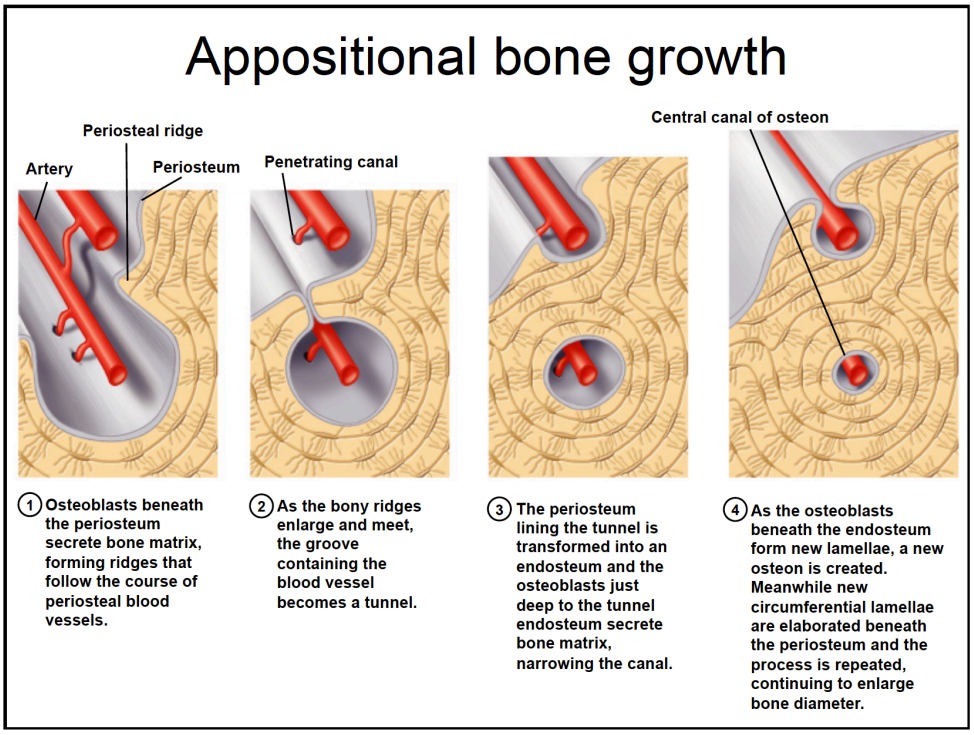
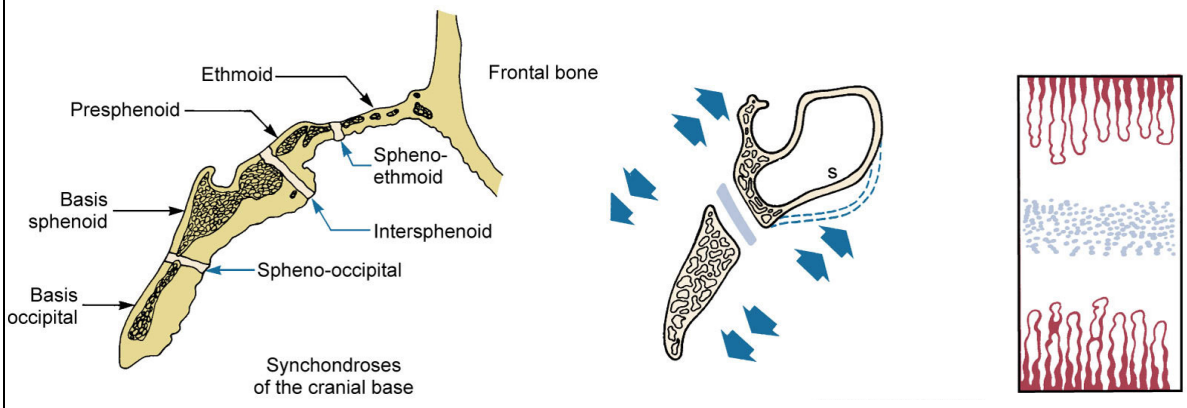


Development of the mandible Intramembranous (except condyles = enchondral)	- Begins with mesenchyme condensation lateral to the **Meckel's cartilage** (cartilage of the 1st pharyngeal arch) and proceeds by intramembranous bone formation. - Meckel's cartilage largely disappears as the bony mandible develops. Some remnants (Hammer & Amboss = incus & malleus) in the middle ear. - Condylar cartilage initially develops as secondary cartilage independent and separated → fusion in early fetal life with the mandible.
Development of the maxilla Intramembranous	- Center of mesenchymal condensation in the maxillary process on the lateral surface of the nasal capsule. - Change of shape by resorption and apposition: modeling & remodeling. - Interstitial growth within the mineralized mass is impossible.
Modeling **Remodeling**	- = Formation of new bone from a cartilaginous predecessor or direct bone formation within the mesenchyme. Adapts structure to function by changing bone size and shape to maintain bone strength when the loading of the bone changes. - = Changes in the shape of a bone due to resorption and replacement.

