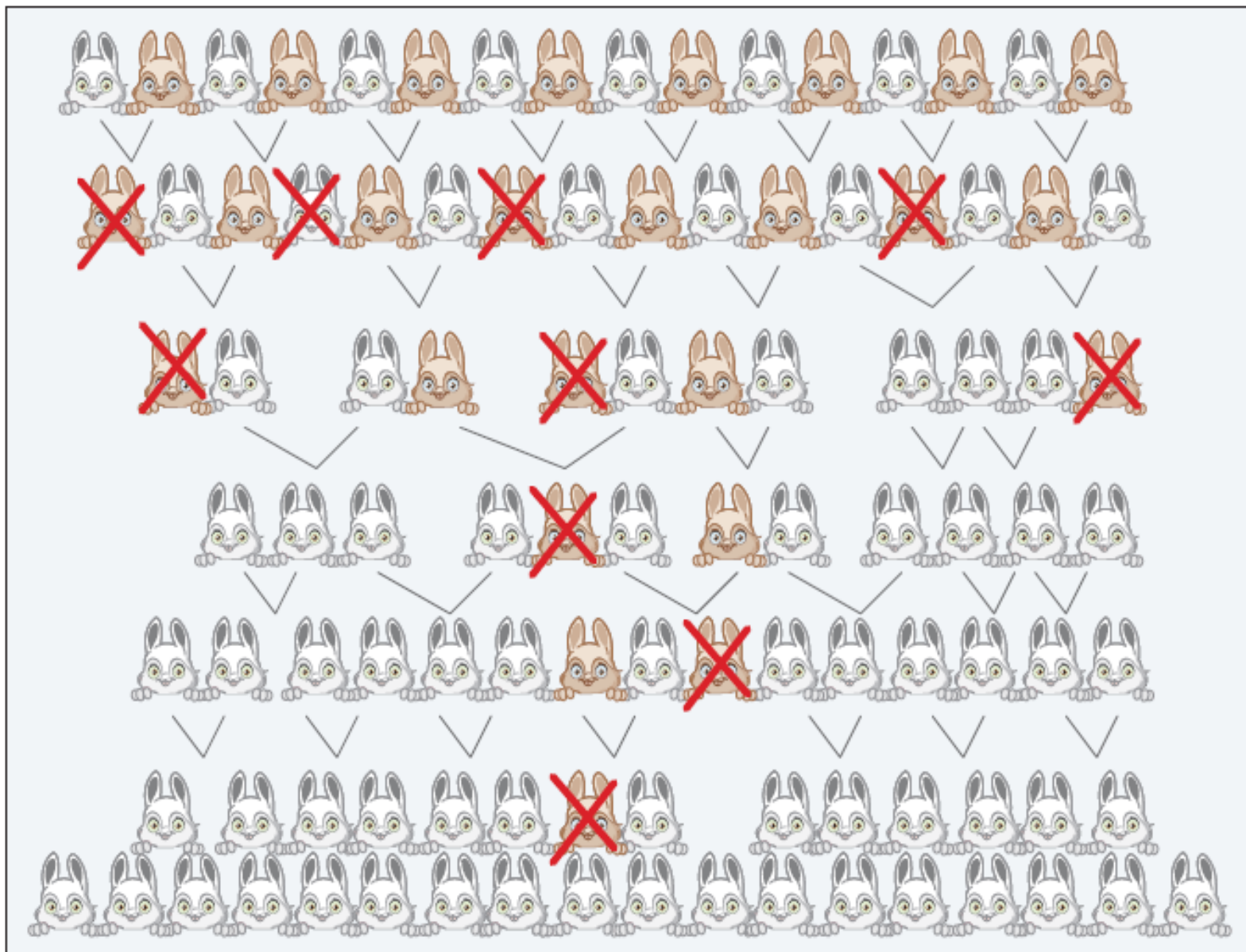
The Environment of Evolutionary Adaptedness (EEA)

EEA

- The ‘environment of evolutionary adaptedness’ is the condition under which our ancestors lived, and to which our morphological and psychological features are adapted
- An adaptation is adaptive with respect to a particular environment
 - For example, some environments will be favourable to white moths, whereas others will be favourable to black moths
 - Adaptations increase an organism’s fitness with respect to a particular environment

figure 1.4 An adaptation is adaptive with respect to a particular environment

Here, the bunnies are selected to have white fur because their environment is white. Had the environment been different, the adaptation would have been different.



Maladaptive Behaviour in the Modern World

Mismatch between our EEA-shaped psychological adaptations and our modern environment

Example 1: Fast Food

- Based on our EEA we have an adaptive hunger for sugars, fats, and salts. Fast food provides these ingredients in high amounts on an ongoing basis.

Example II: Fast Cars

- Certain dangers in our current environment did not exist in the EEA, such as fast cars, guns, and electricity. Accordingly, there was no selection pressure to create adaptations to them.

Maladaptive Behaviour...cont.

Reasons for a Mismatch

- Natural selection works on adaptation, not on behaviours
- Evolution is slow
- Evolution of complex adaptations is particularly slow
- Increasing complexity makes beneficial mutations less likely: Because complexity increases slowly, evolutionary change decreases slowly.

Generative Entrenchment

- A phenomenon that slows the evolution of developmental processes
- Because early perturbations in development can have catastrophic effects later in development, random mutations that affect early development are unlikely to be beneficial



with wife
Valentine
Châtenay

Published
report on
albino
sparrow at 10



G. Biayer



Children
Jacqueline,
Lucienne
and Laurent



Piaget's Background

- Biologist; studied molluscs
- Philosophy, especially knowledge (epistemology)
- Interested in development of intelligence (broadly understood)
- **Genetic epistemologist:**
 - Genetic = development, emergence
 - Epistemology = dealing with knowledge
- Kantian influence: categories (space, time, classes, cause, etc.), but not innate as Kant thought

Overview of Theory

- Strengths (Siegler, 1991, p. 18)
 - Descriptions feel right
 - Topics of broad interest for centuries
 - Breadth (infancy to adolescence; diversity of achievements)
 - Makes interesting observations
- Stage theory
 - Qualitative differences

Bärbel Inhelder (1913-1997)



Orienting Assumptions (Siegler, 1991, p. 24)

1. Child as scientific problem solver, little scientist
2. Activity, construction of reality
3. Methodological assumptions; richness vs. standardization
 - experiment vs. observation
 - longitudinal vs. cross-sectional
 - Articulation of reasoning

Stage Theory

- **Four stages**

- Sensorimotor
- Preoperational
- Concrete operational
- Formal operational

- **Developmental processes**

- Assimilation: fit existing structures
- Accommodation: adapt thinking/modify structures
- Equilibration: equilibrium-disequilibrium-equilibrium

Three Sources of Developmental Change

Assimilation

- The process of interpreting new information in terms of previously understood theories and knowledge.

Accommodation

- The process of changing one's current theory, understanding, or knowledge in order to cope with new information.

Equilibration

- The process of balancing assimilation and accommodation in order to maintain a stable understanding of the world while still allowing for development.

table 2.1**Piaget's Four Stages of Development**

STAGE	AGES	DESCRIPTION
Sensorimotor	Birth to 2 years	Initially endowed with only reflexes, the infant interacts with the physical and social world on a physical basis. The infant is perceptually bound. She makes progress by associating sensory experiences and her own actions.
Preoperational	2 to 7 years	In this stage, the child learns to use symbols such as words and numbers.
Concrete Operational	Approximately 7 to 11 years	The child can now perform mental operations, which allows the logical problem-solving that preoperational children cannot do. Still, the child can only apply these operations to concrete objects.
Formal Operational	12 years to adulthood	The child can now perform mental operations on abstract or hypothetical entities.

table 2.2**The Six Sub-Stages of the Sensorimotor Stage**

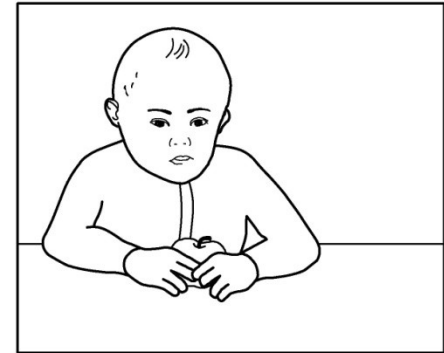
SUB-STAGE	SUMMARY	AGES	DESCRIPTION
1	Exercising Reflexes	Birth to 1 month	Piaget grants the infant only reflexes in this stage. They respond automatically to specific stimuli.
2	Developing Schemes	1 to 4 months	Schemes are action patterns the infant uses to interact with the world, like sucking or grasping.
3	Discovering Procedures	4 to 8 months	More interest in the world. Uses procedures to reproduce events.
4	Intentional Behaviour	8 to 12 months	The child can separate means from ends, and make a plan to achieve a goal or overcome obstacles.
5	Novelty and Exploration	12 to 18 months	The infant can generate new schemes and novel solutions. Tool use starts.
6	Mental Representation	18 to 24 months	The infant can represent the world mentally, so experiments don't need to be overt anymore. Solutions can be imagined.

Attempting to search for a hidden object

Infant retrieves a visible object

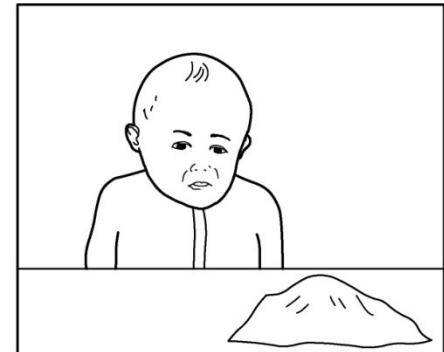


Infant searches for and retrieves a partially hidden object



But ...

Infant is unable to search for a fully hidden object



Primary, Secondary, And Tertiary Circular Reactions

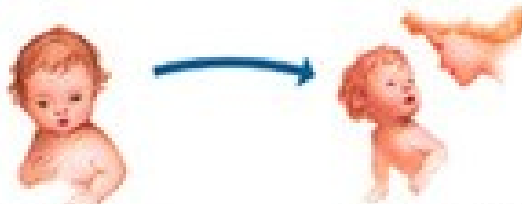


Baby sucks thumb

Baby enjoys sucking



(a) Primary circular reaction: action and response both involve infant's own body (1 to 4 months)



Baby coos

Baby sees smiling face



(b) Secondary circular reaction: action gets a response from another person or object, leading to baby's repeating original action (4 to 8 months)



Baby steps on rubber duck

Baby squeezes rubber duck

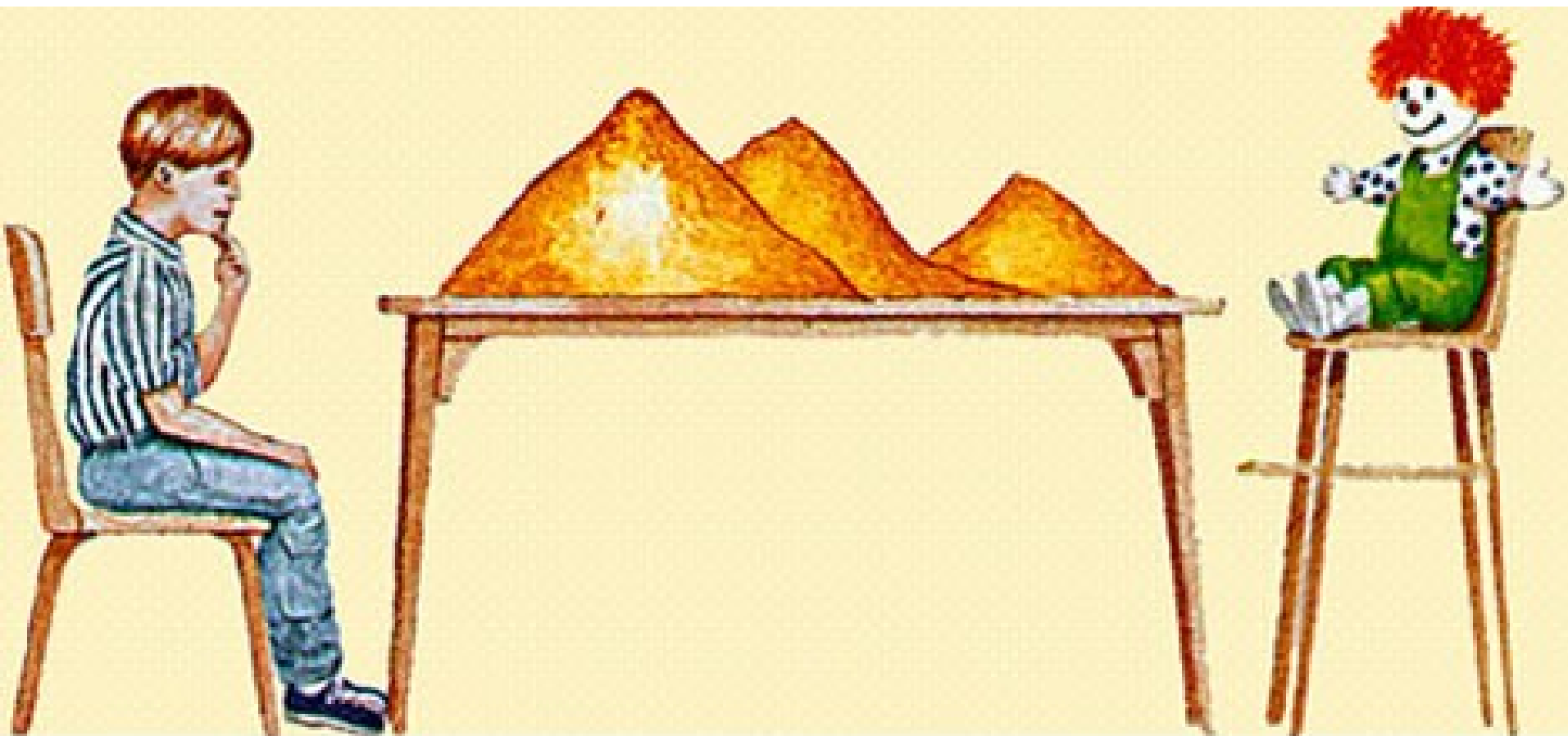
Duck squeaks

(c) Tertiary circular reaction: action gets one pleasing result, leading baby to perform similar actions to get similar results (12 to 18 months)

Beginning of Representational Thought

“At 1;4(3) [Jacqueline] had a visit from a little boy of 1;6, whom she used to see from time to time, and who, in the course of the afternoon, got into a terrible temper. He screamed as he tried to get out of a playpen and pushed it backward, stamping his feet. J. Stood watching him in amazement, never having witnessed such a scene before. The next day, she herself screamed in her playpen and tried to move it, stamping her foot lightly several times in succession.”

