let's talk science

Determinants of Childhood Growth and Development

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April 25th, 2018

University of Victoria

THE UNIVERSITY OF BRITISH COLUMBIA

We are second year medical students, not quite doctors yet :)

Disclaimer

Let's Talk Science - What is it?

Non-profit, national organization

UBC and UVic affiliated

Focused on providing education to communities in sciences, technology, engineering and mathematics

Outline

- Determinants of Growth
- Normal Development
  - Infant
  - Childhood
  - Adolescents
- Learning Disabilities, Autism, ADHD

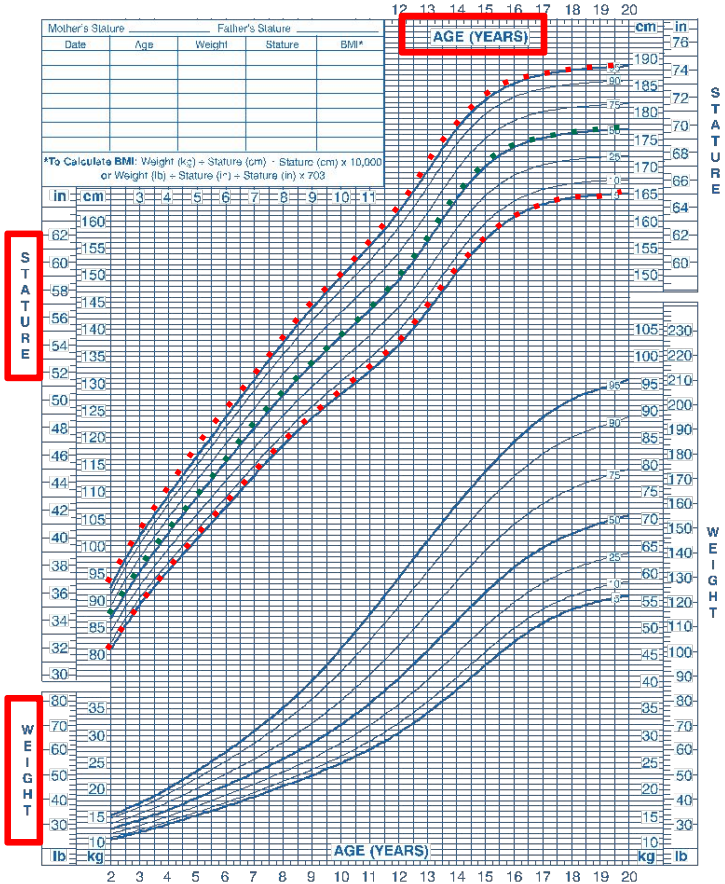
Determinants of Growth


170
160
150
140
130
120
110
100
90
80
70
60
50

2 to 20 years: Boys
Stature-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____



Published May 30, 2000 (modified 11/21/00).
SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

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2 to 20 years: Girls
Stature-for-age and Weight-for-age percentiles

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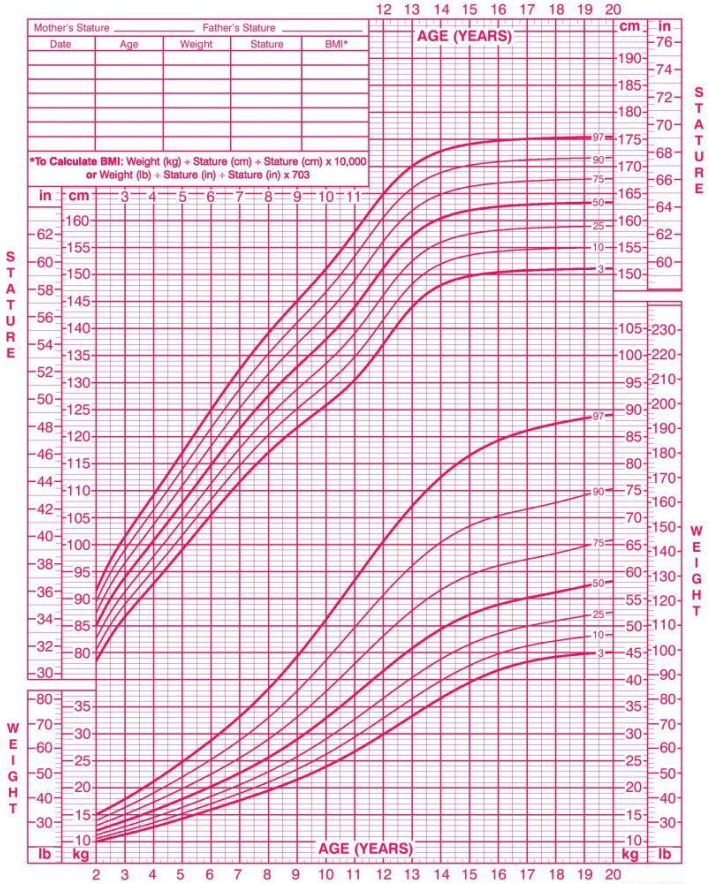

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Clinical basics of childhood growth

- Growth is a complex interplay of genetics and the environment

- Anthropometric measurements are a cornerstone of the well-child check-up, including:
  - Height
  - Weight
  - Body-mass index
  - Head circumference

- Growth monitoring is important because it is easy, cost-effective and abnormal growth patterns, such as decreased growth velocity, may be suggestive of underlying medical or social problems.
  - In some conditions, abnormal growth patterns may be the first sign of disease

Christesen, H. T., Pedersen, B. T., Pournara, E., Petit, I. O., & Júlíusson, P. B. (2016). Short Stature: Comparison of WHO and National Growth Standards/References for Height. *PloS One*, *11*(6), e0157277. http://doi.org/10.1371/journal.pone.0157277
Hall, D. M., & VOSS, L. (2000). Growth monitoring. *Archives of Disease in Childhood*, *82*(1), 10–5. http://doi.org/10.1136/ADC.82.1.10
Zemel, B. S. (2017). Influence of complex childhood diseases on variation in growth and skeletal development. *American Journal of Human Biology*, *29*(2), e22985. http://doi.org/10.1002/ajhb.22985

The impact of stature: a biosocial perspective

- Taller than average individuals are more likely to report better health, less illness as well as improved measures of well-being, such as enjoyment, happiness, sadness, physical pain, and social activity
- Adult height is inversely correlated with depression and suicide
- This is due to biomechanical, biological, genetic, and psychosocial advantages
- “Heightism” – bullying, exclusion, overprotection
- Taller individuals are however more likely to report stress, anger, and for women, worry.

Deaton, A., & Arora, R. (2009). Life at the top: the benefits of height. *Economics and Human Biology*, *7*(2), 133–6. http://doi.org/10.1016/j.ehb.2009.06.001

Lipman, T. H., & McCurry, I. J. (2017). Children with Short Stature and Growth Failure: Heightism, Gender and Racial Disparities. *Pediatric Endocrinology Reviews : PER*, *14*(Suppl 2), 472–477. http://doi.org/10.17458/per.vol14.2017.lm.childrenshortstature

Perkins, J. M., Subramanian, S. V., Davey Smith, G., & Özaltin, E. (2016). Adult height, nutrition, and population health. *Nutrition Reviews*, *74*(3), 149–165. http://doi.org/10.1093/nutrit/nuv105

Wyshak, G. (2014). Height, socioeconomic and subjective well-being factors among U.S. women, ages 49-79. *PloS One*, *9*(6), e96061. http://doi.org/10.1371/journal.pone.0096061

2 to 20 years: Boys
Stature-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____

Mother's Stature _____

Date	Age	We

*To Calculate BMI: Weight (kg) ÷ [Stature (m)]² or Weight (lb) ÷ [Stature (in)]² × 703

STATURE

in: 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62

cm: 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150 155 160

WEIGHT

lb: 10 15 20 25 30 35 40 50 60 70 80

kg: 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

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SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
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Genetics

- 50 – 80% of the variance in height is attributable to genetics – in a perfect world, this would be much greater
- Height is a polygenetic trait, with over 400 gene loci associated with height and many more likely to be discovered
- A child's height can be predicted based off of their parents height (± 10cm):