Sites and types of growth in the craniofacial complex

Factors to differentiate growth	• Site or location of growth • Type of growth • Mechanism of growth • Determinant or controlling factors
Wolff's law	- = Form follows function. - Correlation between the trabecular orientation in the bone and the main direction of the stress + secondary adaptions of the cortical portion of the bone.
Cranial vault: Intramembranous	1. Intramembranous bone formation 2. **Fontanelles**: **anterior, posterior, sphenoid & mastoid fontanelle** = Loose connective tissues that widely separate the bones of the skull at birth (for the deformation in the birth canal) Apposition of bone along their edges eliminates the open space between the fontanelles quickly after birth, but the bones remain separated by thin sutures and fuse eventually only in adult life. 3. Remodeling and growth occur primarily at the periosteum lined contact areas between adjacent skull bones = the **cranial sutures.** - Only responsive growth: Sutures themselves without pressure have no growth potential. - Change in contour: Little bone is removed from the inner surface of the cranial vault, while at the same time new bone is added on the exterior surface.
Cranial base (occipital, sphenoid and ethmoid bones = bony floor under the brain) endochondral intramembranous (only lateral)	- Enchondral ossification: bones are initially formed in cartilage and transformed from this model into bone. - **Synchondrosis**: = band of cartilage that remains between the centers of ossification. Important growth sites: • **Spheno-occipital synchondrosis** • **Intersphenoid synchondrosis** • **Spheno-ethmoidal synchondrosis** - Synchondrosis are built like a two-sided epiphyseal plate: Band of immature proliferation cartilage cells at the center. Bands of maturing cartilage cells and enchondral ossification in both directions. - An immovable joint develops between the bones of the cranial base



Maxilla (Nasomaxillary Complex) Intramembranous **Primary translation:** = Translation due the growth of the bone itself. **Secondary translation:** = Translation of the bone due to growth of the surrounding structures.	- Intramembranous ossification: • Apposition of bone at the sutures that connect the maxilla to the cranium and cranial base. • Surface modeling by apposition and resorption • → Growth: Upward & backward. → Movement: Downward & forward. - Sutures: (nach Sicher, ausg. S. frontonasalis) ○ **S. zygomaticotemporalis** ○ **S. zygomaticomaxillaris** ○ **S. frontonasalis** ○ **S. frontomaxillaris** ○ **S. pterygopalatine**

- ± Until age 6:
    - Growth of the cranial base and growth of the structures behind the maxilla, move the maxilla forward & downward (secondary translation).
    - New bone is added on both sides of the sutures (primary translation)
    - The anterior surface (except anterior nasal spine) tends to resorb while the maxilla is carried forward & downward.
    - A midface deficiency develops in case of failure of the cranial base to lengthen normally (e.g. achondroplasie).

- ± Age 7y:
    - Only growth at the sutures to push the maxilla further forward.
    - Sutures remain the same width, the space is filled by bone proliferation.
    - Various processes of the maxilla become longer:
      P. zygomaticus, P. frontalis, P. alveolaris.

- Tuberosity region at the posterior border of the maxilla (= free area):
  Bone is added at the surface, creating additional space for the primary and permanent molars.

- Palatal vault (= roof of the mouth and floor of the nose)
  Translation and remodeling effects are additive:
    - Forward-downward movement.
    - Bone removal on the nasal side and addition on the oral side.

- Cavity of the palatal plate develops because there is more apposition at the alveolarprocess than translation of the palatal floor.

- Growth in width and length of the palatal develops because of the **growth of the sutura palatina mediana** (posterior more than anterior) and the **sutura palatina transversa**.

- *Björk & Skieller, 1977: "Growth of the Maxilla in Three Dimensions as Revealed Radiographically by the Implant Method"*
    - Increase in width 6/7y to adulthood:
        - Suture: **+4.8 mm** (4y to adulthood: **+6.8 mm**)
        - Intermolar width: **+3.1 mm**.
        - Intercanine width: **+1.1 mm**. (4y to adulthood: **+3.1 mm**)
    - Mx growth in the median suture: posterior > anterior.
    - Strong correlation intermolar width & sutural growth.
      Weaker correlation intecanine width & sutural growth.
    - Molars compensate for the sutural growth:
      Increase intermolar width < sutural growth.
    - Reduction of dental arch length:
        - **-1.5 mm**: Anterior drift of the teeth.
        - **-1 mm**: Transversal expansion reduces the arch length.

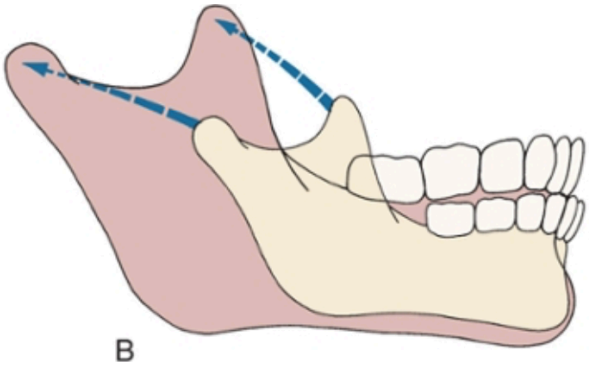
      → Incisors: **2.5 mm** more anterior positioned at adulthood.
      → Molares: **5 mm** more anterior positioned at adulthood.