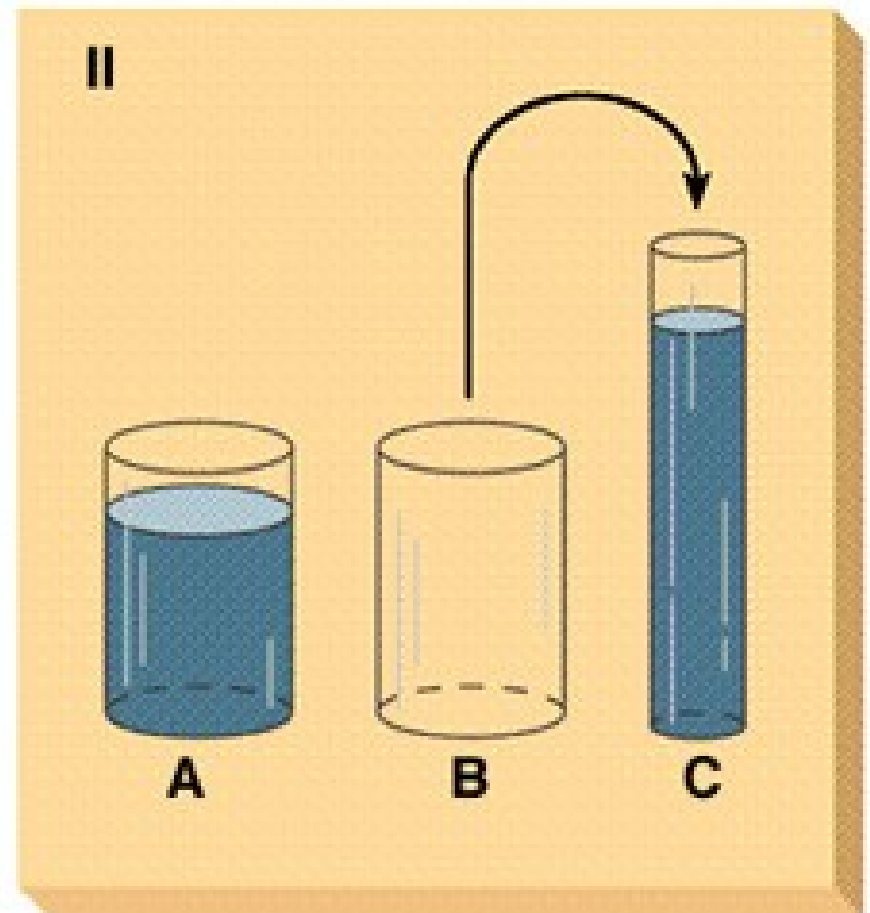
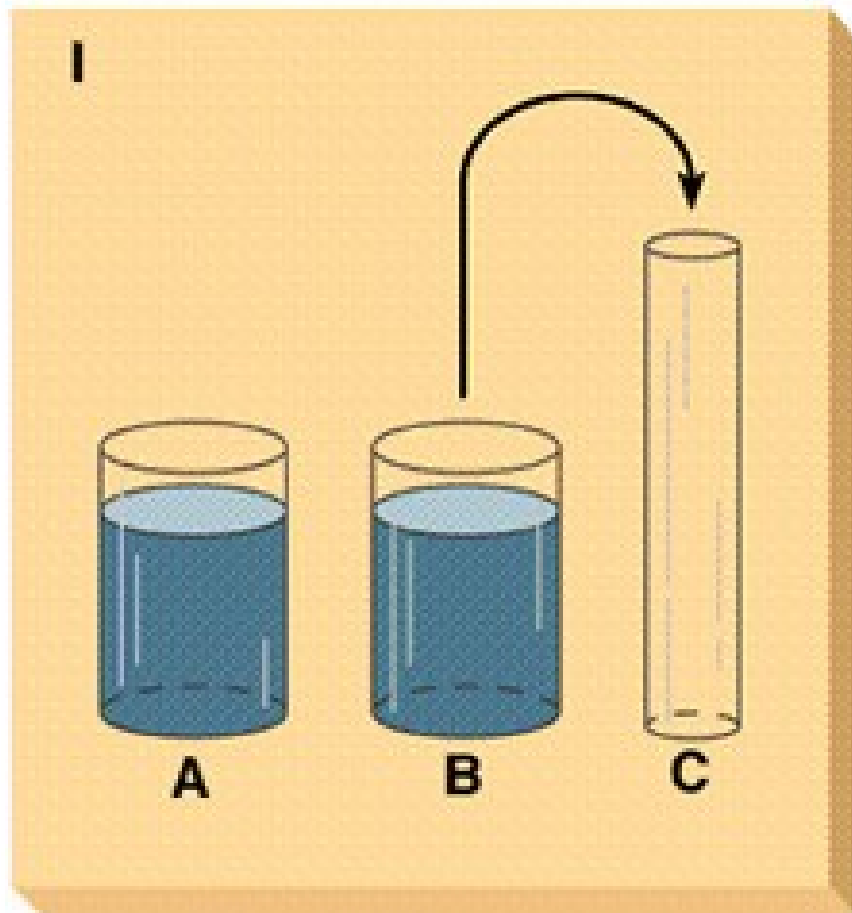
Piaget, Play, Dreams, and Imitation, p. 63



Piaget's "3 mountains" egocentrism test:

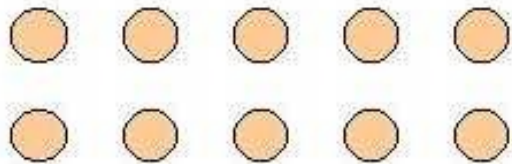
"Draw how the mountains would look from the doll's point of view."

Piaget's Conservation Task

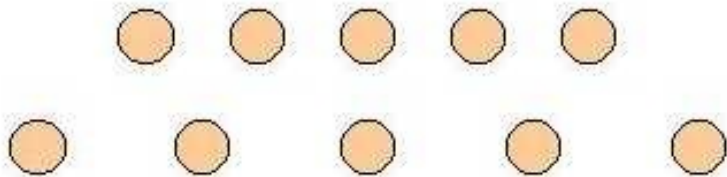


See: FIGURE 2.1 (p. 32)

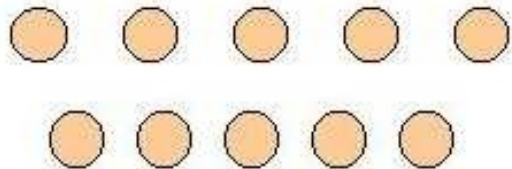
Conservation of Number Task



Child says both rows have the same number.



Preoperational child says bottom row has more.



Preoperational child says top row has more.

Conservation Tasks

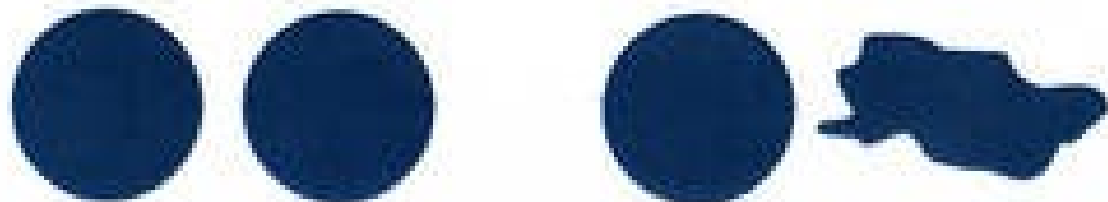
Liquids:



Length:



Mass:



Characteristics of Formal Operational Thought

Abstract

Adolescents think more abstractly than children. Formal operational thinkers can solve abstract algebraic equations, for example.

Idealistic

Adolescents often think about what is possible. They think about ideal characteristics of themselves, others, and the world.

Logical

Adolescents begin to think more like scientists, devising plans to solve problems and systematically testing solutions. Piaget called this type of logical thinking hypothetical-deductive reasoning.

Development of Some Critical Concepts (Siegler, 1991, p. 38)

Conservation

- continuation of 'conservation of existence' (i.e., object permanence) in SM period.
- Conservation of qualities (through transformation) in PO and CO periods.
- Conserve dimensions involving transformations in FO period.

Classes and relations

- 7 dogs, 8 cats: Are there more cats or animals?
- Seriation problem (p. 43)

Factors in Mental Development

Piaget and Inhelder (1969)

Stages (structure) and mechanism of development (process)

- **Stages**
 - Constant order
 - Overall structure
 - Integrative
- **Mechanisms**
 - Constructive child

Mechanisms/Processes

1. Organic Growth/Maturation

- Opens possibilities
- Necessary but not sufficient

2. Acquired experience/Learning

- Necessary but not sufficient
- Physical and logico-mathematical

3. Social interaction/socialization

- Necessary but not sufficient

4. Equilibration; central mechanism of constructivism

- Internal mechanism of all constructivism; ‘motive force of intelligence’ (p. 158)
- Equilibration: active compensations, ‘search for coherence and an organization’ (Piaget & Inhelder, 1969, p. 158)

Shortcomings of Piaget's Cognitive Development Theory

- Piaget greatly underestimated the cognitive competence of infants and children.
- Piaget's stage model is overstated.
- Piaget underestimated the importance of social and emotional contributions to development.

Evaluation

How well do Piaget's general characterizations fit children's thinking?

- E.g., is egocentrism true in all PO activities? Does it disappear after PO stage?

Current Status of Theory

- Shortcomings, but points us in right direction
- May have overestimated unity and uniformity of development
- Basic questions are right

Associationism and Social Learning Theory

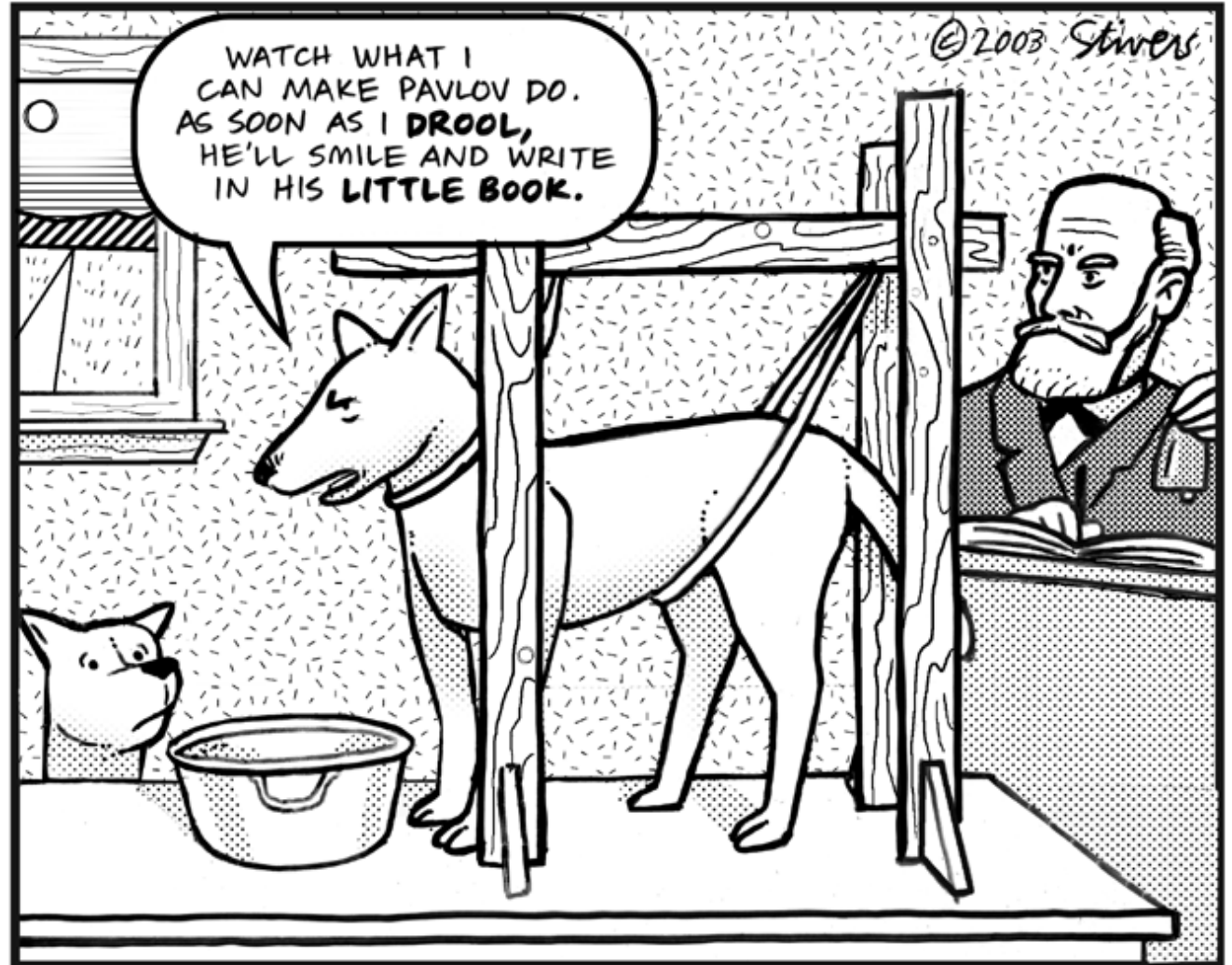
Associationist Perspective

- Associationism encompasses learning theories in general and social learning theory as well.
- Associationist perspective suggests that people have only **general purpose learning mechanisms**, allowing them to associate one stimulus with another.
- Other than these associationist learning mechanisms, the newborn mind is a **blank slate** (cf., Locke)