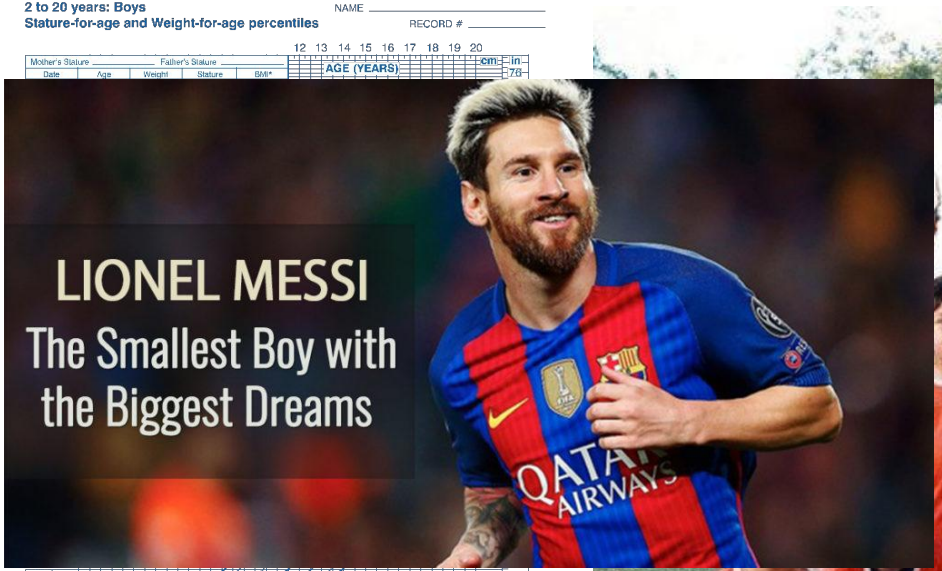
BOYS: (Father's height + mother's height + 13cm)/2

GIRLS: (Father's height + mother's height – 13cm)/2

Wright, C. M., & Cheetham, T. D. (1999). The strengths and limitations of parental heights as a predictor of attained height. *Archives of Disease in Childhood*, *81*(3), 257–60. http://doi.org/10.1136/ADC.81.3.257

Wood, A. R., Esko, T., Yang, J., Vedantam, S., Pers, T. H., Gustafsson, S., … Frayling, T. M. (2014). Defining the role of common variation in the genomic and biological architecture of adult human height. *Nature Genetics*, *46*(11), 1173–86. http://doi.org/10.1038/ng.3097

Zemel, B. S. (2017). Influence of complex childhood diseases on variation in growth and skeletal development. *American Journal of Human Biology*, *29*(2), e22985. http://doi.org/10.1002/ajhb.22985



2 to 20 years: Boys
Stature-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____

Mother's Stature _____ Father's Stature _____

Date	Age	Weight	Stature	BMI*

12 13 14 15 16 17 18 19 20
AGE (YEARS)
cm
in
76

WEIGHT
80 70 60 50 40 30
35 30 25 20 15 10
lb kg
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
AGE (YEARS)

Published May 30, 2000 (modified 11/21/00).
SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
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CDC
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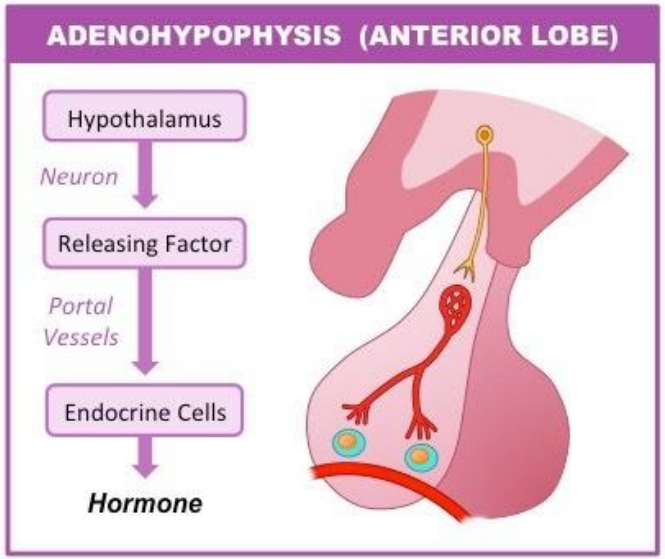
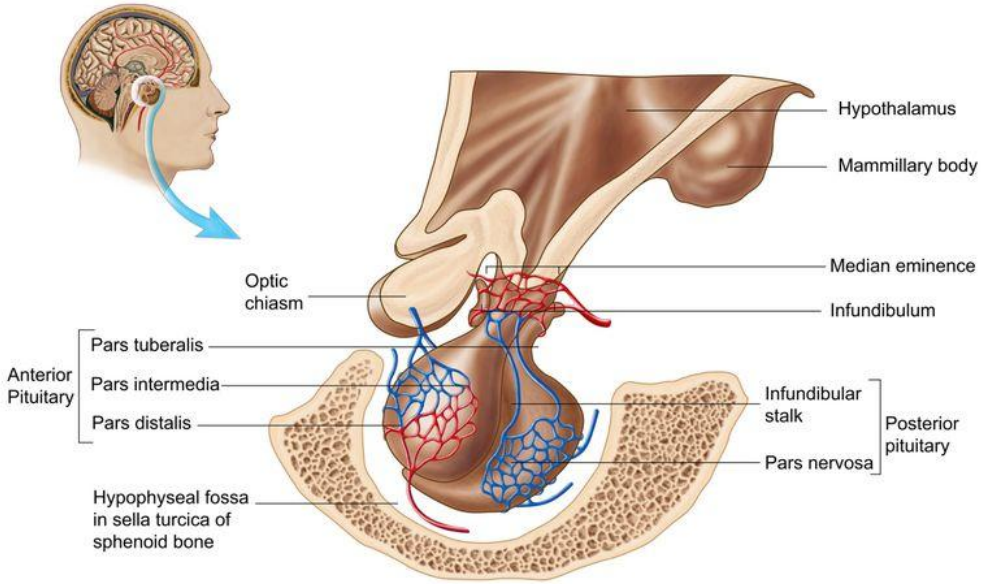
Hormones

- The pituitary gland

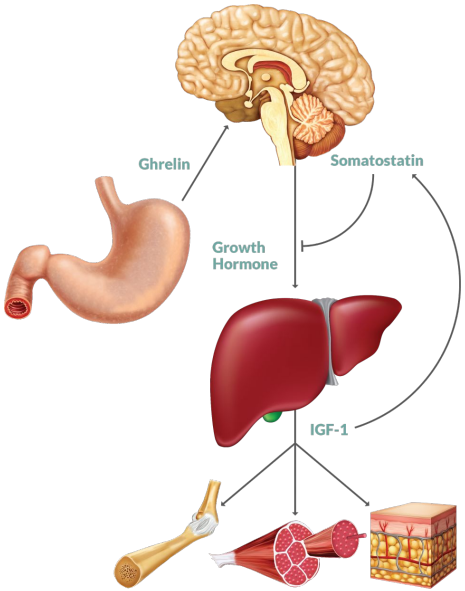




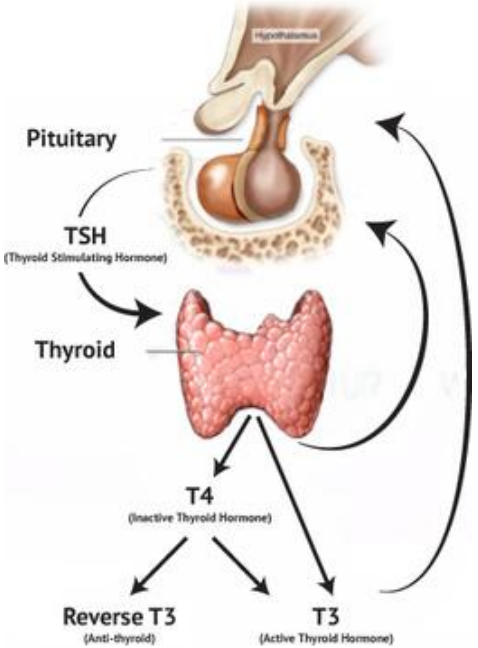
Gardner, D. G., Shoback, D. M., & Greenspan, F. S. (Francis S. (2011). *Greenspan's basic & clinical endocrinology*. McGraw-Hill Medical.