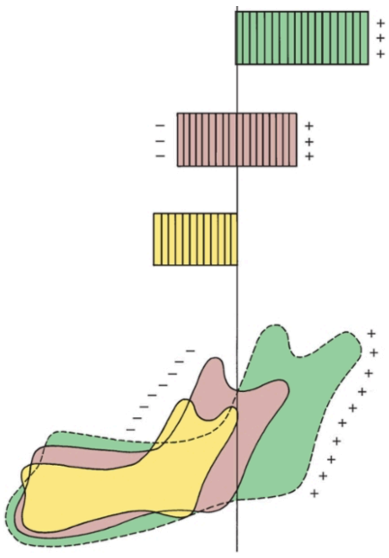
- Summary: apposition:
    - Tuber (dorsal)
    - Orbital floor (cranial)
    - Palatal roof (caudal)
    - Molar and frontal alveolar process (caudal) and molar vestibular
    - Proc. zygomaticus (dorsal)
    - Nasal floor (palatal)

- Summary: resorption:
    - Palatal roof (cranial)
    - Frontal vestibular alveolar process
    - Proc. zygomaticus (anterior)
      (*Note*: ø sure if correct, anterior surface of the zygomatic arch = stable structure according to Björk)
    - Nasal floor (nasal)

- Summary: translation nasomaxillary complex:
    - Maxilla: downward forward.
      (frontal resorption (exception spina nasalis ant.), apposition dorsal)

	• Nasal floor: caudal. (resorption nasal, apposition palatal) • Orbital floor: cranial. (apposition cranial, resorption caudal) • Palate: caudal. (apposition palatal, resorption nasal) • Processus zygomaticus: dorsal. (apposition dorsal, resorption anterior)
Mandible Endochondral: condyles Periosteal: (intramembranous) all other areas	- Enchondral activity (cartilage covers the surface of the mn condyle) and periosteal activity (all other surfaces). Displacement by the cranial base that moves the TMJ is only negligible. - Growth of the mn from the perspective of the stable cranial base: Chin moves downward and forward. - <u>Principal sites of growth:</u> • Posterior surface of the ramus (periosteal apposition) + resorption at the anterior surface of the ramus + modeling: → Mandible becomes longer. • Coronoid processus • Condylar processus (endochondral replacement + surface modeling): → Ramus grows higher. • Posterior remodeling creates space for the second primary and the permanent molars. Early cessation of growth → not enough space for 8-8 → impaction. • Minimal changes in the body and chin area. • The chin is translated downward and forward but almost inactive. - Transversal growth: • Up to 6th month of life: 2 bones. • Age 6th y: Ossification of the midsymphsal cartilage. • Age 4-10y: Mandibular condyles grow larger. • Apposition vestibular at the alveolar process. - <u>Summary: apposition:</u> • Posterior surface of the ramus • Alveolar process frontal and molar side • Inner side of the lateral side of the ramus • Anterior side of the corpus vestibular - <u>Summary: resorption:</u> • Anterior surface of the ramus • Mandibular posterior bottom edge • Vestibular frontal alvelaor process • Outside lateral side of the raumus

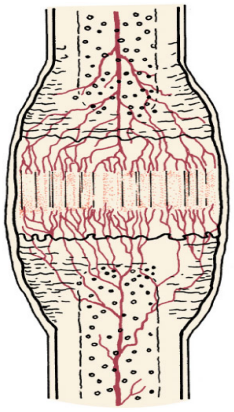




Facial soft tissues	- Do not perfectly parallel the growth of the underlying hard tissues. - <u>Lips:</u> • Train behind the growth of the jaws before adolescence, then undergo a growth spurt → lip height relatively short in the mixed dention. • Lip separation at rest (lip incompetence) is maximal during childhood and decreases in adolescence. • Maximum lip thickness during adolescence, then decrease. → Esthetic problem for women. - <u>Upper lip adolescence and mid-adulthood:</u> *(Vig, 1978)* o Upper lip lengthening **3.2 mm** o Thinner **3.6 mm** - <u>Upper lip mid- to late-adulthood:</u> *(Vig, 1978)* o Further **1.4 mm** lengthening and thinning of the upper lip • Lips are framed by the nose and the chin which become both more prominent during adolescence and therefore decrease the relative prominence of the lips. - <u>Growth of the nose:</u> • Nasal bone: Growth completed at about age 10y. Afterwards only growth of the nasal cartilage and soft tissues: → Nose becomes more prominent in adolescence, esp. for boys.