Classical Conditioning



Ivan Pavlov
(1849-1936)



Associationism and Social Learning Theory

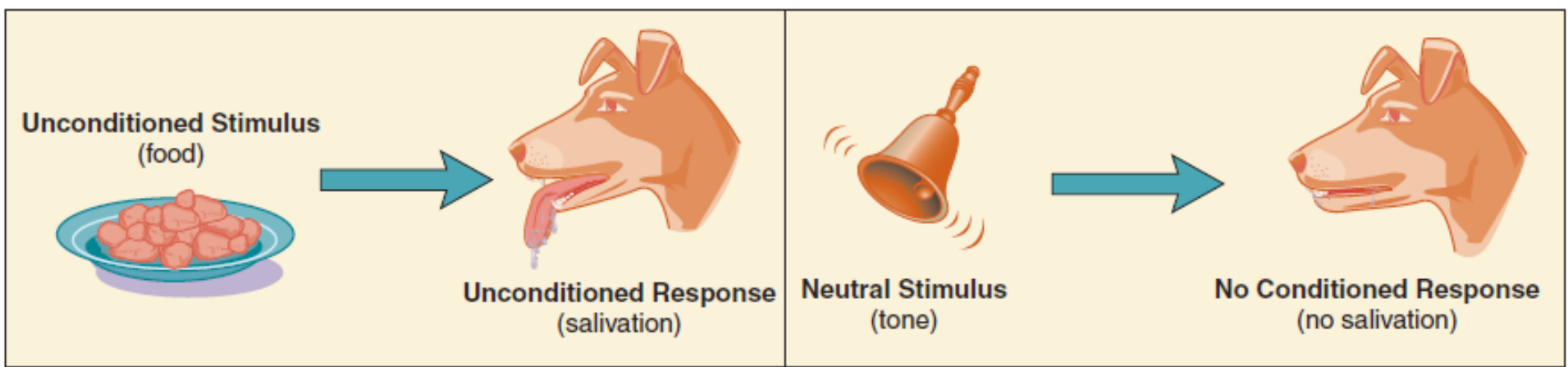
Classical Conditioning

- A learning process in which a neutral stimulus comes to be associated with a naturally eliciting stimulus so that each evokes the same response.
 - **Unconditioned stimulus** elicits a response before any training has taken place.
 - **Unconditioned response** follows the presentation of the unconditioned stimulus.
 - **Conditioned stimulus** has been associated with the unconditioned stimulus and elicits a response after training has taken place.
 - **Conditioned response** follows the conditioned stimulus once training has taken place.

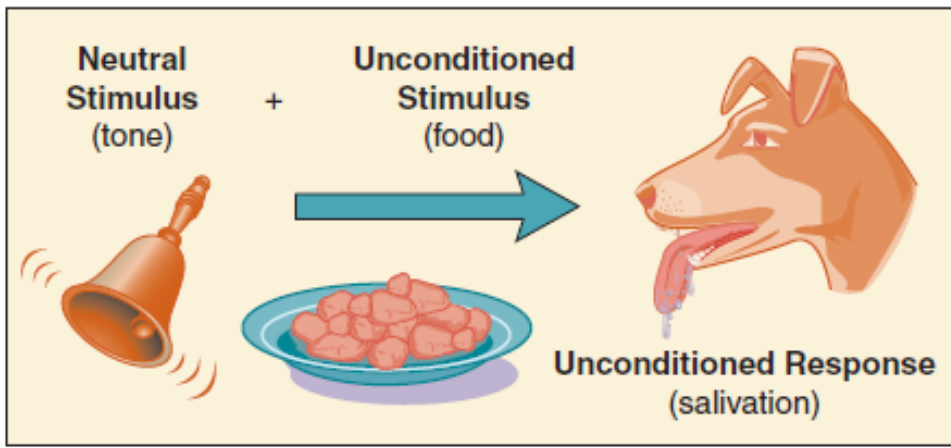
figure 2.3

Through the process of classical conditioning, the unconditioned stimulus comes to be associated with the conditioned stimulus, thus eliciting the conditioned response when presented alone.

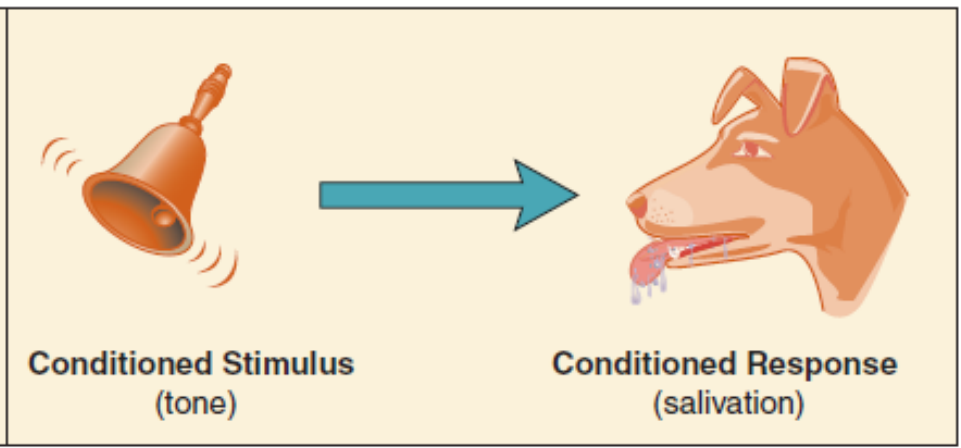
BEFORE CONDITIONING



DURING CONDITIONING



AFTER CONDITIONING



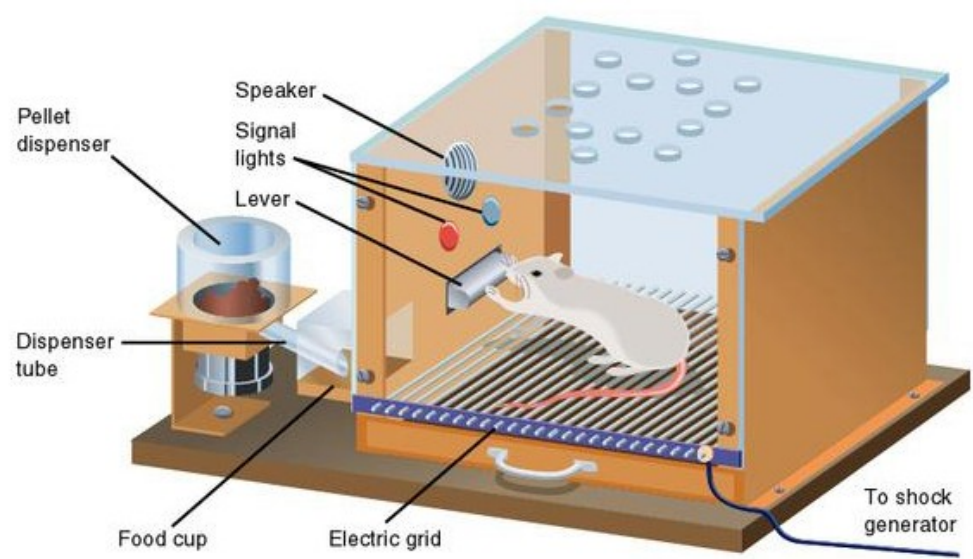
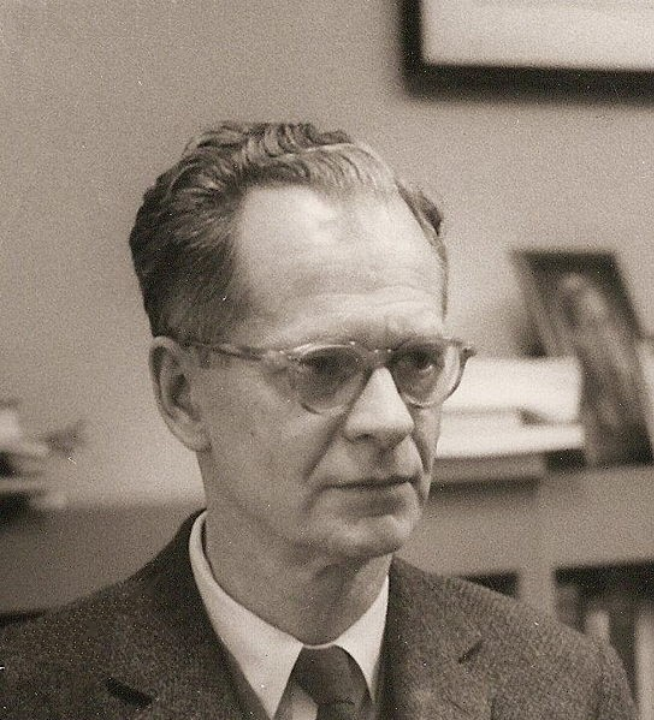


John B. Watson tests baby's grasping reflex

Associationism and Social Learning Theory

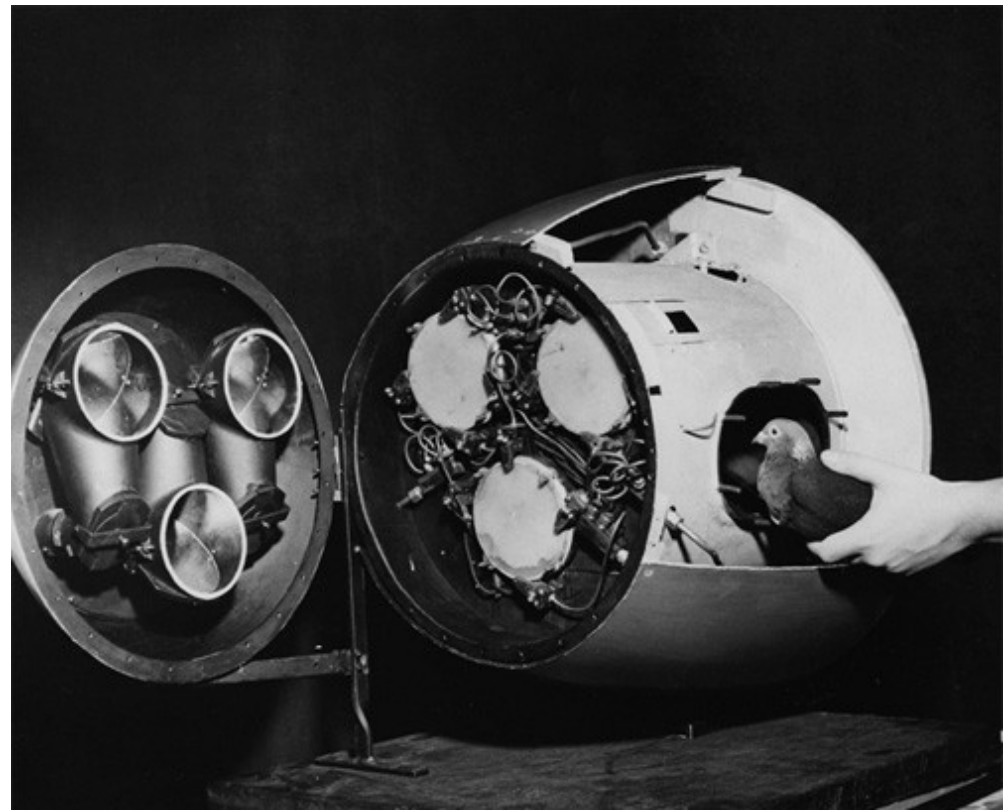
Operant Conditioning

- A type of learning in which a specific behaviour becomes more or less likely as a result of **rewards or punishment**.
 - *Reinforcer* = Any consequence that makes a behaviour **more likely** to occur.
 - *Punisher* = Any consequence that makes a behaviour **less likely** to occur.