Hormones

Growth Hormone



Thyroid Hormone



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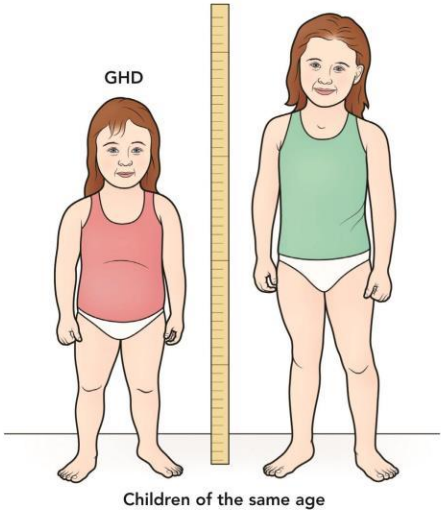
Hormones: growth hormone

- **Effects of growth hormone (and IGF-1):**
  - Promotion of linear growth, stimulation of epiphyseal growth, and increased bone density
  - Increased protein synthesis and amino acid uptake
  - Decreased protein breakdown and increased lipolysis

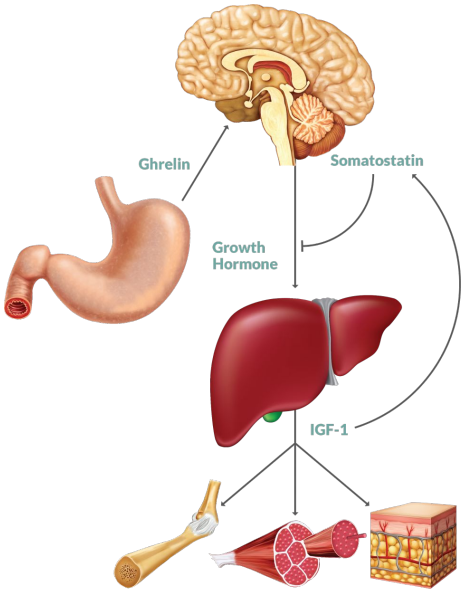
- **Isolated growth hormone deficiency**
  - Congenital (genetic) or acquired (cancer, infection, trauma, radiation, *etc.*) defect in somatotropes
  - Can cause short stature, delayed bone age, delayed puberty, truncal obesity, cardiac disease and dysfunction, and decreased memory and cognitive function
  - Treated with synthetic growth hormone injections



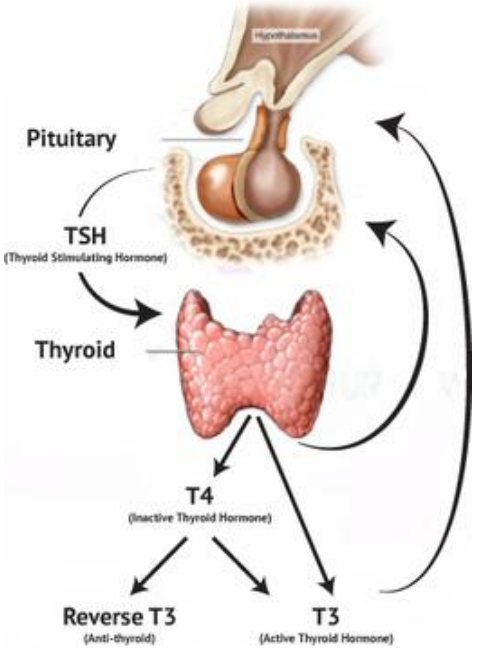
Alatzoglou, K. S., Webb, E. A., Le Tissier, P., & Dattani, M. T. (2014). Isolated Growth Hormone Deficiency (GHD) in Childhood and Adolescence: Recent Advances. *Endocrine Reviews*, *35*(3), 376–432. http://doi.org/10.1210/er.2013-1067
Gardner, D. G., Shoback, D. M., & Greenspan, F. S. (Francis S. (2011). *Greenspan's basic & clinical endocrinology*. McGraw-Hill Medical.

Hormones

Growth Hormone



Thyroid Hormone



Gardner, D. G., Shoback, D. M., & Greenspan, F. S. (Francis S. (2011). *Greenspan's basic & clinical endocrinology*. McGraw-Hill Medical.

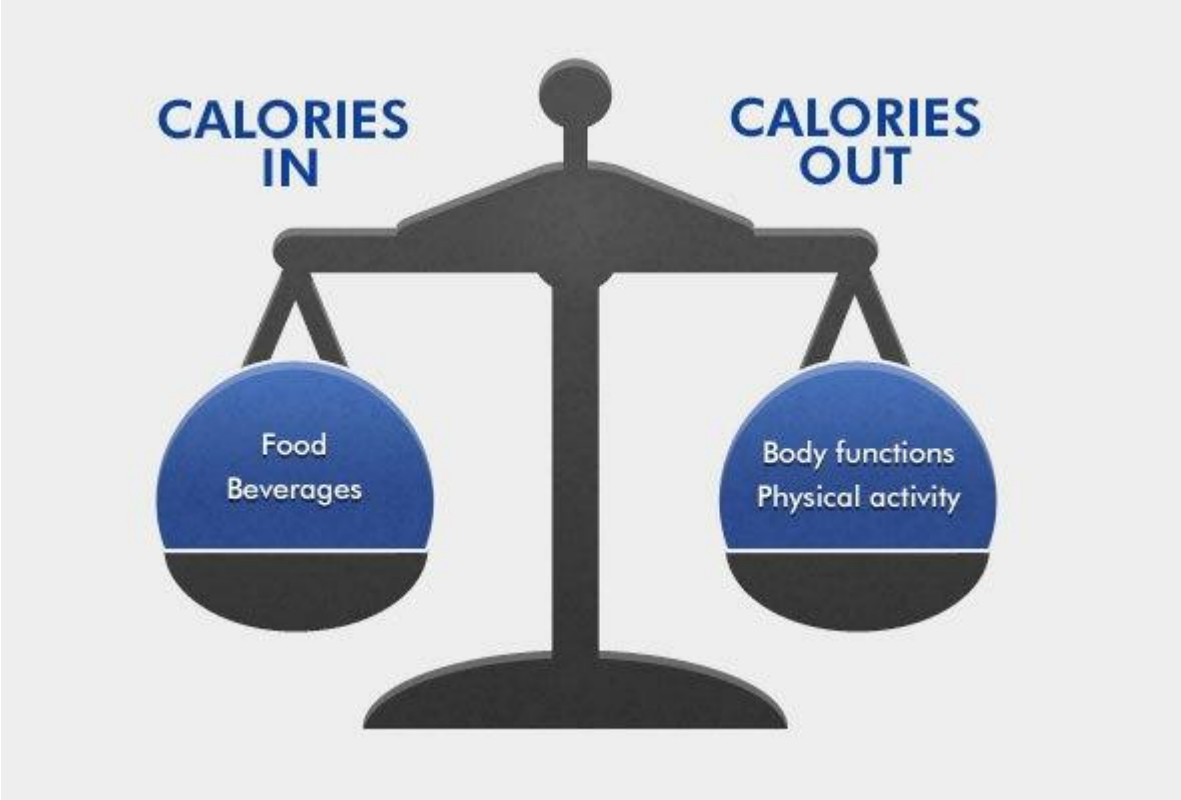
Hormones: thyroid hormone

- **Effects of thyroid hormone:**
  - Permissive effect on growth
  - Increased metabolism – increased oxygen consumption, heart production, energy production
  - Increased bone turnover and gut motility

- **Hypothyroidism**
  - Causes include congenital, autoimmune, cancer, drug-induced, radiation, and iodine deficiency
  - Symptoms include short stature, delayed puberty, obesity, low growth velocity, decreased bone age, dry skin, constipation, cold intolerance, and developmental delay
  - Treatment is exogenous thyroid hormone

Gardner, D. G., Shoback, D. M., & Greenspan, F. S. (Francis S. (2011). *Greenspan's basic & clinical endocrinology*. McGraw-Hill Medical.