Theories of growth control	
Theories of growth control	1. Bone is the primary determinant of its own growth. Genetic control is expressed directly at the level of bone in the periosteum. → Thought not to be true nowadays. 2. Cartilage is the primary determinant of growth, bone responds secondarily and passively. This would mean that the genetic control is **epigenetic.** (= indirect control, whatever source it is) 3. The soft tissues matrix is the primary determinant of growth, cartilage and bone responds secondary and passively = also epigenetic control. → Theory 2 & 3 are probably true. - Growth is influenced by **genetic factors** and **the environment**: Nutritional status, physical activity, health or illness.
Site of growth **Center of growth**	= Location at which growth occurs. = Location at which independent (genetically controlled) growth occurs.
1. Bone as primary determinant of growth → *not true*	- Idea: o The overall pattern of the craniofacial growth is very constant. o Sutures and endochondral ossification centers were considered growth centers. - → Not true: o Areas of sutures between two facial bones transplanted in another location do not continue to grow → lack of initial growth potential. o Sutures respond to outside influences.
2. Cartilage as determinant of craniofacial growth → *true*	- Idea: o For many bones, cartilage grows, while bone merely replaces it. o Confirmation by transplantation experiments. - Not all cartilage acts the same when transplanted: o <u>Spheno-occipital synchondrosis:</u> YES Cartilage also grows when transplanted. → Capable of acting as growth center. o <u>Mandibular condyle:</u> NO Little or no growth observed when transplanted. Study: After fracture of the mandibular condyle with dislocation in children, an excellent chance exists that a new condylar process will regenerate from the periosteum to approximately the same size and that the dislocated old condyle is resorbed. Only 15-20% of children suffer a reduction of growth after a condylus fraction. Whether it occurs, is a function of the severity of the soft tissue injury. → Mn condyle ≠ No growth center. o <u>Nasal septal cartilage:</u> PROBABLY YES Some growth potential when transplanted. Loss of maxilla growth in animal studies when the cartilage is removed. Cave: growth could also be impeded by scar tissue and bad blood supply. o <u>Epiphyseal plate:</u> YES Growth center.
3. Functional matrix growth theory Introduced by Moss, 1960' → *true*	- Idea: Growth of the face occurs as a response to functional needs and neurotrophic influences. It is mediated by the soft tissue in which the jaws are embedded. - Experiments for support: o Small brain = small skull. (microcephaly if pregnant women have a Zika virus infection) o Hydrocephalus (cerebrospinal fluid not resorbed) = big skull. o The size of the eyes determines the size of the orbits. o TMJ ankylosis impairs mandibular growth. o Bonegrowth can be induced at surgical created sites. (= distraction osteogenesis)

- **Distraction**:
  - = Induction of bone growth at surgically created sites.
    Start segment separation of 0.5-1 mm per day after a few days of initial healing and callus formation.
  - Osteogenesis is possible.



- Fibrous radiolucent interzone with longitudinal oriented collagen bundles at the area of lengthening with proliferating fibroblasts and undifferentiated mesenchymal cells.
- Osteoblasts at the edge of the interzone.
- Rich blood supply in the mineralization zone at both sides of the interzone.
- Zone of remodeling under the mineralization zone.

Summary

- Growth of the cranium occurs almost entirely in response to growth of the brain.
- Growth of the cranial base is primarily the result of endochondral growth and bony replacement at the synchondrosis (with individual growth potential). An influence of the brain is possible.
- The maxilla is translated downward & forward as the face is growing and remodeling. Influence of the growth of the cartilage is unknown. Soft tissues and cartilage can contribute to the maxilla forward translation.
- The mandible is translated by growth of the muscles and other adjacent soft tissues. New bone at the condyle is added in response to soft tissue changes. Remodeling.
- Functional need concept (*Piotr*):
- = Structures adapt to the needs. (larger nostrils if more air is needed)

Growth of Craniofacial Units

Growth	**Cranial Vault**	**Cranial base**	**Maxilla**	**Mandible**
Sites	-Sutures (major) -Surfaces (minor)	-Synchondrosis -Sutures (laterally)	-Sutures -Surfaces -Apposition -Remodeling	-Condyle -Ramus -Other surfaces
Centers	None	Synchondrosis	None	None
Type (mode)	Mesenchymal (=intramembranous)	-Endochondral -Mesenchymal (later only)	Mesenchymal	-Endochondral (condyle only) -Mesenchymal
Mechanism	Pressure to separate the sutures	Interstitial growth at synchondrosis	-Cartilage push (cranial base) -Soft tissue pull -Cartilage pull? (nasal septum)	Soft tissue pull (neurotrophic?)
Determinant	Intracranial pressure (brain growth)	-Genetic (at synchondrosis) -Cartilage pull (at lateral sutures)	Soft tissue pull (neurotrophic?)	Soft tissue pull (neurotrophic?)