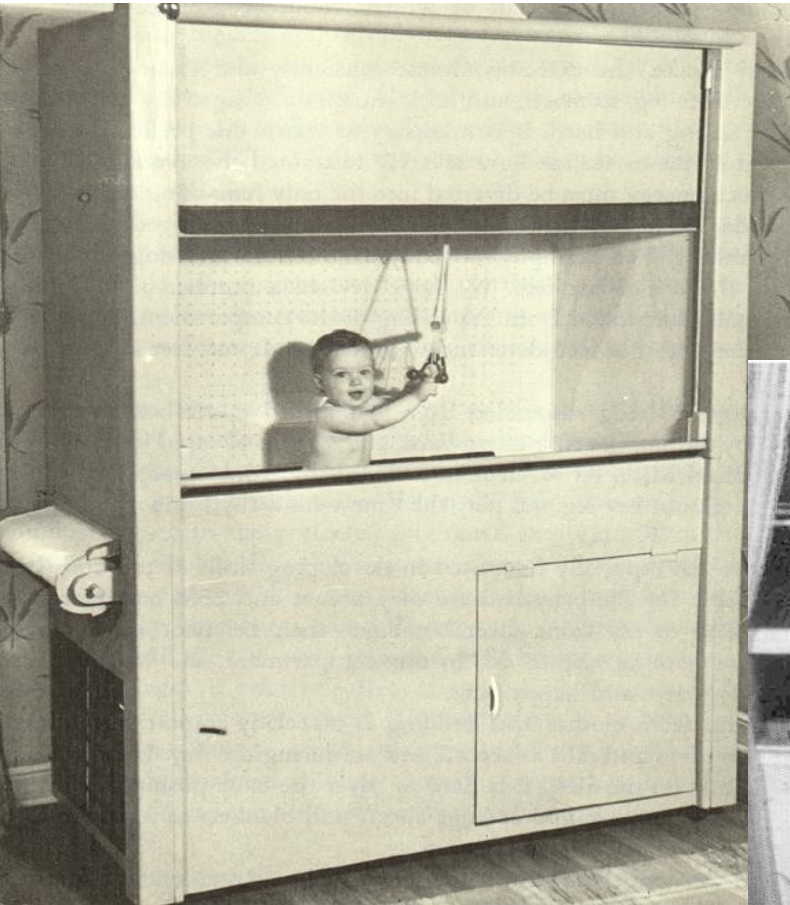


B. F. Skinner
(1904-1990)

Operant
Conditioning



Skinner's Baby Box (air crib)



Associationism and Social Learning Theory

Social Learning Theory (Albert Bandura)

- The focus of social learning theory was the process by which adults taught children to behave as proper adults.
- Imitation as a powerful learning mechanism is emphasized in addition to classical and operant conditioning.
- **Observational learning** is a process by which an actor's behaviour changes as a result of observing the model.
- Bandura demonstrated that the rewards and punishments that children witnessed (but did not receive) affected the likelihood that they would perform the behaviour.

Albert Bandura (1925-)



Bobo Doll
Experiment

Associationism and Social Learning Theory

Shortcomings of the Associationist and Social Learning Views

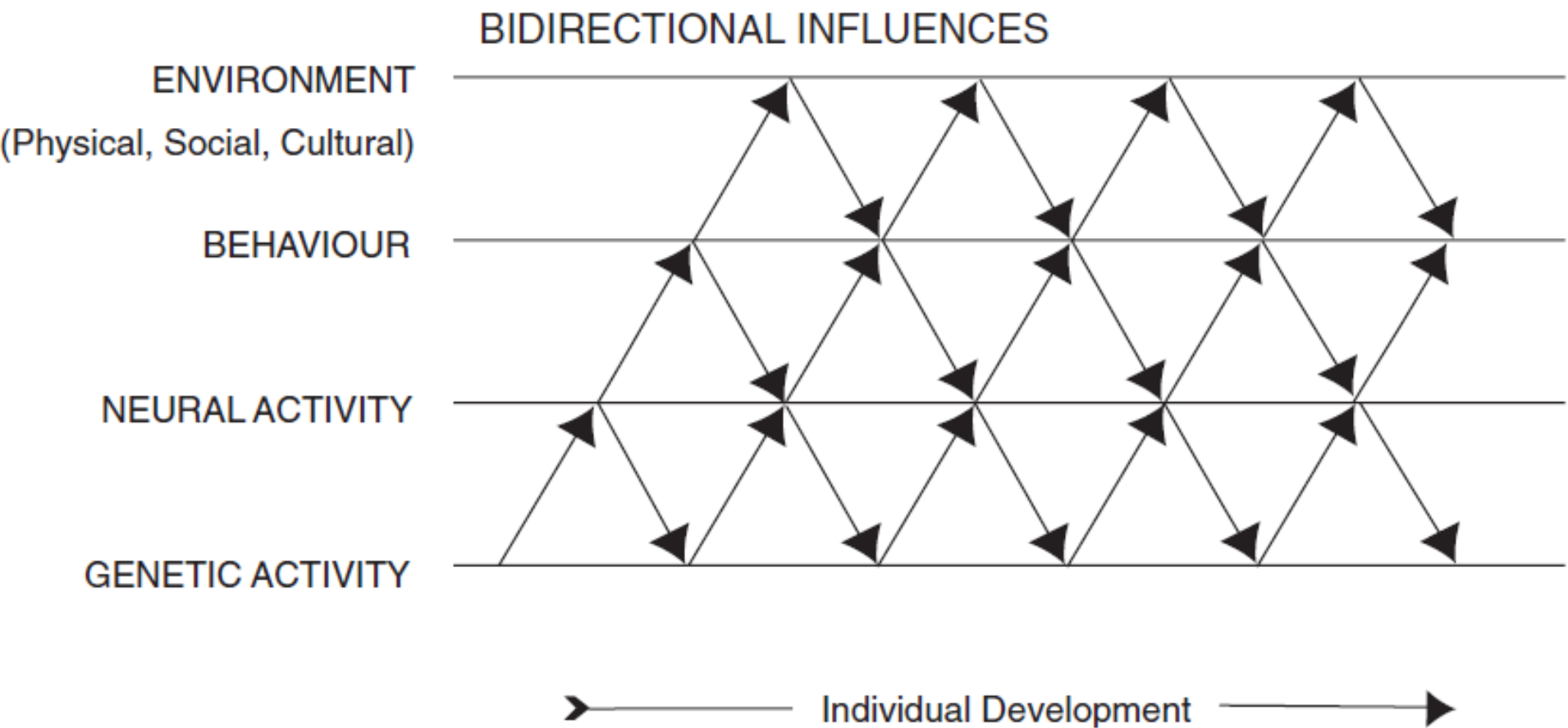
- Accounts deeply underestimate the power and specificity of learning mechanisms.
- Accounts have problems in describing how the child knows when two objects or events are similar.
- Accounts cannot ignore evolution, since the rewards have an evolutionary history.

Developmental System Theory

- A perspective that emphasizes that when it comes to complex systems, the whole is more than the sum of its parts.
- This perspective reminds us to consider all of the resources contributing to development, both genetic and environmental.
- All of the developmental resources act together as a system and are equally important to create the developing organism.
- This approach emphasizes the continual **bidirectional interaction** among genes, the brain, behaviour, and the environment during development.

figure 2.4 Bidirectional influences

Developmental systems theorists remind people to think of genes as having a bidirectional influence on behaviour such that genes, the brain, behaviour, and the environment continually influence each other during development (Gottlieb, 1991).



Developmental System Theory

Shortcomings of the DST Perspective

- The interactionist claim does not answer the complex question of development.
- DST acknowledges that numerous developmental resources interact, but it does not acknowledge a special role for genes in evolution.

Evolutionary Psychology

This approach to psychological research is mindful of our evolutionary history and the processes by which complex organisms are created.

Darwin on Psychology

- ▶ Darwin anticipated that the theory of evolution by natural selection would be important to psychology.
- ▶ Darwin contributed to the field of developmental psychology with his detailed observations and the innovation of the baby biography.

Evolutionary Psychology

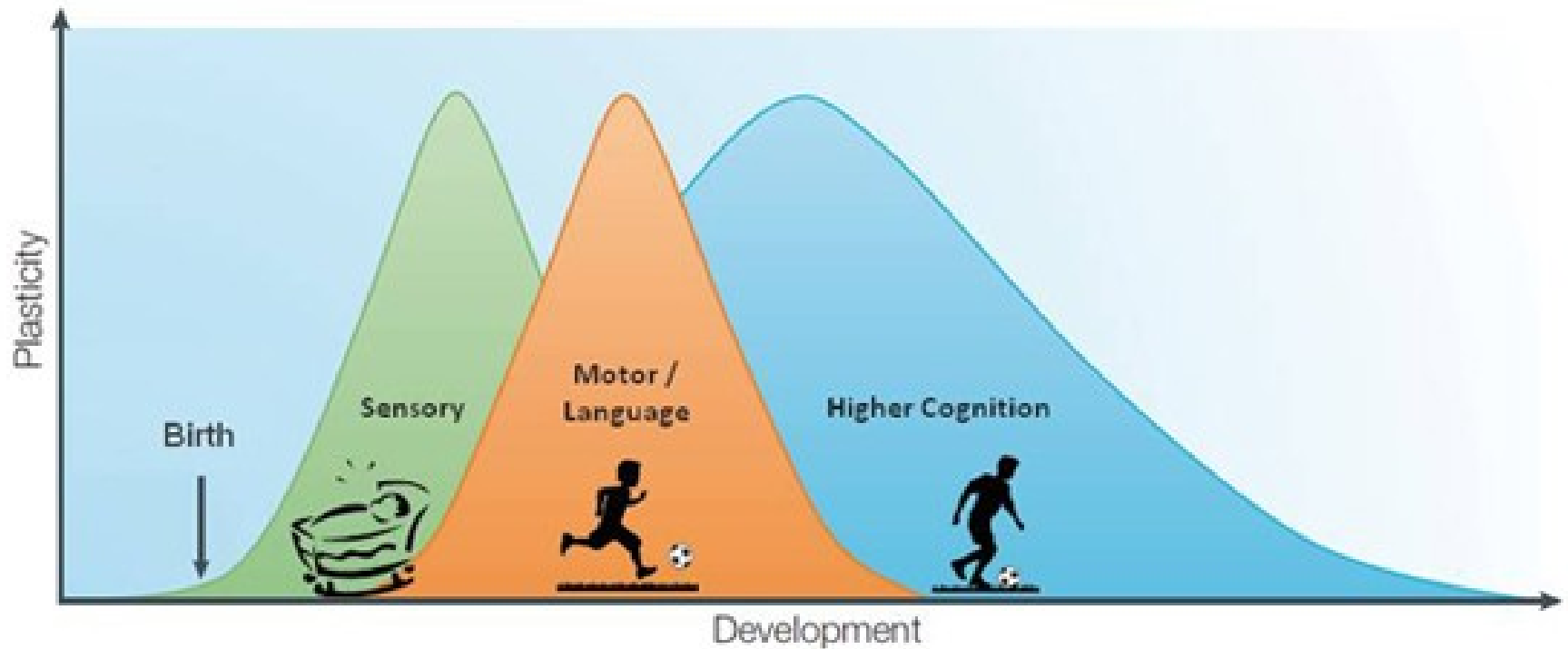
Ethology

- Studies fitness-enhancing behaviours that were shaped by natural selection.
- **Imprinting** is the psychological process by which newborns first identify their mother and then strongly attach to her (Lorenz).
- Ethology introduced the idea of **sensitive or critical periods** and **attachment** to the field of developmental psychology.

Konrad Lorenz (1903-1989)



Fig 1: Windows of plasticity in brain development

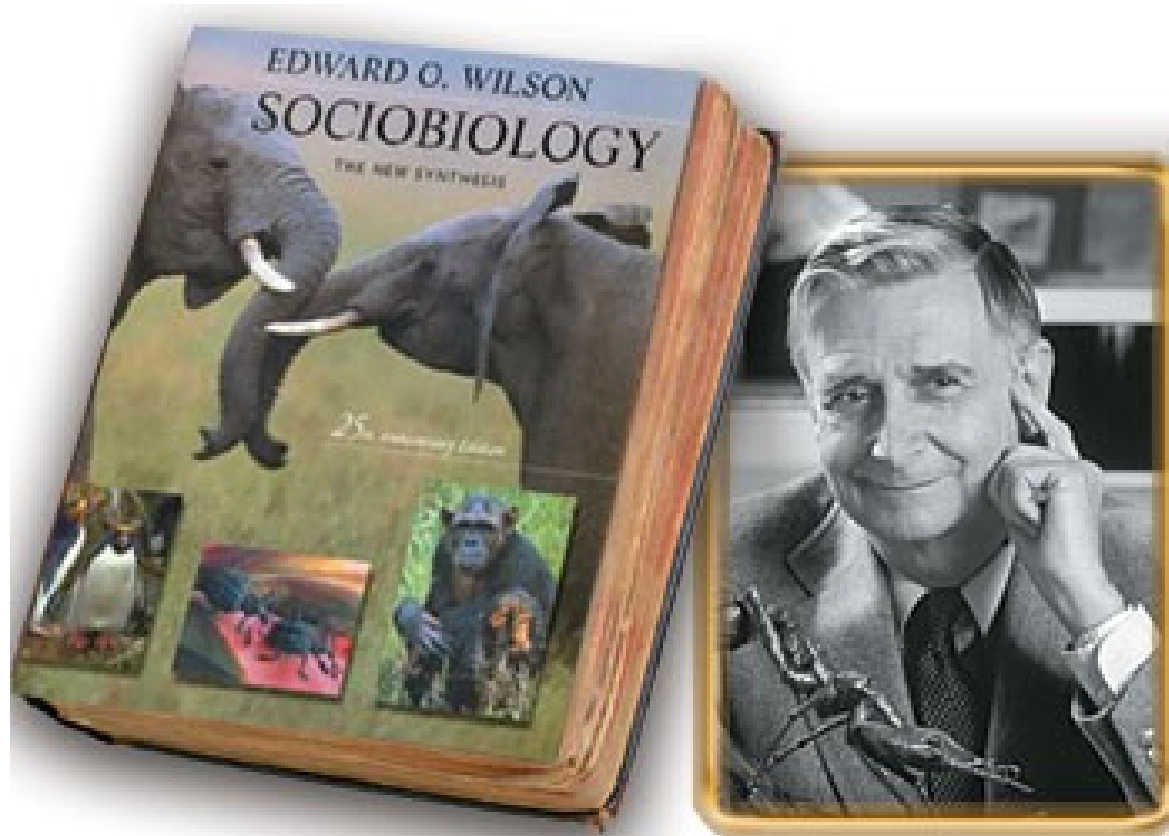


Adapted from Hensch, T. K. (2005). Critical period plasticity in local cortical circuits. *Nature Reviews Neuroscience*, 6(11), 877–888.