Nutrition


CALORIES IN
CALORIES OUT
Food
Beverages
Body functions
Physical activity

Nutrition

- Nutrition is the single most important external factor limiting growth
- The most important nutrient is protein, followed by minerals, vitamin A, and vitamin D
- Milk consumption is correlated with adult height in the United States
- Maternal supplementation with micronutrients (iodine, folate, and calcium) has been found to decrease small-for-gestational age births
- Nutritional requirements vary depending on age and location

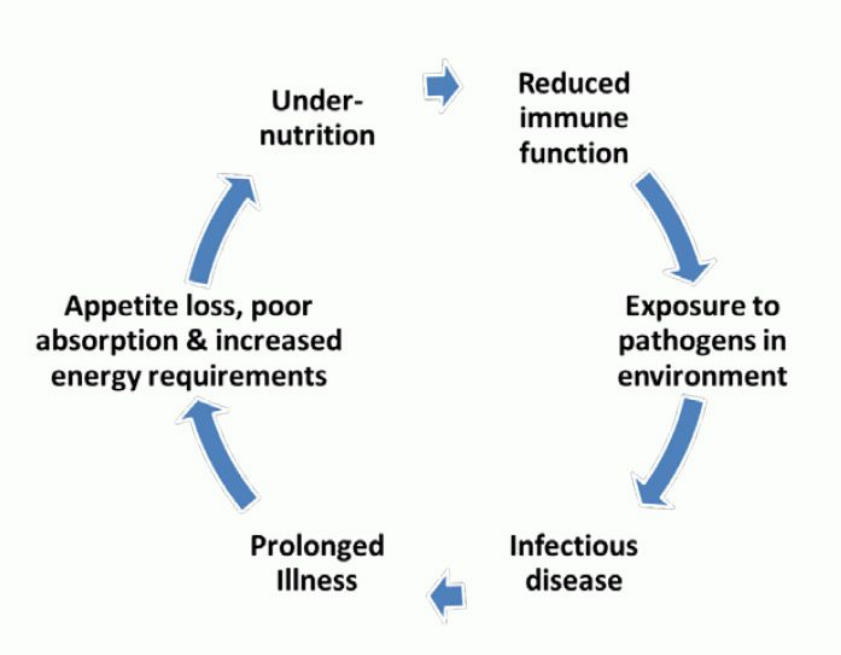
Zemel, B. S. (2017). Influence of complex childhood diseases on variation in growth and skeletal development. *American Journal of Human Biology*, *29*(2), e22985. http://doi.org/10.1002/ajhb.22985

Nutritional growth retardation

- An epidemic worldwide but underappreciated and under recognized in North America
- Often due to poverty or stimulant medication, which can cause anorexia and poor intake
- Difficult to differentiate from familial short stature, as individuals with nutritional growth retardation do not usually appear wasted and biomarkers of malnutrition are often normal
- Diagnosis often requires careful anthropometric growth monitoring

Lifshitz, F. (2009). Nutrition and growth. *Journal of Clinical Research in Pediatric Endocrinology*, *1*(4), 157–63. http://doi.org/10.4274/jcrpe.v1i4.39

Malnutrition and disease are synergistic



Katona, P., & Katona-Apte, J. (2008). The Interaction between Nutrition and Infection. *Clinical Infectious Diseases*, *46*(10), 1582–1588. http://doi.org/10.1086/587658

Zemel, B. S. (2017). Influence of complex childhood diseases on variation in growth and skeletal development. *American Journal of Human Biology*, *29*(2), e22985. http://doi.org/10.1002/ajhb.22985

Freedom from disease

- 5 infectious diseases cause > 50% of childhood deaths < 5 years old worldwide: pneumonia, diarrhea, malaria, measles, and AIDS

- Asthma, cystic fibrosis, inflammatory bowel disease, renal disease are associated with abnormalities in growth
    - *Slowed growth velocity is often the first sign of inflammatory bowel disease (Crohn's and Ulcerative colitis) in children*
    -

- Preventative strategies include supplementation, breast feeding, and vaccination

- The mechanism(s) by which disease limits growth is variable, including inflammation, malabsorption, poor appetite, immobility/neuromuscular limitations, or medical therapies

Katona, P., & Katona-Apte, J. (2008). The Interaction between Nutrition and Infection. *Clinical Infectious Diseases*, *46*(10), 1582–1588. http://doi.org/10.1086/587658
Schlaudecker, E. P., Steinhoff, M. C., & Moore, S. R. (2011). Interactions of diarrhea, pneumonia, and malnutrition in childhood. *Current Opinion in Infectious Diseases*, *24*(5), 496–502. http://doi.org/10.1097/QCO.0b013e328349287d
Zemel, B. S. (2017). Influence of complex childhood diseases on variation in growth and skeletal development. *American Journal of Human Biology*, *29*(2), e22985. http://doi.org/10.1002/ajhb.22985


Let Them Eat Dirt
"A MUST-READ... takes you inside a child's gut and shows you how to give kids the best immune start early in life."
—WILLIAM SEARS, MD, co-author, The Baby Book
Saving Our Children from an Oversanitized World
B. BRETT FINLAY, Ph.D AND MARIE-CLAIRE ARRIETA. Ph.D


UNITED STATES
OLYMPIC TEAM

Physical activity

- Important for normal skeletal development
  - Physical exercise during growth may help to prevent osteoporosis-related fractures later in life

- Moderate physical exercise results in cardiovascular benefits and favourable changes in body composition, both of which promote growth
  - Exercise also increases endogenous growth hormone production

- Intensive physical exercise may however attenuate growth and delay puberty
  - Due to negative energy balance, psychological stress, and strict dietary regimes
  - Primarily observed in gymnasts

Baxter-Jones, A. D., Helms, P., Maffulli, N., Baines-Preece, J. C., & Preece, M. (n.d.). Growth and development of male gymnasts, swimmers, soccer and tennis players: a longitudinal study. *Annals of Human Biology*, *22*(5), 381–94. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/8744994

Georgopoulos, N. A., Roupas, N. D., Theodoropoulou, A., Tsekouras, A., Vagenakis, A. G., & Markou, K. B. (2010). The influence of intensive physical training on growth and pubertal development in athletes. *Annals of the New York Academy of Sciences*, *1205*(1), 39–44. http://doi.org/10.1111/j.1749-6632.2010.05677.x

Nordström, A., Karlsson, C., Nyquist, F., Olsson, T., Nordström, P., & Karlsson, M. (2004). Bone Loss and Fracture Risk After Reduced Physical Activity. *Journal of Bone and Mineral Research*, *20*(2), 202–207. http://doi.org/10.1359/JBMR.041012

Urlacher, S. S., & Kramer, K. L. (2018). Evidence for energetic tradeoffs between physical activity and childhood growth across the nutritional transition. *Scientific Reports*, *8*(1), 369. http://doi.org/10.1038/s41598-017-18738-4

Sleep

- The cognitive and developmental benefits of sleep have been well studied; however, there may also be several relationship between sleep and infant growth:
    1. **Sleep and obesity** – less than 12 hours/day in the first 2 years of life is associated with an increased BMI in childhood, due to increased caloric intake and insulin resistance from counter-regulatory hormones\

    2. **Sleep and growth stunting** - sleep is temporally coupled with growth in early life, with increases in sleep preceding length growth.
        - Growth stunting may be associated with shorter sleep duration, increased night waking, and shorter nap duration but likely secondary to other factors

    3. **Sleep and growth hormone** – peak growth hormone production occurs just after the onset of sleep

Kordas, K., Siegel, E. H., Olney, D. K., Katz, J., Tielsch, J. M., Chwaya, H. M., … Stoltzfus, R. J. (2008). Maternal reports of sleep in 6–18 month-old infants from Nepal and Zanzibar: Association with iron deficiency anemia and stunting. *Early Human Development*, *84*(6), 389–398. http://doi.org/10.1016/J.EARLHUMDEV.2007.10.007
Taveras, E. M., Rifas-Shiman, S. L., Oken, E., Gunderson, E. P., & Gillman, M. W. (2008). Short Sleep Duration in Infancy and Risk of Childhood Overweight. *Archives of Pediatrics & Adolescent Medicine*, *162*(4), 305. http://doi.org/10.1001/archpedi.162.4.305
Tham, E. K., Schneider, N., & Broekman, B. F. (2017). Infant sleep and its relation with cognition and growth: a narrative review. *Nature and Science of Sleep*, *9*, 135–149. http://doi.org/10.2147/NSS.S125992