Notes: **Zellphysiologie**	
Rezeptoren	- Zelloberflächen Rezeptoren: für hydrophile Signalmoleküle, z.B. Wachstumsfaktoren. • Ionenkanäle • Enzym gekoppelt, z.B. RTK (receptor tyrosin kinase) • G-Protein gekoppelt → 2nd messenger z.B. cAMP, Ca^{2+} - Kernrezeptoren: für hydrophobe Signalmoleküle, z.B. Steriodhormone, Transkriptionsfaktoren
Zellkommunikation:	- Endokrin: Horomone - Parakrine: Parakrine Faktoren, z.B. PDGF, TGF-B, Histamine - Neuronal: Neurotransmitter, z.B. Acetylcholin - Kontakabhängig: Rezeptor-Ligand, z.B. RANK/RANKL
Zellgedächnis	- Methylierung - Feedback Loops: Anhäufung von Transkriptionsfaktoren und den nachfolgen synthetisierten Proteinen.
DNA Dogma	- DNA → (Transription) → RNA → (Translation) → Proteine. - DNA = Doppelstrang aus o Pyrimidin: Cytosin, Thymin → Uracil in RNA o Purin: Guanin, Adenin. - Basenpaare: o G & C o A & T resp. U in RNA - Introns & Extrons. - Enhancer & Silcencer Sequenzen zur Regulierung der Transkription. - Differenzierte Zellen haben den gleichen Genom → alle Informationen für die Bildung eines kompletten Organismus.
Translation	- Freie Ribosome: Proteine für IZM. - Gebunde Ribosome: Proteine für Sekretion. - Findet im Zytoplasma statt. - 20 Aminosäuren.
Transduktion	= Umwandlung eines Signal in ein anderes Signal. - Ziel: • Verstärkung • Synergie: Mehrere Inputs für eine Reaktion nötig.
Main 2nd messengers	- cAMP - Ca^{2+}
Gewebe	- Verschiene Zelltpyen + - EZM: o Kollagen: Zug. o Proteoglykane: Kompression. o Glykoproteine: Linker / Zelladhäsion.
Zellverbindungen	- Tight junctions: Dicht. - Adherence junctions: Verbindet Aktinbündel veschiedener Zellen oder Zelle/Matrix. - Desmosome: Intermediäre Filamente zwischen Zellen. - Gap junctions: Ionenpassag. Elektrische Koppelung von Zellen. - Hemidesmosome: Verankerung intermediärer Filamente einer Zelle zur Basalmembran.
Zellentwicklung	- Totipoten → pluripotent → multipotent → oligopotent → unipotent. - Stammzellen vs. differenzierte Zellen: o Potential ↑ o Spezialisierung ↓

Social and behavioral development

- Humans: Great majority of behaviors are learned and not instinctive → environment influences our behavior.
- Instinct behaviors (sex drive) can be modified by learning.
- The older the individual, the more complex the behavioral pattern and the more important the learned overlay of behavioral will be.
- More complex skills and behaviors appear as learning proceeds. Continues flow model, no distinct stages.
- Mechanisms to learn behavioral responses:
    - Classical conditioning
    - Operant conditioning
    - Observational learning

1. Classical conditioning by *Ivan Pavlov*

- = **Learning by association**:
  Association of a neutral stimulus with one that leads to a specific reaction.

- **Generalization / Reinforcement:**
  Associations tend to become generalized and strengthened every time when the conditioned and unconditioned stimulus occur together.

- **Extinction of the conditioned behavior:**
  Association between the conditioned and the unconditioned stimulus is weakened or disappears when it is not reinforced.

- **Discrimination:**
  Contrary to generalization.

- Pain = unconditioned stimulus.
  Number of aspects of the setting in which pain occurs can become associated with this unconditioned stimulus.

- *Dentist:*
    - *Dental office should look different than a clinic.*
    - *Avoid pain at the first visit.*
    - *Let children look first at other's tx.*

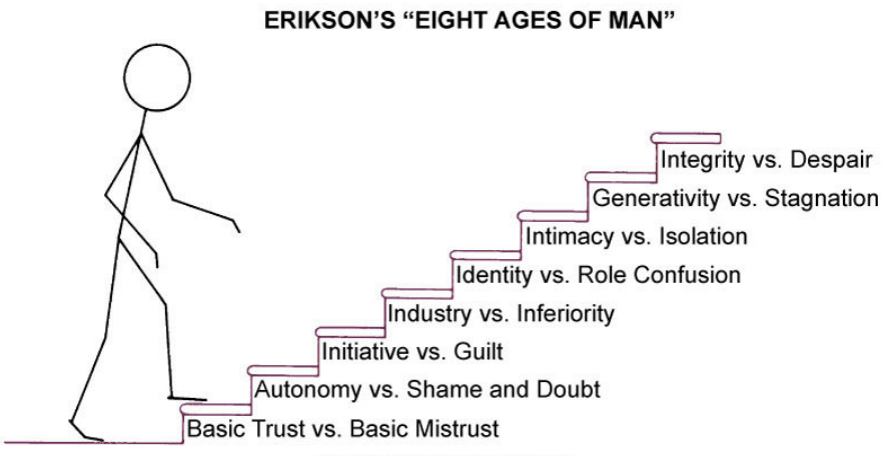
2. Operant conditioning theory by *B.F. Skinner*

- Basic principle = the consequence of a behavior is in itself a stimulus that can affect future behavior. The consequence that follows a response will alter the probability of this response occurring again in a similar situation.

- Individual's determination is considered less important than the unconscious determinant behavior.
- Can be used to modify behavior at any age.
- Reinforcements vs. extinction and generalization vs. discrimination are possible like in classical conditioning.