Evolutionary Psychology

Sociobiology

- Studies biological basis of social behaviour, popularized by E.O. Wilson in the 1970s.
- Wilson focused on social behaviours such as altruism, co-operation, mating, and aggression.



Evolutionary Psychology

Modern Evolutionary Psychology

- An approach that emphasizes the environment of evolutionary adaptedness, the EEA, or the conditions under which our ancestors lived, and to which our morphological and psychological features are adapted.
- Explicit consideration of psychology; psychological processes, not the behaviours themselves, are the product of evolution by natural selection.

Methods of Developmental Psychology

- **Cross-sectional (Between subjects)**
 - + One measurement session
 - + Relatively quick
 - + No risk of attrition or practice effects
 - Does not measure **development**
 - Could measure cohort effects

Methods of Developmental Psychology

- **Longitudinal (Within subjects)**
 - + Measures development over time
 - + No cohort effects
 - + Can measure general trends and individual differences
 - Time consuming
 - Selective attrition (definition on p. 47)
 - Practice effects (definition on p. 47)

The Best of Both

- **Cross-sequential design**
 - Two or more groups (e.g., different ages) at T_1
 - Test again at T_2
 - + Can study effect of time
 - + Buffers effects of selective attrition
 - + Can test cohort effects
 - Time consuming
 - Expensive

Cohort

Ages

1975	15	16	17	18	19	20	21	22
1976	14	15	16	17	18	19	20	21
1977	13	14	15	16	17	18	19	20
1978	12	13	14	15	16	17	18	19
1979	11	12	13	14	15	16	17	18
1980	10	11	12	13	14	15	16	17
1981	9	10	11	12	13	14	15	16
1982	8	9	10	11	12	13	14	15
1983	7	8	9	10	11	12	13	14
1984	6	7	8	9	10	11	12	13
1985	5	6	7	8	9	10	11	12

Time of measurement

1990 1991 1992 1993 1994 1995 1996 1997

Key

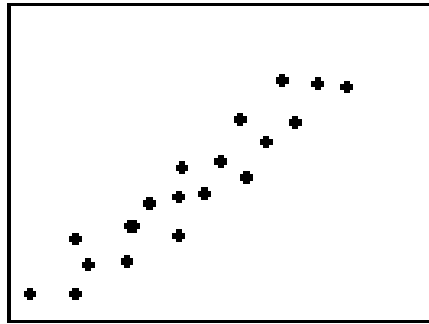
- Longitudinal ———
- Cross-sectional - - - - -
- Time-lag ———
- Cohort Sequential - - - - -
- Time Sequential ———
- Cross Sequential ———

Figure 3: Design strategies for use with age as a factor

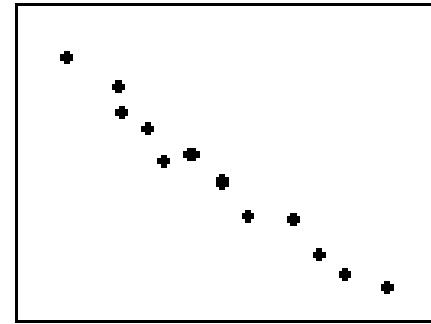
Making Inferences

- **Naturalistic observation**
 - + High external validity (generalizability)
 - Little experimenter control
 - Lacks random assignment
- **Correlational design**
 - Measure A and B to see if relationship exists
 - No manipulation/control of variables
 - Correlation coefficient (-1.0 to +1.0; 0.0 = no correlation).
 - Negative: A↑ and B↓
Positive: A↑ and B↑
 - No causal claims possible

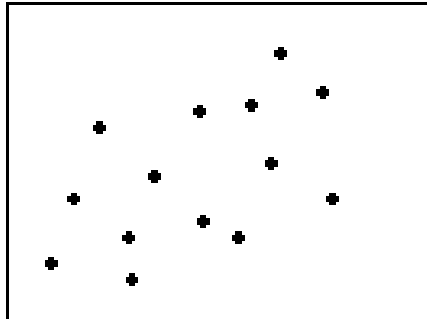
Degree of Correlation



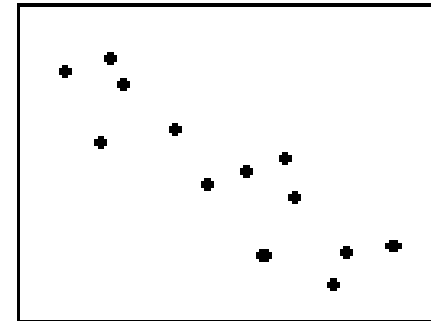
Strong Positive



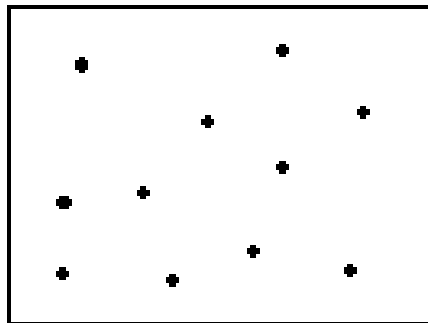
Strong Negative



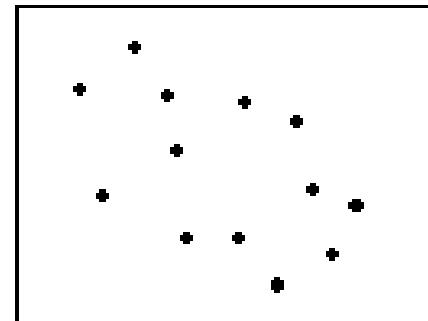
Weak Positive



Moderate Negative



None



Weak Negative

- **Experimental design**
 - IVs and DV
 - Strongest design for causality
 - Random assignment of subjects
- **Within-subjects Design**
 - Multiple measures with same subjects
 - E.g., time (aging) or manipulation between T_1 and T_2 is of interest
- **Between-subjects Design**
 - Compare two groups
 - Random assignment, but ensure match groups on demographics

Psychophysical Methods

Pre- and non-verbal children

- **Preferential-looking paradigm**
 - David Teller, 1970s
 - 2 sides of visual display; viewing aperture between
 - Technological advances:
 - Computer presentation
 - Eye trackers

- **Habituation paradigm**
 - Look longer at things that are novel/interesting (not habituated)
 - Technique can falsify hypothesis that baby cannot discriminate between two stimuli
- **Violation of expectations paradigm**
 - Look longer at impossible events
 - Test infant's expectations about world

- **Non-visual psychophysical techniques**
 - Autonomic nervous system changes (heart rate, pupil dilation, sucking rate, etc.)
 - EEG recording
- **Reliability**: research results repeatable?
- **Validity**: test measures what researcher intends?
 - No reliability → no validity
 - No validity → could be reliable
- *Internal validity*: Issues of recruiting, screening, test design, bias in test setting
- *External validity*: Will study generalize to real world or only the stimuli used?

Ethical Considerations

- What factors are weighed in determining whether research is ethical?
- What special considerations apply when dealing with children?
- What is an IRB?

Is it Ethical?

- Balance risks and benefits
- **Risks** could be possible harm to subjects
- **Benefits**: Important and valid scientific questions (basic, e.g., working of mind, and applied, e.g., therapies/treatments)
- Benefits **must** outweigh risks to be ethical

Society for Research in Child Development's Ethical Standards for Research with Children

- 16 Standards/Principles (p. 57)
- **Basic themes:**
 1. Non-harmful procedures (least stressful)
 2. Consent (inform child; parent; third parties)
 3. Deception (with debriefing)
 4. Right to privacy (protect identity, anonymity, confidentiality)
 5. Right to knowledge of results (and benefits of treatment if shown effective)

Chapter 3

The Basics: Evolution, Genes, and Conception

A Modern Understanding of Evolution

Evolution is defined as

- the processes that lead to changes in the relative frequency of alleles over the course of successive generations.

Modern Synthesis (Darwin and Mendel)

- The modern understanding that the gene, Mendel's particulate mechanism of inheritance, was the heritable matter that Darwin's theory of evolution relied on.

Darwin's Problem: Blending Inheritance

Darwin's problem was the implication that traits (inherited in 'fluid') would average in the offspring.

- Blending inheritance: any advantageous mutation would be diluted in subsequent generations.
- Evolution by natural selection would not be possible.
- Mutation would not be possible.

Mutation

- A spontaneous error; failure to create a true replica in the process of DNA replication, resulting in a novel sequence.

figure 3.1 Darwin's problem: Blended inheritance

Suppose a new mutation came along that led to an advantage. When the lucky individual with this advantageous gene passes it on, the gene is blended with that of the other parent, leading to offspring who are intermediate. The advantage is diluted more with each generation and will never have the chance to spread.






Mendelian Inheritance

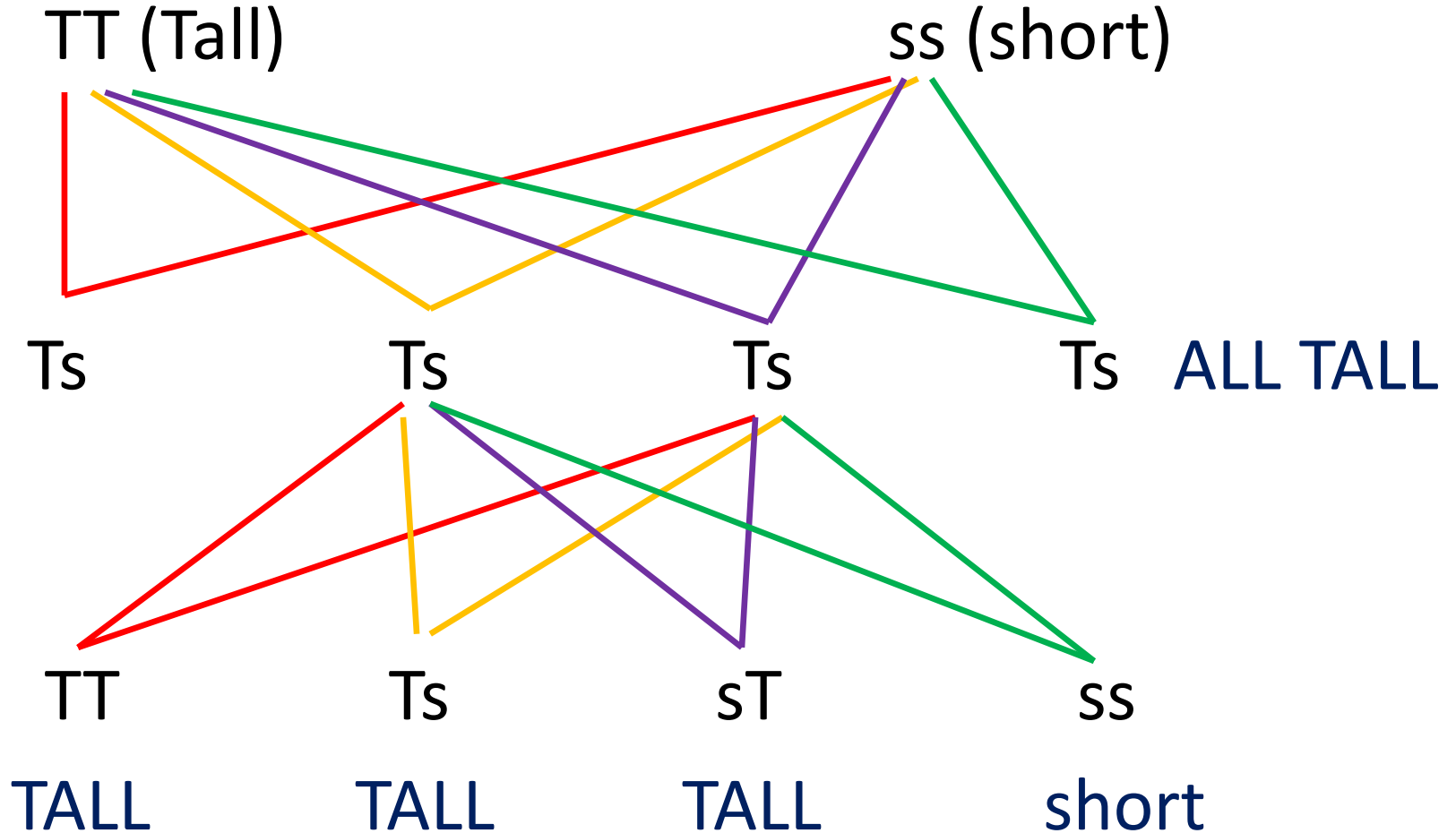
- Mendel conducted two critical experiments.
 - A purebred short plant and a purebred tall plant were crossed
 - The first hybrid generation (F1) was uniformly tall.
 - The second hybrid generation (F2) had $\frac{3}{4}$ tall plants and $\frac{1}{4}$ short plants.
- Inheritance was particulate: information contained in coherent bits that retained character (even if not expressed).
- There is **no irreversible blending** of characteristics. A trait not seen in one generation could reappear in succeeding generations.
- There are dominant and recessive genes.

figure 3.3 Mendel's Experiment

Mendel found that when a purebred short plant and a purebred tall plant were crossed, although the first hybrid generation was uniformly tall, the second hybrid generation had short plants. There was no irreversible blending of traits, and a trait not seen in one generation could reappear in the next.