Sleep requirements by age

Age	Recommended	May be appropriate	Not recommended
Newborns *0-3 months*	14 to 17 hours	11 to 13 hours 18 to 19 hours	Less than 11 hours More than 19 hours
Infants *4-11 months*	12 to 15 hours	10 to 11 hours 16 to 18 hours	Less than 10 hours More than 18 hours
Toddlers *1-2 years*	11 to 14 hours	9 to 10 hours 15 to 16 hours	Less than 9 hours More than 16 hours
Preschoolers *3-5 years*	10 to 13 hours	8 to 9 hours 14 hours	Less than 8 hours More than 14 hours
School-aged Children *6-13 years*	9 to 11 hours	7 to 8 hours 12 hours	Less than 7 hours More than 12 hours
Teenagers *14-17 years*	8 to 10 hours	7 hours 11 hours	Less than 7 hours More than 11 hours
Young Adults *18-25 years*	7 to 9 hours	6 hours 10 to 11 hours	Less than 6 hours More than 11 hours

National Sleep Foundation recommendations

Hirshkowitz M, Whiton K, Albert SM, et al. National sleep foundation's sleep time duration recommendations: methodology and results summary. Sleep Heal. 2015;1(1):40–43.

Table adapted from https://sleepfoundation.org/excessivesleepiness/content/how-much-sleep-do-babies-and-kids-need

Socioeconomics

- Poor living conditions, parental social class, and maternal education all independently associated with adult height
- Likely a result of lack of access to resources and increased exposure to risk factors, as well as family dynamics

Zemel, B. S. (2017). Influence of complex childhood diseases on variation in growth and skeletal development. *American Journal of Human Biology*, *29*(2), e22985. http://doi.org/10.1002/ajhb.22985

'Feral' child barks and hisses after being raised as a pet

A "feral" five-year-old girl who hisses and barks after being forced by her family to live as one of their many pets has been rescued from a home in far eastern Russia.

Natasha Mikhailova Photo: AFP

By Adrian Blomfield in Moscow
12:57PM BST 27 May 2009

How about that?
News » World News »
Europe » Russia »

In How About That?

Pictures of the day

Pictures of the day

Psychological support

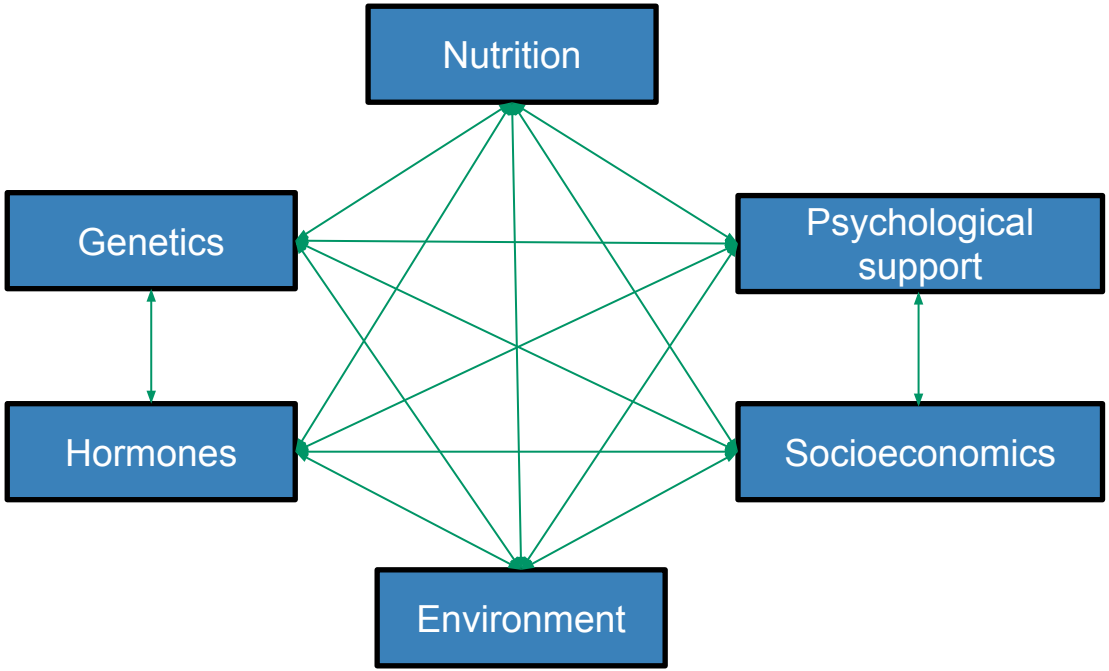
- Adverse early life experiences, such as abuse, neglect, and maltreatment, have been associated with short stature relative to growth trajectories
- Chronic stress is associated with deficits in growth hormone and estrogen production
- Psychosocial short stature – syndrome caused by deprivation, emotional stress, and neglect in children and infants
    - Growth hormone secretion may be attenuated but treatment is not efficacious
    - Children demonstrate catch-up growth when removed from environment

Gohlke, B. C., Khadilkar, V. V., Skuse, D., & Stanhope, R. (1998). Recognition of Children with Psychosocial Short Stature: A Spectrum of Presentation. *Journal of Pediatric Endocrinology and Metabolism*, *11*(4), 509–518. http://doi.org/10.1515/JPEM.1998.11.4.509
Ranabir, S., & Reetu, K. (2011). Stress and hormones. *Indian Journal of Endocrinology and Metabolism*, *15*(1), 18–22. http://doi.org/10.4103/2230-8210.77573

The determinants of childhood growth

- Genetics (the instruction manual)
- Hormones (growth hormone, thyroid hormone, and sex hormones)
- Nutrition (adequate micro- and macronutrients)
- Environment (prenatal, sleep, freedom from disease, physical activity)
- Socioeconomics (parental income, social class)
- Psychological support (love)