	Probability of Response Increases	Probability of Response Decreases
Pleasant stimulus (S_1)	I S_1 Presented Positive reinforcement or reward	III S_1 Withdrawn Omission or time-out
Unpleasant stimulus (S_2)	II S_2 Withdrawn Negative reinforcement or escape	IV S_2 Presented Punishment

	- 4 ways to react: 1. **Positive reinforcement:** If a pleasant consequence follows a response, the behavior that led to this pleasant consequence becomes more likely in the future. *E.g.: Gift after the dentist's visit.* 2. **Negative reinforcement:** Withdrawal of an unpleasant stimulus after a response. Increases the likelihood of a response in the future. *E.g.: No tx for a crying child → cries again when it doesn't want a tx.* 3. **Omission / time-out:** Removal of a pleasant stimulus after a particular response. Children regard attention by others as a pleasant stimulus. *E.g.: Withholding attention.* Cave: child may react with anger and frustration. 4. **Punishment:** An unpleasant stimulus is presented after a response. Effective at all ages. *E.g.: Voice control.* Cave: fear and anger from the patient. - Both reinforcements increase the likelihood of a particular behavior to reoccur, where as punishment and omission suppress it. - Voice control: = Speaking to a patient in a firm and controlled voiced to gain his attention. Form of punishment. Use with care. Immediate reward after an improvement is necessary.
3. Observational learning (modeling)	= Imitation of a behavior observed in a social context. - 2 stages: • Acquisition: of the behavior by observing. • Performance: of that behavior. - Not all observations are preformed: • Children can acquire almost any behavior which they observe if it's not too complex to perform for them at their physical level. • Role model: People who are liked or respected are more likely to be imitated by a child (siblings/mother). • Expected consequences of the behavior increase or decrease the likelihood to perform it. → No performance of a behavior if a punishment follows). *- Dentist:* • *Mother = Best predictor how anxious a child will be during tx.* • *Open area with several tx stations → other patients are idols.*

Stages of emotional development	
By Erik Erikson, based on Sigmund Freud	- **"Eight ages of man"**: Psychosocial development proceeds by critical steps. - Turning points, moments of decision in between. - Each stage represents a psychosocial crisis in which individuals are influenced by their social environment to develop more or less towards one extreme of the conflicting personality qualities dominant at that stage. - Chronological age varies, but the sequence of the stages is constant. - Qualities of earlier stages will may be evident in later stages due to uncompleted resolution of earlier stages. 
1: **Birth - 18 m** **Development of basic trust vs. basic mistrust**	- Depends on a caring and consistent mother or mother substitute, who meets the physiologic and emotional needs of an infant. - Physical growth can be retarded by severe "maternal deprivation". - *Dentist:* • *Child has separation anxiety → let parents hold the child during tx.*
2: **18m - 3 y** **Development of autonomy vs. shame / doubts**	- Child is moving away from his mother, developing and individual identity or autonomy. - If failure: development of shame / doubts in the child's mind about his ability to stand alone and doubts in others. - Parents must provide opportunities to develop independent behavior while protecting the child against consequences of dangerous and unacceptable behavior. - *Dentist:* • *Offer choices if possible (colors).* • *Make the child think whatever the dentist wants is the child's choice.*
3: **3 – 6 y** **Development of initiative vs. guilt**	- Vigorous pursuit of activity of the child. Physical activity and motion, extreme curiosity and questioning, aggressive talking. - Parents must channel the activity in manageable tasks. - Child should express new thoughts and do new things without being made feel bad if it was a failure. - If failure: Guilt from goals that were contemplated but not attained. - *Dentist:* • *Children are curious in the office.* • *Success in the first appointment helps the child to become more independent.*
4: **7 – 11 y** **Mastery of skills: industry vs. inferiority**	- Child works to acquire the academic and social skills that allow him to compete in an environment where recognition is given to those who produce. Child learns the rules by which our world is organized. - Influence of peer group increases. - Parents should present an environment that provides challenges with a chance of being met, rather than guarante failure. - If failure: Inferiority. - Failure to measure up to a peer group: → personality characteristics of inadequacy, inferiority and uselessness.

	- *Dentist:* • *Setting attainable intermediate goals, clearly outlining how to reach them.* • *Positively reinforce good behavior.*
5: **12 – 17 y** **Development of personal identity vs. role confusion**	- Includes a feeling of belonging to a larger group and a realization that one can exist outside the family. - Emerging sexuality. - Peer group members become important role models (although some distance necessary to establish one's own uniqueness). Values of the parents / authority figures are rejected. - Health problems considered as problems considered of somebody else. - *Dentist:* • *Orthodontic tx only if the patient wants it, not only to please the parents.* • *Outline the tx as being done FOR and no TO the patient.*
6: **Young adult** **Development of intimacy vs. isolation**	- Success: Person is willing to compromise and even to sacrifice to maintain a relationship, establish affiliations and partnerships. - If failure: Isolation often accompanied by strong prejudices that serve to keep others away rather than bringing them into closer contact. - *Dentist:* • *Patients think that a change in their appearance will facilitate attainment of intimate relationships.* • *Inform patients that tx. includes all aspects of a person: appearance, personality, emotional qualities, intellect, psychological impact.*
7: **Adult** **Guidance of the next generation: generativity vs. stagnation**	- Becoming a successful and supportive parent. - Do a service to the group community and nation. - If failure: stagnation characterized by self-indulgence and self-centered behavior.
8: **Late adult** **Attainment of integrity vs. despair**	- Individual has adapted to the combination of gratification and disappointment. - Feeling that he has made the best of this life's situation and made peace with it. - If failure: Despair, disgust, unhappiness, fear that death will occur before a change of the life occurs.