EXPERIMENT	
Parent plants	
First hybrid generation	
Second hybrid generation	

Tall dominant



Chromosomes, Genes, and Alleles

Chromosome

- A single molecule comprising a very large DNA helix.
- A single chromosome may include thousands of genes.

Gene

- Difficult to define
- A functional sequence of DNA that remains across a large number of generations, potentially long enough for it to function as a significant unit of natural selection (Dawkins, p. 70).
- Seeing gene as blueprint, code, plan is a **metaphor**.

Allele

- One possible form of a gene that may occupy a particular location on the chromosome.
- Once selected to the point of being universal, we call it a gene.

Evolutionary Processes

Mutation

- One process that leads to changes in gene frequency.
- Creative process in evolution; generates possibility of change.

Genetic Drift

- The change in gene frequency that results from the fact that genes pass from parent to offspring through random selection.

Founder Effect

- A special case of genetic drift in a small ‘founder’ population.
- Can create ethnic groups susceptible to specific genetic disorders.

Bottleneck

- A situation in which the population is drastically reduced for at least one generation, such that genetic diversity is lost.

Adaptations, By-Products, and Noise

- Adaptation
 - A trait that is designed and preserved by the process of natural selection as a result of having conferred a reproductive advantage in the environment in which it evolved.
- By-product
 - A trait that has come about as a result of natural selection, though it was not itself selected for, and has not historically performed, adaptive functions.
- Noise
 - A product of evolution by natural selection that is composed of the random effects of traits that were not selected.
 - Result of mutation or new environmental circumstances.

Adaptations, By-Products, and Noise

Distinguishing adaptations from by-products and noise

- Evidence by looking for hallmarks, such as efficiency, economy, precision, and reliability.

Exaptations

- A feature, now useful to an organism, that did not arise as an adaptation for its present role but was subsequently co-opted for that function.
 - For example, bird feathers were adapted to solve the problem of thermoregulation and later became adaptive because of their role in flight.

What Does DNA Do Anyway?

- ▶ DNA is composed of chromosomes and can store information because it is made of sequences of four types of nucleotides. Two strands of DNA zip together to form a double helix.
- ▶ The two strands, weakly bound to each other, unzip and then form bonds with available complementary bases to create two new identical DNA strands.

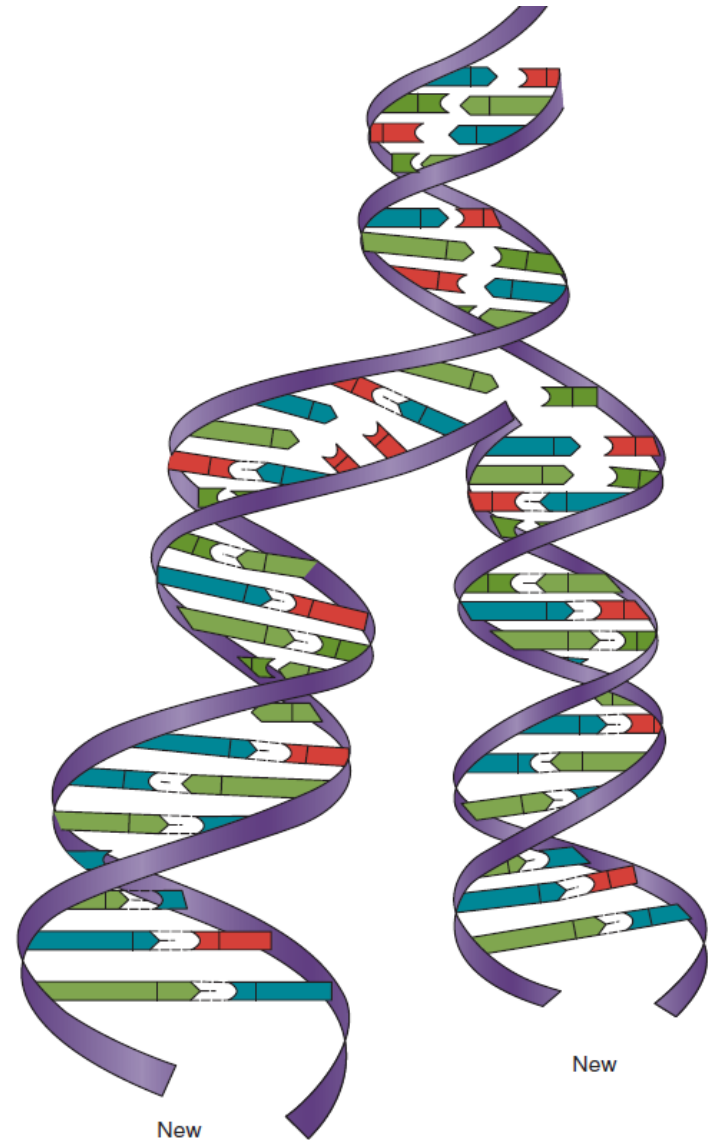
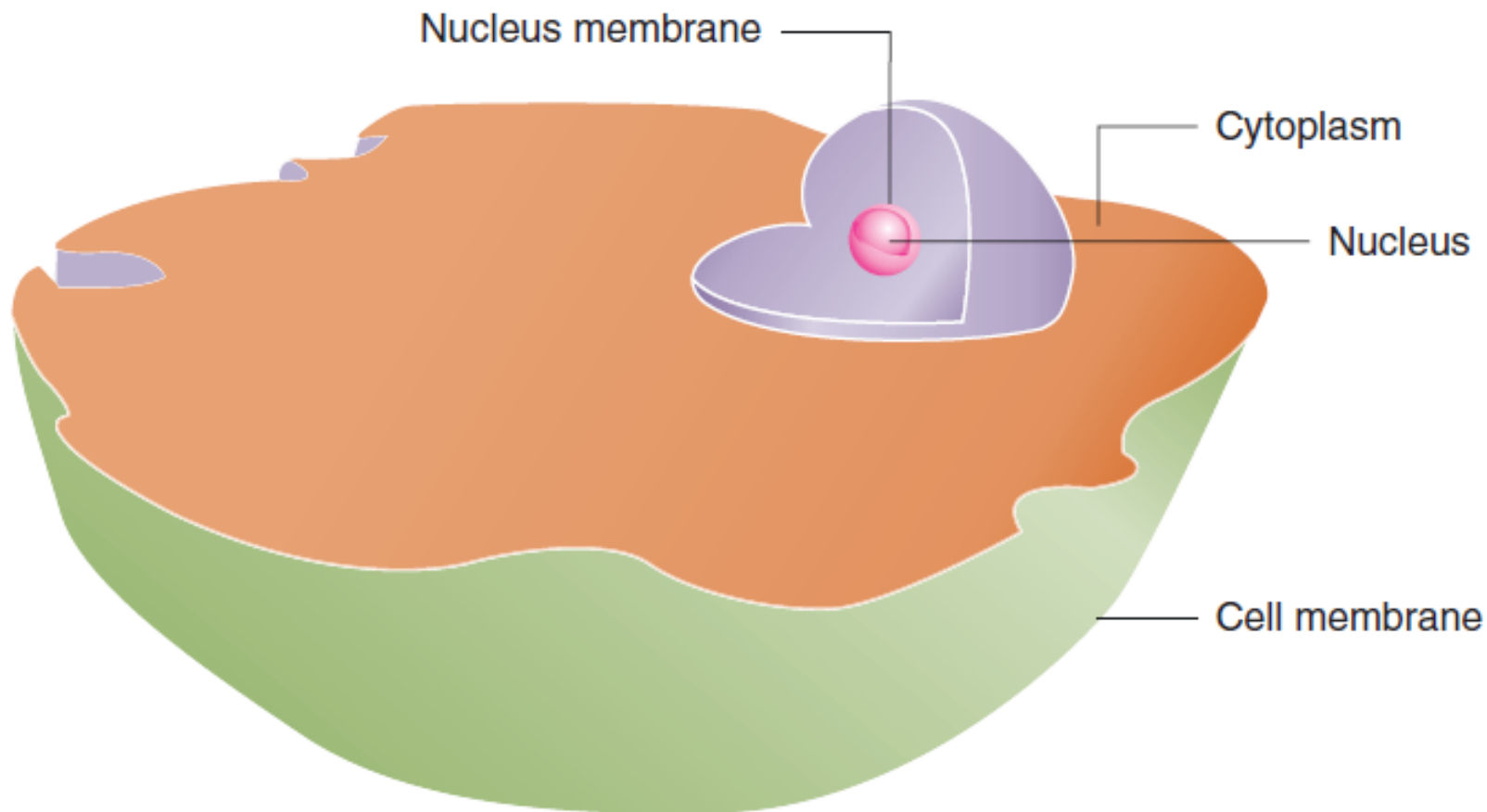


figure 3.6 A cell

Each cell has a cell membrane that is full of cytoplasm, a fluid in which all the organelle float about. In the cytoplasm is the nucleus, which is enclosed in the nuclear membrane. Within that cell nucleus are chromosomes, which comprise DNA.



What Does DNA Do Anyway?

Proteins

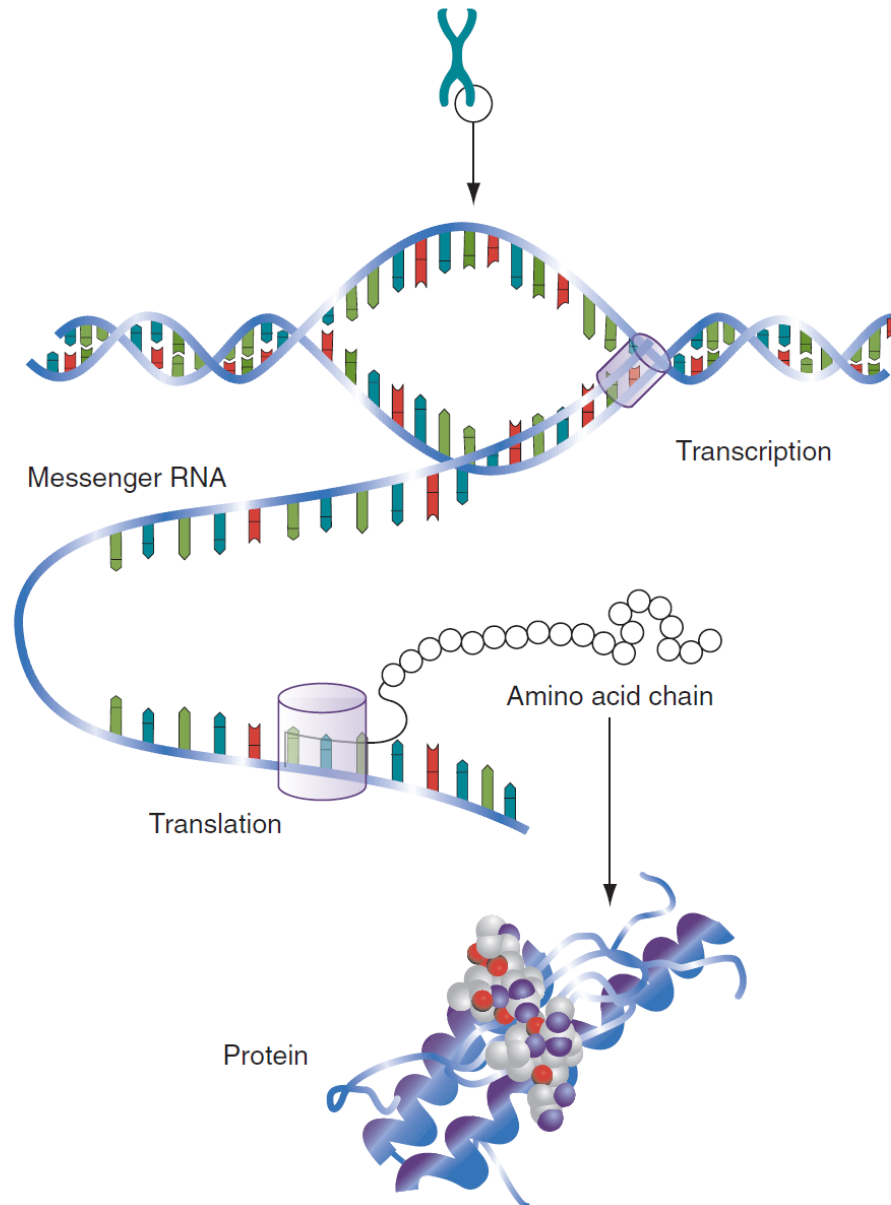
- Sequences of amino acid that combine and fold in specific shapes in order to accomplish specific functions.

Messenger RNA

- A molecule that serves as an intermediate step when DNA is transcribed to make a protein.
- Sequence of messenger RNA is read from the DNA molecule and is then translated into a protein.

figure 3.8 Transcription

Proteins are created via two steps: The DNA is transcribed into messenger RNA, and then the messenger RNA is translated into a protein.



What Does DNA Do Anyway?

The relation between DNA and the outcome protein is not deterministic, but rather is designed to be influenced by the environment right from the start.

Pleiotropy

- The phenomenon of a single gene having effects on more than one phenotypic trait.
- One gene might affect multiple developmental outcomes.
 - For example, a single gene mutation might cause different outcomes in cognitive function and in skin pigmentation.
- Pleiotropy has been used to explain diseases, cancers, and senescence.

Interactionism: The Bidirectional Influences of Developmental Resources

Interactionism

The perspective in developmental science that development unfolds as a result of the interaction between genes and all other 'developmental resources'.