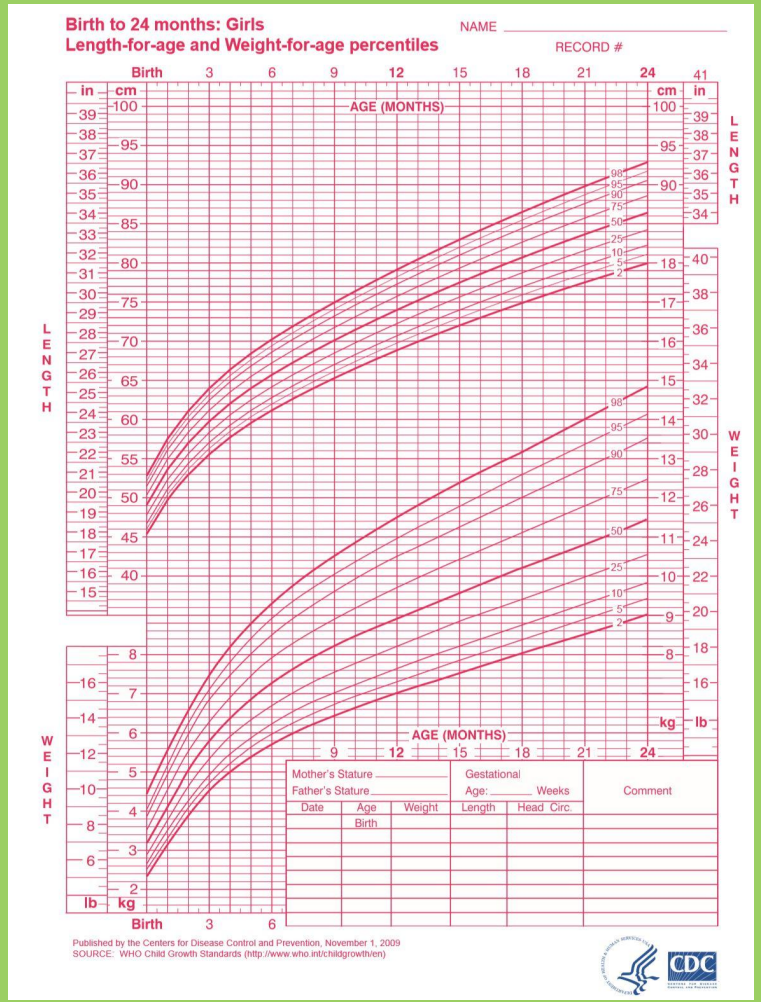
The determinants of childhood growth

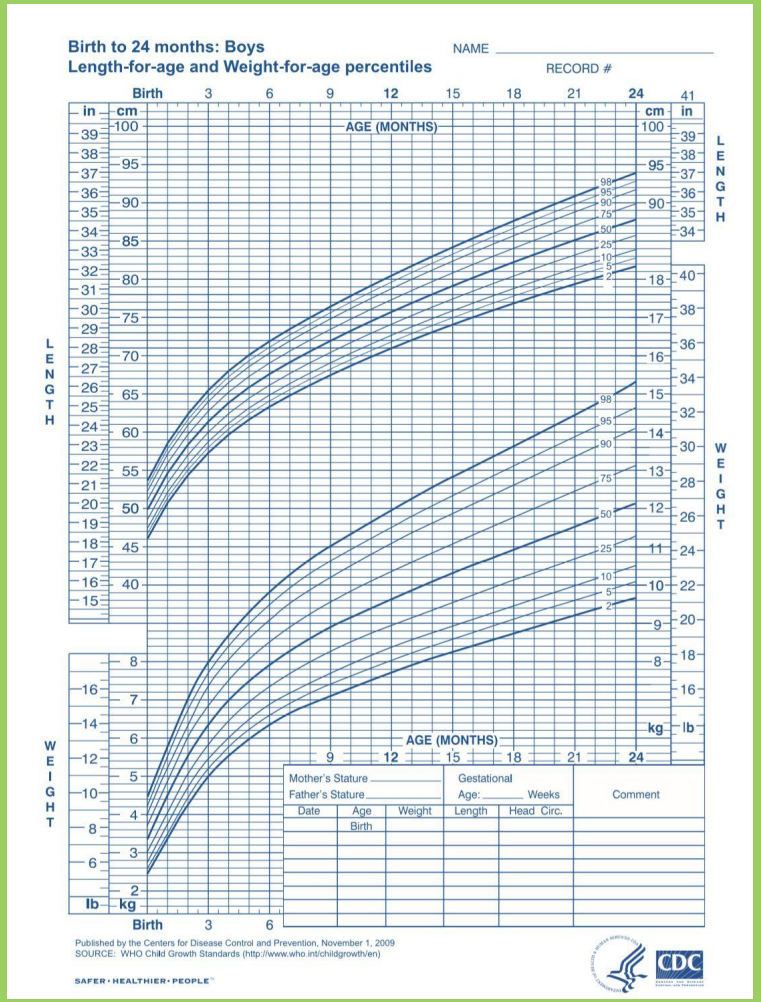


Childhood Development

The Infant (birth to 2 years)

http://www.lovethispic.com/blog/4565/50-funny-baby-pictures%2C-memes-and-quotes





WHO Child Growth Standards (http://www.who.int/childgrowth/en)

Domains of Development

- Gross motor
- Fine motor
- Speech/ Language
- Cognitive/ Problem Solving
- Social/ Emotional

Andrews & Dosman 2014. Developmental Stages. University of Alberta

“***Developmental milestones*** *are things most children can do by a certain age”*

The Division of Developmental Pediatrics,
Department of Pediatrics, Faculty of Medicine and Dentistry, University of Alberta

SNAPSHOTS* DEVELOPMENTAL MILESTONES

Mnemonic	Gotta Find Strong Coffee Soon‡				
	G = Gotta	F = Find	S = Strong	C = Coffee	S = Soon
Age	Gross Motor	Fine Motor	Speech / Language	Cognitive / Problem Solving	Social / Emotional
Newborn	Primitive reflexes – step, place, Moro, Babinski, ATNR Flexor posture	Primitive reflexes – grasp	Primitive reflexes – root, suck Alerts to sound Startles to loud sounds Variable cries	Visual focal length ~10" Fix & follow slow horizontal arc Prefers contrast, colours, face Prefers high pitched voice	Bonding (parent → child) Self-regulation/soothing
2 mos	Head steady when held Head up 45° prone	Hands open half of time Bats at objects	Turns to voice Cooing	Prefers usual caregiver Attends to moderate novelty Follows past midline	Attachment (child → parent) Social smile
4 mos	Sits with support Head up 90° prone, arms out Rolls front → back	Palmar grasp Reaches and obtains items Brings objects to midline	Laugh, razz, "ga", squeal	Anticipates routines Purposeful sensory exploration of objects (eyes, hands, mouth)	Turn-taking conversations Explores parent's face
6 mos	Postural reflexes Sits tripod Rolls both ways	Raking grasp Transfers hand to hand	Babble (nonspecific)	Stranger anxiety Looks for dropped or partially hidden object	Expresses emotions: happy, sad, mad Memory lasts ~24 hrs
9 mos	Gets from all 4s → sitting Sits well with hands free Pulls to stand Creeps on hands and knees	Inferior pincer grasp Pokes at objects	"Mama", "dada" (specific) Gestures "bye bye", "up" Gesture games ("pattycake")	Object permanence Uncovers toy "Peek-a-boo"	Separation anxiety
12 mos	Walks a few steps Wide-based gait	Fine pincer (fingertips) Voluntary release Throws objects Finger-feeds self cheerios	1 word with meaning (besides mama, dada) Inhibits with "no!" Responds to own name 1-step command with gesture	Cause & effect Trial & error Imitates gestures and sounds Uses objects functionally, eg rolls toy car	Explore from secure base Points at wanted items Narrative memory begins
15 mos	Walks well	Uses spoon, open top cup Tower of 2 blocks	Points to 1 body part 1-step command no gesture 5 words Jargoning	Looks for moved hidden object if saw it being moved Experiments with toys to make them work	Shared attention: points at interesting items to show to parent Brings toys to parent
18 mos	Stoops and recovers Runs	Carries toys while walking Removes clothing Tower of 4 blocks Scribbles, fisted pencil grasp	Points to object, 3 body parts 10-25 words Embedded jargoning Labels familiar objects	Imitates housework Symbolic play with doll or bear, eg "Give teddy a drink"	Increased independence Parallel play
2 yr	Jumps on two feet Up & down stairs "marking time"	Handedness established Uses fork Tower of 6 blocks Imitates vertical stroke	Follows 2-step command 50+ words, 50% intelligible 2 word phrases "I", "me", "you", plurals	New problem-solving strategies without rehearsal Searches for hidden object after multiple displacements	Testing limits, tantrums Negativism ("no!") Possessive ("mine!")

Newborn

Black = milestone
Orange = milestone and red flag if not met
Red = red flag if not met

Gross motor	Fine motor	Speech/ Language	Cognitive/ Problem Solving	Social/ Emotional
Primitive reflexes - Moro - Babinski - Asymmetric Tonic Neck Reflex	Primitive reflexes - palmar grasp	Primitive reflexes - Root - Suck	Fix & follow slow horizontal arc	Bonding (parent → child)

Andrews & Dosman 2014. Developmental Stages. University of Alberta
https://www.fitpregnancy.com/baby/baby-care/your-newborn-users-guide

Moro Reflex

Babinski Reflex

Asymmetric Tonic Neck Reflex

2 months

Black = milestone
Orange = milestone and red flag if not met
Red = red flag if not met

Gross motor	Fine motor	Speech/ Language	Cognitive/ Problem Solving	Social/ Emotional
Head up 45° prone Roll back → front	Bats at objects	Turns to voice Cooing	Prefers usual caregiver Follows horizontal arc	Attachment Social smile

Andrews & Dosman 2014. Developmental Stages. University of Alberta
https://www.babycenter.com/303_baby-at-2-months-week-4_1615795.bc

4 months

Black = milestone
Orange = milestone and red flag if not met
Red = red flag if not met

Gross motor	Fine motor	Speech/ Language	Cognitive/ Problem Solving	Social/ Emotional
Rolls front → back Sits with support Rolls back → front	Palmar grasp Brings objects to midline	Laugh / Squeal coos	Anticipates routine	Turn-taking conversations Explores parent's face

Andrews & Dosman 2014. Developmental Stages. University of Alberta
http://thegingerbreadbaby.blogspot.ca/2015/05/pretend-its-april-4-months-and-4-year.html