Cognitive development	
Theory by Jean Piaget: 4 stages with variable time frame	= Development of intellectual capabilities. - Intelligence is a result of biologic adaptation. Every individual is born with the capacity to adjust or adapt to the physical and the sociocultural environment in which he lives. - Intelligence happens as an interplay between two processes: • **Assimilation**: Child assimilates events into mental categories called cognitive structures = classifications for sensations and perception. • **Accommodation**: Occurs when the child changes the cognitive structures or mental categories to better represent the environment. - A child's ability to adapt is age related.
1: **Birth – 2 y** **Sensorimotor period**	- Rudimentary concept of objects. - Ideal that objects in the environment are permanent. (disappear if you don't look at them) - Lack of language capability, simple modes of thoughts are the foundation for the development at this time. - Little ability to interpret sensory data. - Limited ability to project forward or backward in time.
2: **2 – 7 y** **Preoperational period**	- Children learn to use words to symbolize absent objects. - Use of language in a literal sense, understand words like they learn them. - Children fail to consider aspects such as function. → Understand some words differently than adults. - Children understand the world how they sense it through their 5 primary senses. → Everything else is difficult to understand, capability for logical reasoning is limited. - Child is ego-centered: incapable of assuming another person's point of view. - Animism: Everything is see as being alive. - *Dentist:* • *Give dental instruments lifelike names and qualities.* • *Dental staff should use immediate sensation.*
3: **7 – 11 y** **Period of concrete operations**	- Improved ability to reason in concrete situations. Abstract level is limited. - Child can use a limited number of logical processes, especially if they involve objects which can be handled and manipulated. - Ability to see another point of view develops. - Animism declines. - *Dentist:* • *Instructions must be illustrated with concrete objects.*
4: **11 – adult** **Period of formal operations**	- Thought process has become similar to the one of adults. - Child understand concepts like health, disease… - They can think about thinking, but think that all the others think the same like they. - **Imaginary audience:** Teenagers feel that they are constantly observed and criticized by those around them → makes them self-conscious and particularly susceptible to peer influence. - **Personal fable:** Concept hold "because I'm unique, I'm not subject to the consequences other will experience → risky behavior. - *Dentist:* • *Child must be intellectually treated like an adult.* • *Do not try to impose a change of the reality as perceived by the adolescents, help them to see the actual reality that surrounds them more clearly.* • *Motivate patient to have a try and judge his peers' response.* • *Help teenager to solve their own problems.*

Proffit Chapter 3:

Early Stages of Development

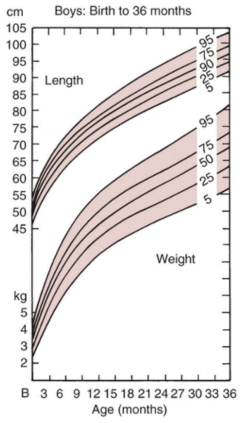
Late fetal development and birth

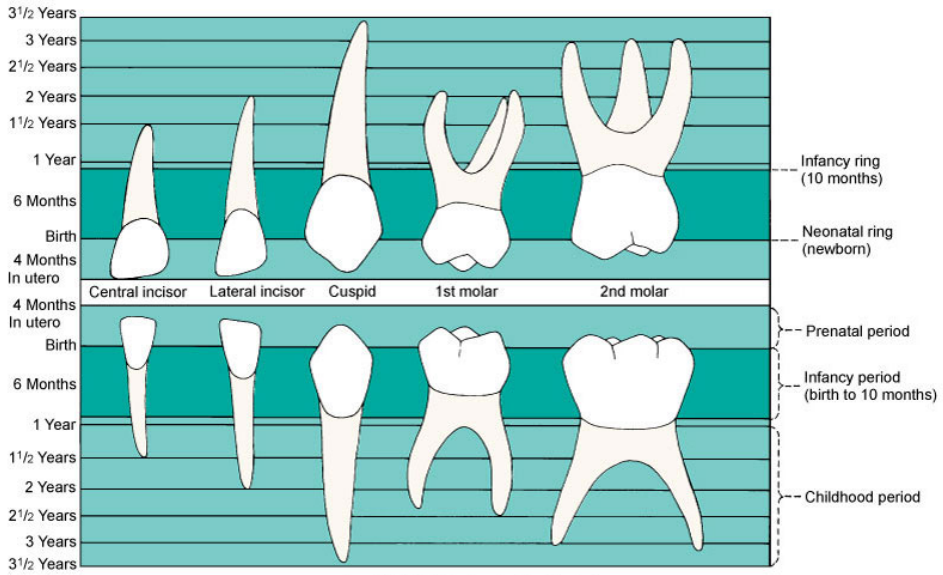
Prenatal

- Dental development starts in the 3th month.
  - 6-8th pw: **Dental lamina** (Zahnleiste) = Initiaion
  - **Bud** (Knospe) = Morphogenesis
  - 8th pw: **Cap** (Kappe) = Morphognesis, start enamel secretion
  - 12th pw: **Bell** = Cytodifferention
  - >12th pw: Matrixsecretion
- Development of all primary teeth and 6+6 starts before birth.