Examples:

- Interaction between genetic susceptibility to depression and environmental factors.
- Social status and stressors can affect gene expression.

Events during the lifetime of an adult can affect the expression of some genes.

Genes and Depression

- Serotonin is a neurotransmitter.
- The serotonin transporter gene comes in two alleles.
- The shorter version of the allele is linked to depression, but not directly (determinist).
- Only if the childhood environment of someone with the shorter version includes major stressor or trauma, does the depression and suicidality risk increase.
- Therefore, genes **interact** with environment.

Social Status and Gene Expression

- Usually think genes give attributes that affect social status. But...
- In fish, social rank affects expression of gene coding for sex hormone (androgen, estrogen) receptors.
- \uparrow rank \rightarrow \uparrow receptors \rightarrow \uparrow sexual behaviour
- \uparrow rank \rightarrow \uparrow receptors \rightarrow \uparrow dominant behaviour
- Also seen in some rats
- Loneliness in humans affects gene expression

Scarr's Niche-Picking Theory

- Traditional view: families create environment for child development (e.g., books at home encourage reading). But...
- Child contributes too, picks niche. Interest in books evokes response in parents.
- Older children more actively choose areas of interest.

Meiosis, Conception, and Pregnancy

Zygote

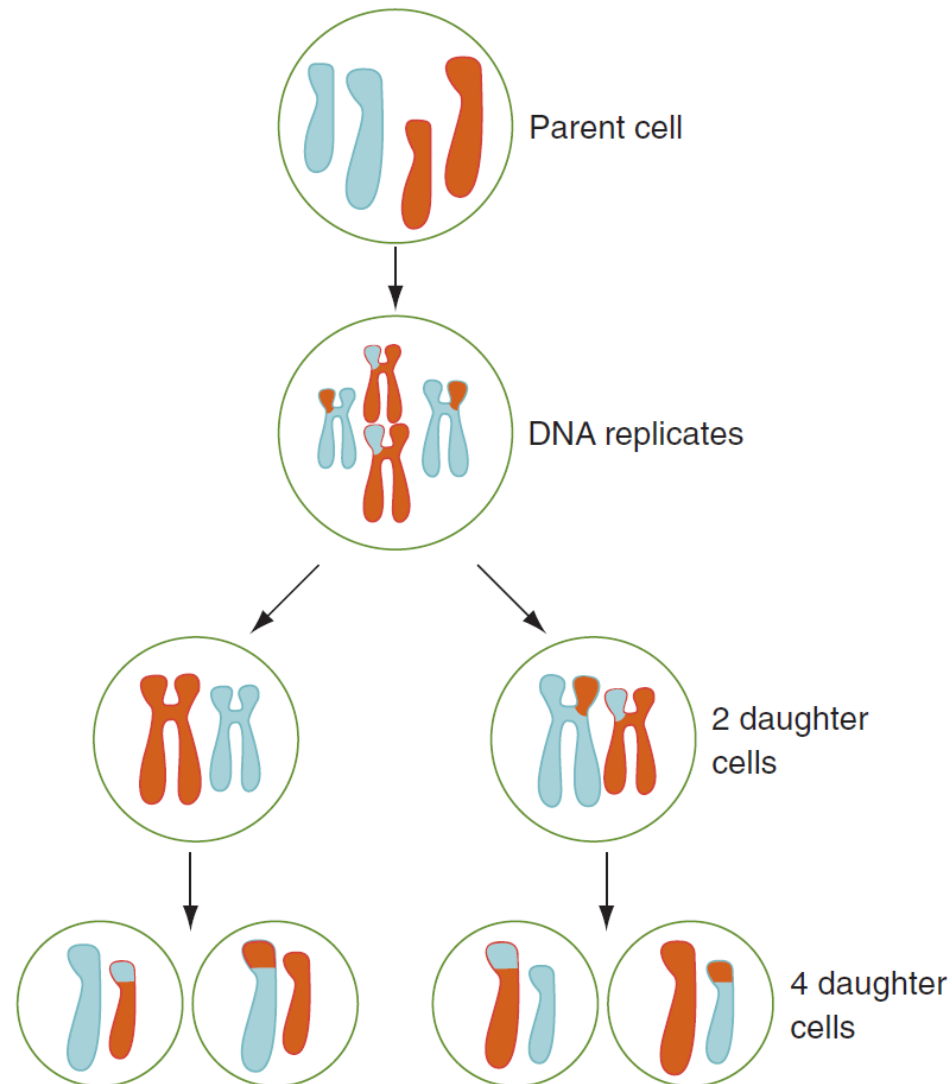
- The fertilized egg, which is still in the single-cell stage.
- Full complement of genetic material.

Meiosis

- Process by which sex cells produced.
- The process in which the complete set of pairs of chromosomes are reduced to a single set of unpaired chromosomes.
- Four daughter cells are created from the two intermediate daughter cells.
- Which chromosome goes into which cell is determined by chance.

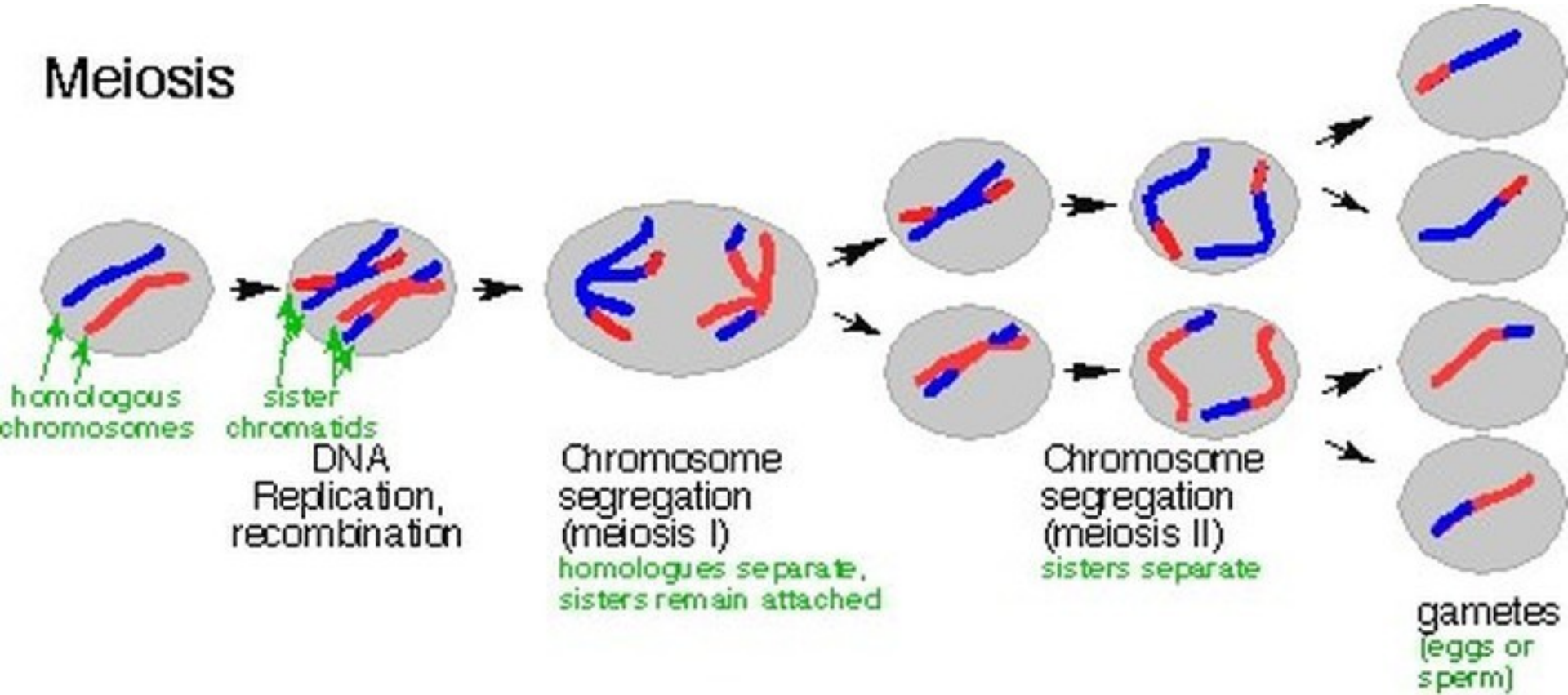
figure 3.10 Meiosis

Meiosis is the process in which the complete set of pairs of chromosomes is reduced to a single set of unpaired chromosomes. Then, four daughter cells are created from the two intermediate daughter cells. Which chromosome goes into which cell is determined by chance: the genes are shuffled by design.



Meiosis

Meiosis

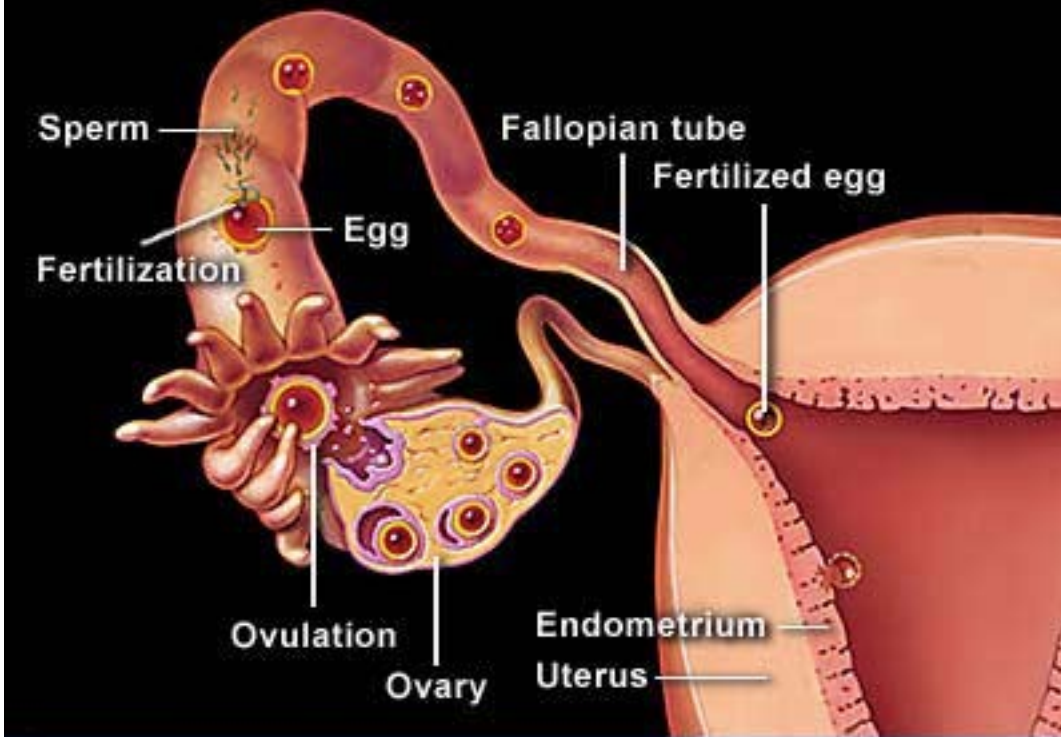


Alternative Technologies in Fertility

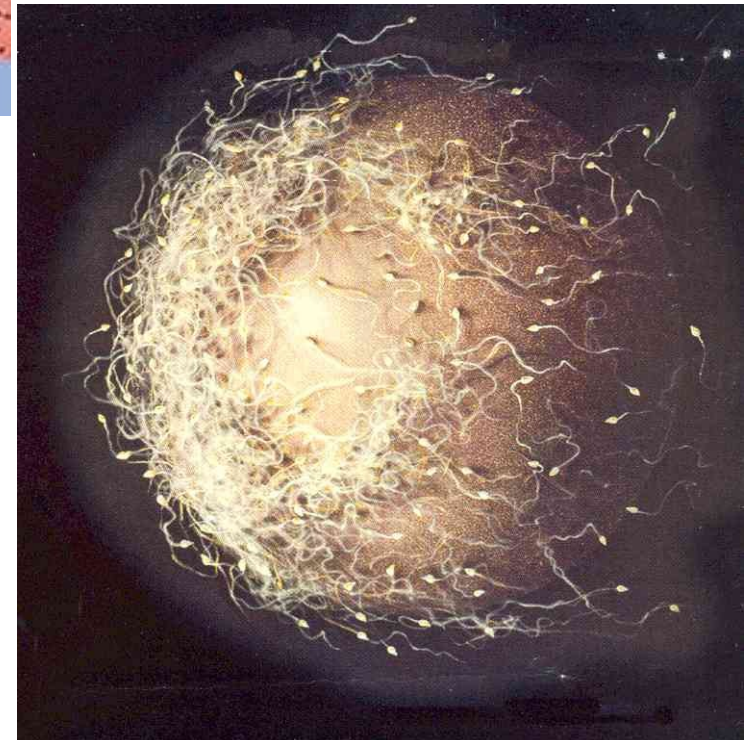
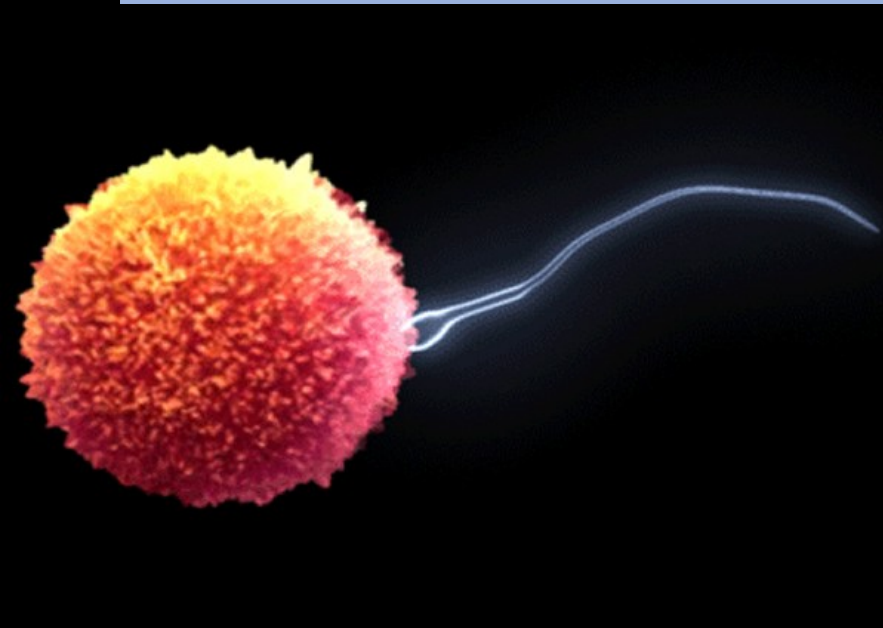
Modern technologies

- Donor insemination
- In vitro fertilization (IVF)

How are IVF babies doing? (p. 90)



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Meiosis, Conception, and Pregnancy

Monozygotic twins

- Twins that form from one zygote and thus have identical genomes.
- Also called ‘**identical**’ twins but are not, in fact, identical people.
- They may have had different prenatal environments (e.g., different placentas, amniotic sacs), accounting for differences.
- Often develop different specializations in order to reduce direct competition in their local environment (psychological adaptation).