Still Face Experiment

6 months

Black = milestone
Orange = milestone and red flag if not met
Red = red flag if not met

Gross motor	Fine motor	Speech/ Language	Cognitive/ Problem Solving	Social/ Emotional
Sits tripod Rolls both ways Postural reflexes Primitive reflexes gone	Raking grasp Transfers hand to hand	Babble Laughs	Looks for dropped or partially hidden object	Memory lasts ~24 hrs Expresses emotions: happy, sad, mad

Andrews & Dosman 2014. Developmental Stages. University of Alberta
https://kidspot.co.nz/baby/six-nine-months-social-emotional-milestones/

9 months

Black = milestone
Orange = milestone and red flag if not met
Red = red flag if not met

Gross motor	Fine motor	Speech/ Language	Cognitive/ Problem Solving	Social/ Emotional
Pulls to stand Sits with hands free Postural reflexes Rolls both ways	Pokes at objects Clumsy pincer grasps Raking grasp	"Mama" "Dada" Gestures "bye-bye" and "up"	Object permanence - searches for hidden toy	Separation anxiety

Andrews & Dosman 2014. Developmental Stages. University of Alberta
http://www.momjunction.com/articles/toys-for-nine-month-old-babies_00369243/?ref=content/

12 months

Black = milestone
Orange = milestone and red flag if not met
Red = red flag if not met

Gross motor	Fine motor	Speech/ Language	Cognitive/ Problem Solving	Social/ Emotional
Walks a few steps Wide-based gait Sits Crawls Pulls to stand	Throws objects Fine pincer grasps	Speaks one word Follows one-word commands with gestures Responds to name	Cause & effect Trial & error Object permanence	Points at wanted items Narrative memory begins

Andrews & Dosman 2014. Developmental Stages. University of Alberta
http://www.momjunction.com/articles/babys-12th-month-a-development-guide_00101960/#gref

15 months

Black = milestone
Orange = milestone and red flag if not met
Red = red flag if not met

Gross motor	Fine motor	Speech/ Language	Cognitive/ Problem Solving	Social/ Emotional
Walks well	Uses spoon, open top cup Tower of 2 blocks	5 words 1-step commands	Experiments with toys	Points at interesting things to show parents

Andrews & Dosman 2014. Developmental Stages. University of Alberta
https://www.amonkeyandhismama.com/my-almost-15-month-old/

18 months

Black = milestone
Orange = milestone and red flag if not met
Red = red flag if not met

Gross motor	Fine motor	Speech/ Language	Cognitive/ Problem Solving	Social/ Emotional
Runs Walks alone	Removes clothing Tower of 4 blocks Scribbles Fisted pencil grasp	10-25 words Labels familiar objects Follows one-step commands	Imitates housework Imaginative play with doll or bear	Parallel play

Andrews & Dosman 2014. Developmental Stages. University of Alberta
http://www.meganstarkblog.com/keiras-18-month-old-portrait-session/

2 years

Black = milestone
Orange = milestone and red flag if not met
Red = red flag if not met

Gross motor	Fine motor	Speech/ Language	Cognitive / Problem Solving	Social/ Emotional
Jumps on 2 feet Runs	Uses fork Tower of 6 blocks Handedness established	Follows 2-step commands 50+ words 2-word phrases Speech 50% intelligible to strangers	New problem solving skills	Testing limits, tantrums Negativism (“no”) Possessive (“mine”) Parallel play

Andrews & Dosman 2014. Developmental Stages. University of Alberta
https://www.parents.com/toddlers-preschoolers/development/behavioral/tackle-terrible-twos/

Childhood Development

School Years

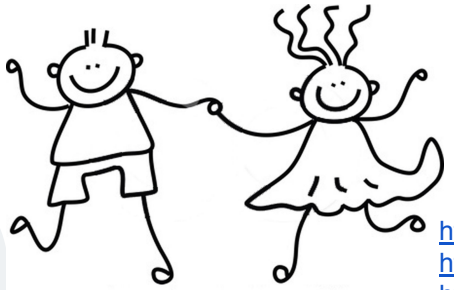
A time of big change!

http://www.tomcorsonknowles.com/blog/healthy-breakfast-your-kids-will-surely-love/ (image)

Developmental Milestones

Gross Motor Abilities

3 Years of Age	- Can ride a tricycle - Can run - Able to go up stairs foot by foot
4 Years of Age	- Able to hop on one foot - Can sometimes catch a ball
5 Years of Age	- Can do somersault - Able to ride a two-wheel bike

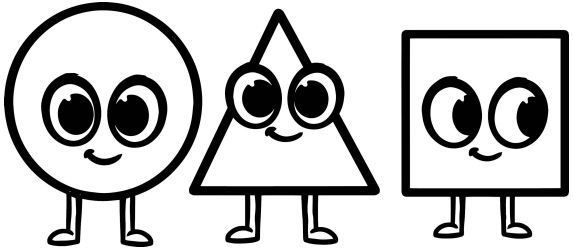


**** Least predictive ability for cognitive outcome later in life!***

https://www.cdc.gov/ncbddd/actearly/pdf/checklists/all_checklists.pdf
https://www.healthlinkbc.ca/health-topics/abo8756
http://letterformat.site/ (image)

Fine Motor Abilities

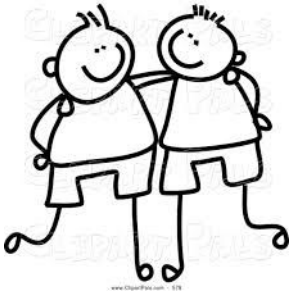
3 Years of Age	- Able to draw a circle - Have started to dress themselves - Have begun to use utensils
4 Years of Age	- Able to draw a square - Can use scissors
5 Years of Age	- Able to draw a triangle - Can doodle a person



https://www.cdc.gov/ncbddd/actearly/pdf/checklists/all_checklists.pdf
https://www.healthlinkbc.ca/health-topics/abo8756
http://futurities.info/ (image)

Social and Emotional Abilities

3 Years of Age	- Separates easily from parents - Shows a variety of emotions - May notice the emotions of other people and respond appropriately
4 Years of Age	- Can take turns when playing with other children - More able to roleplay
5 Years of Age	- Better understanding of what is real and what is not - Becoming more independent



https://www.cdc.gov/ncbddd/actearly/pdf/checklists/all_checklists.pdf
https://www.healthlinkbc.ca/health-topics/abo8756

Language Abilities

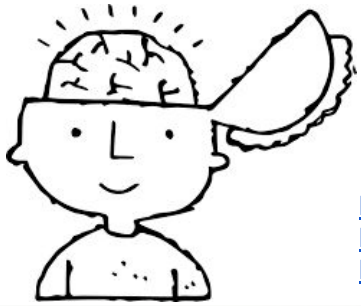
**** Speech is most predictive of cognitive development!***

3 Years of Age	- Can follow 3 step instructions - Knows their name - Strangers can generally understand the child is saying
4 Years of Age	- Beginning to understand basic grammar
5 Years of Age	- Can tell stories - Has more meaningful conversations

https://www.cdc.gov/ncbddd/actearly/pdf/checklists/all_checklists.pdf
https://www.healthlinkbc.ca/health-topics/abo8756
https://www.istockphoto.com (image)

Cognitive Abilities

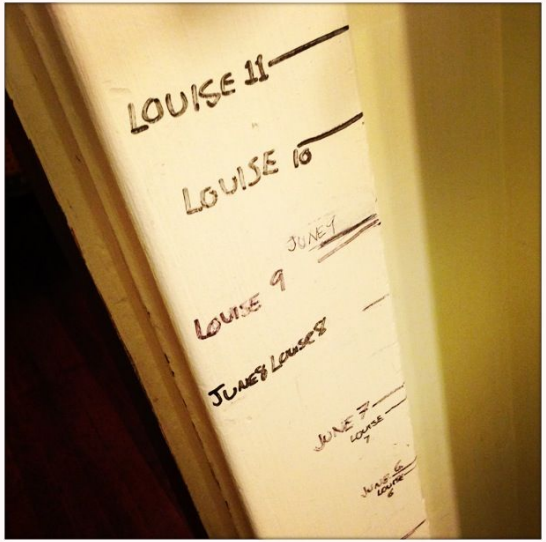
3 Years of Age	- Builds towers of 6 or more blocks - Can play make-believe
4 Years of Age	- Can name some numbers and may be able to count a few - Can tell when things are different or the same - Can play board or card games
5 Years of Age	- Understands the basic function of time - Knows everyday objects



https://www.cdc.gov/ncbddd/actearly/pdf/checklists/all_checklists.pdf
https://www.healthlinkbc.ca/health-topics/abo8756
http://therunawaymule.com/brain-coloring-page.html (image)

As children get older...