Birth

- Distortion of the head due to the fontanelles (anterior, posterior, sphenoid, mastoid) and missing mandible makes passage through the birth canal easier.
- **Neonatal line**: Line seen in the enamel which is formed at the moment of birth up to a prominent area of stained, distorted or poorly calcified enamel.
  → Birth = traumatic process followed by a growth cessation and weight decrease in the first 7-10 days postnatal.





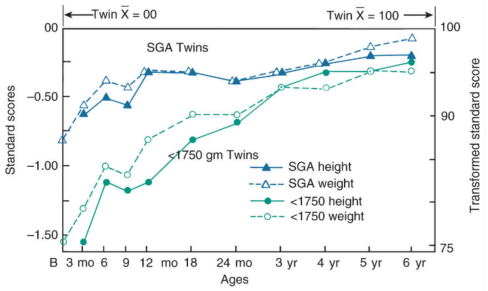
- Growth disturbances lasting 1-2 weeks or more will leave a visible record in the enamel of teeth forming at this time.
- Extremely rapid growth in early infancy, with a progressive slowing down after the first 6 m postnatal. Growth curves for boy and girls are nearly identical at this age.

TABLE 3.1 Chronology of Tooth Development, Primary Dentition

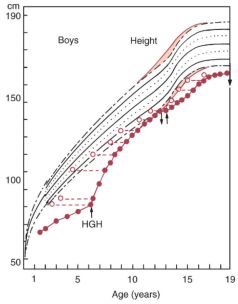
Tooth	CALCIFICATION BEGINS		CROWN COMPLETED		ERUPTION		ROOT COMPLETED	
	Maxillary	Mandibular	Maxillary	Mandibular	Maxillary	Mandibular	Maxillary	Mandibular
Central	14wk in utero	14wk in utero	1½ mo	2½ mo	10mo	8mo	1½ yr	1½ yr
Lateral	16wk in utero	16wk in utero	2½ mo	3mo	11mo	13mo	2yr	1½ yr
Canine	17wk in utero	17wk in utero	9mo	9mo	19mo	20mo	3¼ yr	3¼ yr
First molar	15wk in utero	15wk in utero	6mo	5½ mo	16mo	16mo	2½ yr	2¼ yr
Second molar	19wk in utero	18wk in utero	11mo	10mo	29mo	27mo	3yr	3yr

Infancy and early childhood: The primary dentition years (infancy = birth - 6 months)

Premature birth (low birth weight)	- < 2500 gm at birth → greater risk of problems in the immediate postnatal period. - Normal growth and overcoming of the initial handicap if a premature infant survives. Children are smaller in the first 1-2 y of life, but at age 3y there is normally no difference visible to peer.



Catch up growth small for gestational age / < 1750 g



Growth for boy with growth hormoe deficit, tx at 6.2 y

Chronic illness	- Normal child: 90% energy is required for survival and activity, 10% for growth. → Less energy available with chronic illnesses. - Chronic illnesses cumulate the growth deficit: • The more chronic the illness, the greater the cumulative impact. • The more severe the illness, the greater the impact at any given time. • Relatively brief growth interruptions have no long-term effect. - Psychologic and emotional stress affects growth in extreme cases the same way as chronic illness (induction of a reversible growth hormone deficiency + disturbance of the appetite center).
Nutritional status	- Chronically inadequate nutrition has an effect similar to chronic illness. - Additional nutritional intake after achieving a certain level of nutritional adequacy is not a stimulus to more rapid growth. → Food is necessary for normal growth, but not a stimulus.
Secular change in growth and development	- Current trend towards more rapid growth and earlier maturation (menarche) is related to better nutrition (more protein, trace minerals & vitamins) and exposure to environmental chemicals with an estrogenic effect (pesticides). - Head and face are becoming taller and narrower in the recent time. This is maybe related to softer food and less functional loading of the facial skeleton.
Maturation of oral function	- <u>Newborn infant:</u> • Obligatory nasal breathers. To open the airways, the mandible is positioned downward, the tongue moves downward and forward away from the posterior pharyngeal wall. • Swallowing occurs in the last months of fetal life (amniotic liquid). • Drinking milk: Suckling and swallowing (no sucking!). → Stimulates the mammal's muscles to contract and to squirt milk. The newborn places the tongue in contact with the lower lips (most common position over the day) to receive milk and groove it, to make the milk flow posteriorly in the pharynx. • **Infantile swallow pattern**: ○ Active contraction of the musculature of the lips ○ Tongue tip in contact with the lower lip ○ Little activity of the posterior tongue or pharyngeal musculature • Suckling reflex and infantile swallow pattern disappear normally during the first year of life. - <u>Maturing infant:</u> • Activity of the elevator muscles of the mandible increases with swallowing. • Use of the tongue in a more complex way. • Maturation of oral function follows a gradient form anterior to posterior: First sounds are formed anterior in the month m/p/b. • Mostly some sort of habitual non-nutritive suckling → transition in an adult swallowing pattern starts when the suckling activity stops. • Openbite: ○ Transition to an adult swallowing pattern is more difficult. Need to seal the anterior space. ○ Tongue trust does not cause an open bite.