Dizygotic twins

- Twins that develop from two completely different zygotes and thus have different genomes.
- Also called ‘**fraternal**’ twins; genetically related to each other as two brothers would be.

Meiosis, Conception, and Pregnancy

Pregnancy timeline

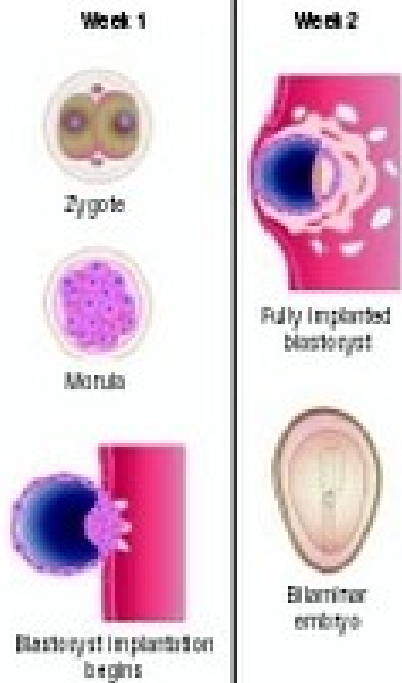
- | | |
|------------------------|------------------|
| – Conception – 2 weeks | germinal period |
| – 3 – 8 weeks | embryonic period |
| – Remaining weeks | fetal period |

Adaptations in pregnancy

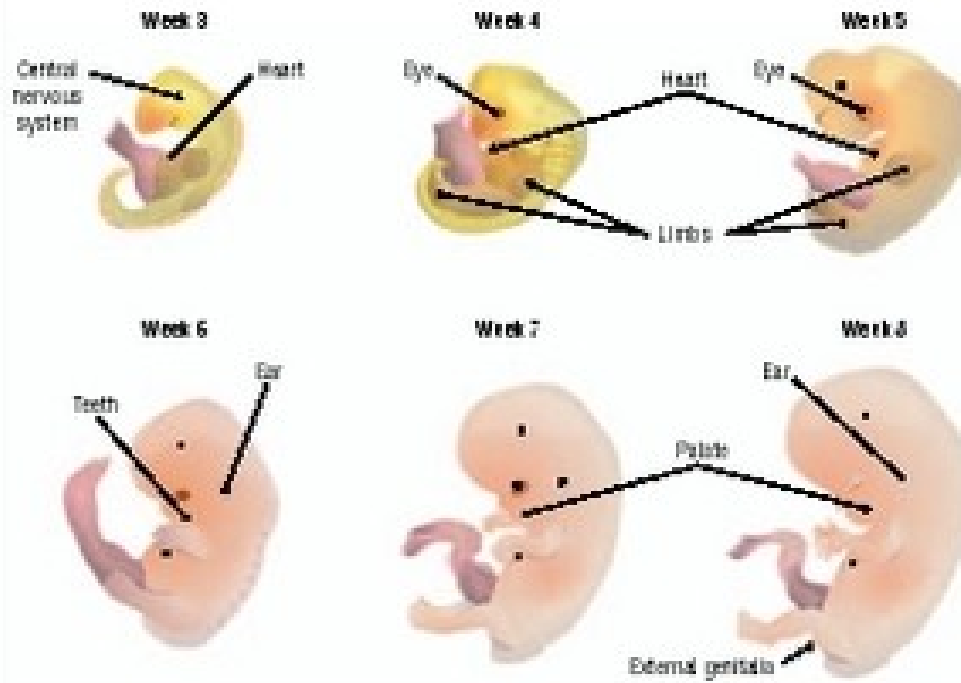
- Pregnancy sickness, once thought to be an illness, is an adaptation that protects the fetus from toxins in the diet.
- Happens during the first trimester when the fetus's developing nervous system is most vulnerable to the exposure of toxins.
- Women who experience pregnancy sickness are less likely to have a miscarriage.

Prenatal development

Germinal period



Age of embryo



Fetal period



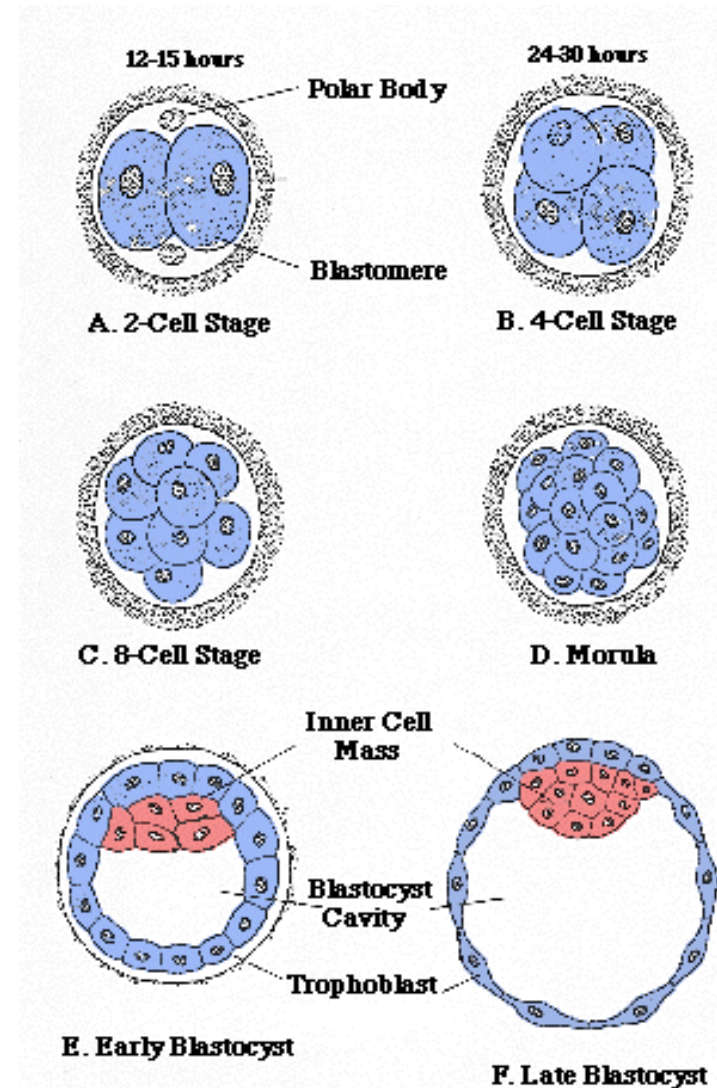
• Indicates area of development

Stages of Prenatal Development

Gestation = 38 weeks

1. Germinal (up to 150 cells)

- Conception to 14 days
- Zygote becomes blastocyst (2 layers); inner layer forms embryo
- Implants in uterine wall



Stages of Prenatal Development

2. Embryonic (up to 1 inch, 2.5 cm)

- Weeks 3-8
- Placenta & umbilical cord form
- Heartbeat at 4 weeks; lungs, limbs, fingers, eyes, nose, mouth, etc. in rudimentary form (organogenesis)

3. Fetal (up to 20 inches/50 cm and 7 lb/3.2 kg)

- Weeks 9-38/birth
- Refine organs, ready for life outside womb
- Viability at 24 weeks
- **Fetal brain**: neuronal proliferation and migration; glial cells (glue)

Brain Development

Neuron

- A nerve cell that is specialized for conducting information between the brain and other body parts or within the brain.

Axon

- The long fibre that runs the length of a neuron, conducting the electric signal from the cell body to the terminals.

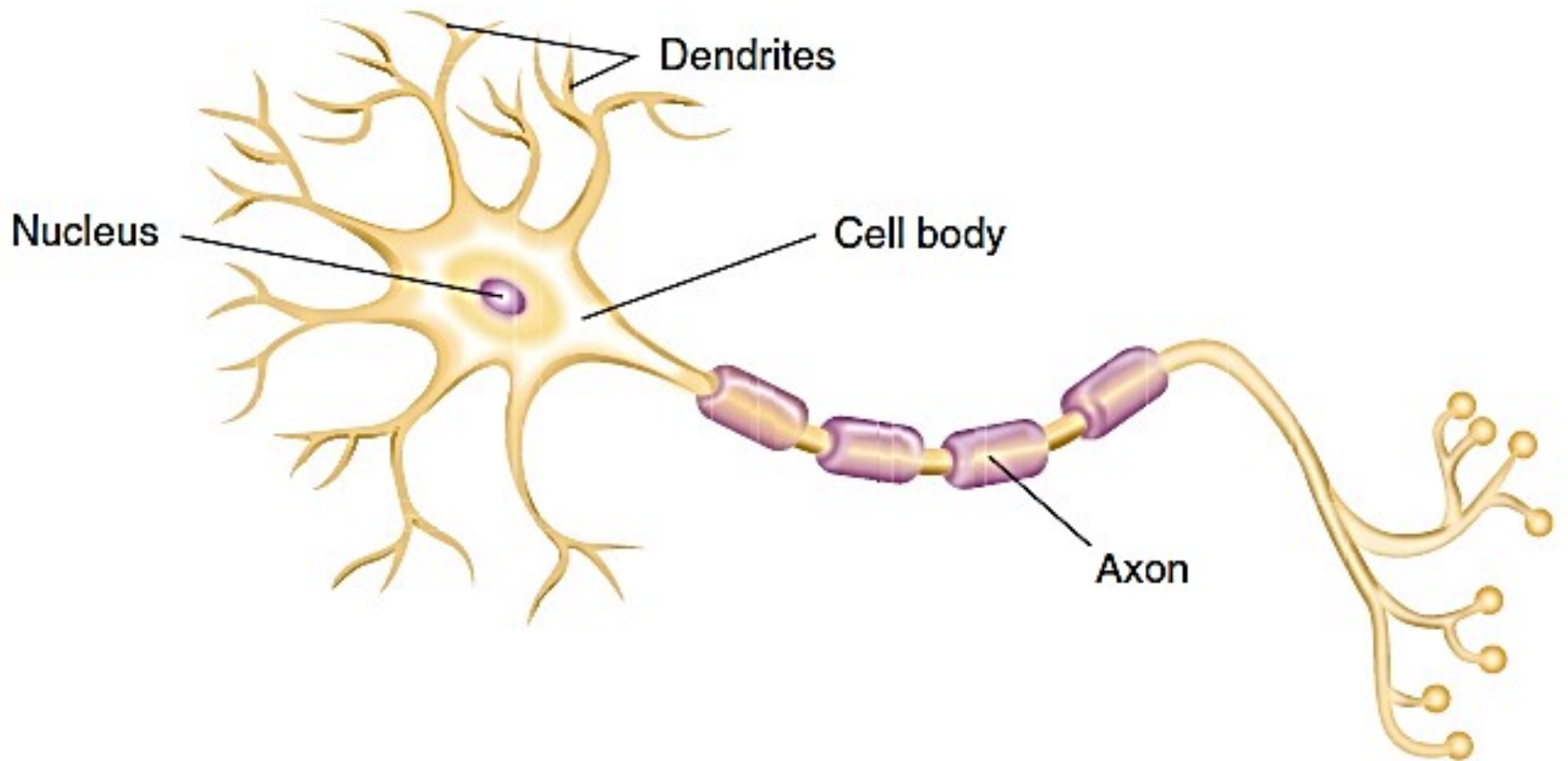
Dendrite

- One of the fibres extending from the cell body of a neuron, designed to receive a signal from a nearby neuron.

Synapse

- The gap between two neurons, across which a chemical signal is transmitted (neurotransmitters).

Brain Development



Brain Development

Myelination

- Development of a fatty sheath around the axon.
- Sheaths serve as insulation, allowing for signals to travel faster.

Synaptogenesis

- Growth of synapses between neurons.

Synaptic Pruning

- Developmental process by which synapses are eliminated.
- Creation of excess neurons and pruning provides **plasticity**

Brain Development

Hemispheric Specialization

- The two hemispheres of the human brain are specialized
- Left hemisphere:
 - Processing language information
- Right hemisphere:
 - Spatial thinking and visual imagery
- Both hemispheres:
 - Processing sensory information and sending motor commands to the other side of the body