- Gain more and more ability to be active and play sports
- Improve both their written and verbal language
- Improved ability to handwrite and draw
- They begin to lose teeth
    - lose about four baby teeth a year!
- Are able to read stories
- Enjoy being social and having friends



https://www.healthlinkbc.ca/health-topics/abo8756
http://slimbolala.blogspot.ca/2013/02/kitchen-door-frame.html (image)

Childhood Development

Adolescence


Welcome to being a parent of a teenager. Prepare for a large amount of eye rolling, emotional outbursts, and thoughts of running away. And that's just the parents.
FACEBOOK.COM/MOTHERHOOD.ORG

Another time of big changes!

http://soberfish.co.uk/the-grown-up-awkward-teenager/ (image)

The biggest changes we see in youth are the physical changes and the social/emotional changes

…. Who am I!?

Puberty!

→ The process of going from sexual immaturity to sexual maturity

Girls: 10.5 years of age (range 8-12)
Boys: 11.5 years of age (range 9-13)
***** There is currently an observed trend towards puberty happening earlier***

- Growth spurts
- More injuries in sports
- Acne
- Hormonal fluctuations
- Menses
- Reproductive ability

https://www.uptodate.com/contents/normal-puberty

"At your age, Tommy, a boy's body goes through changes that are not always easy to understand."

From early to late adolescence

- Earlier in adolescence is characterized by wanting independence and less interest in parents and family
    - but this does turn around as we get into early adulthood

- Often this is when youth become aware of body image

- Experimentation!
    - The brain is still developing until the mid-20s

- Emotional Lability!
    - The parts of the brain are developing at different paces and it can lead to some dyssynchrony

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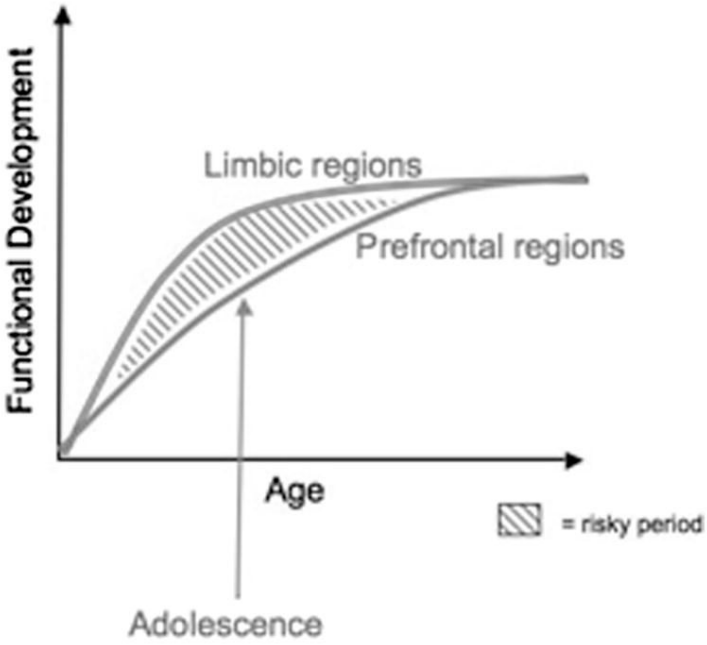
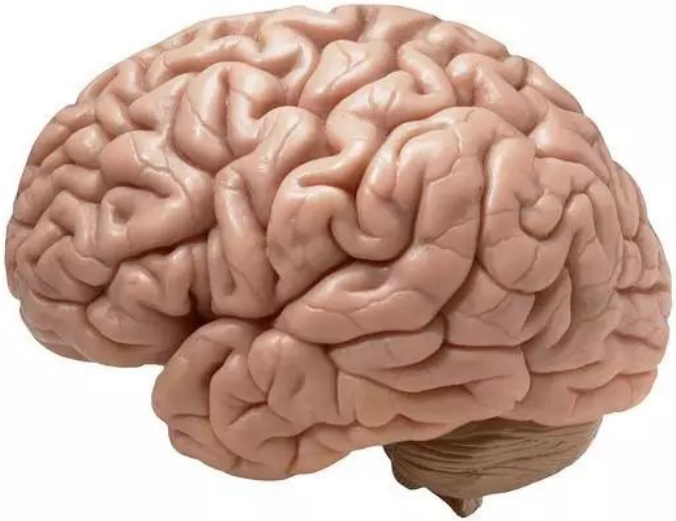


PFC



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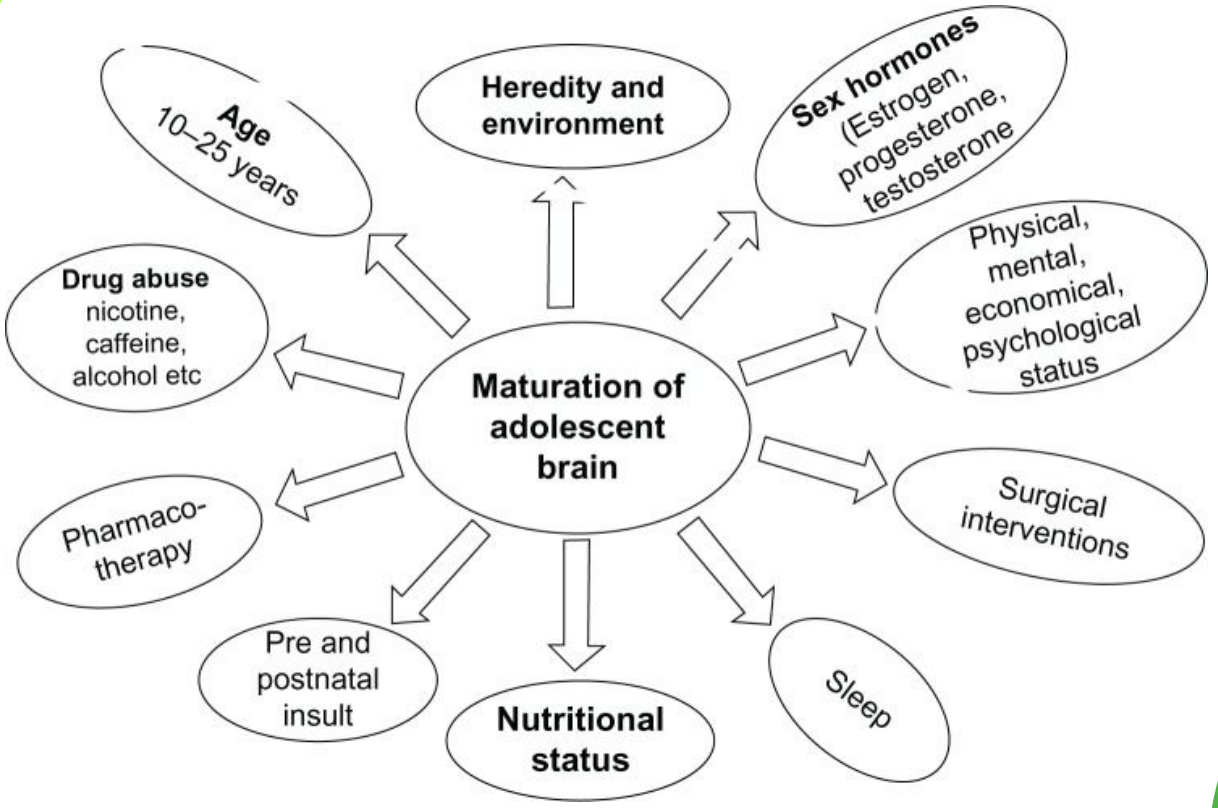
https://www.medicaldaily.com (image)



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Learning Disabilities

“Learning Disabilities refer to a number of disorders which may affect the acquisition, organization, retention, understanding or use of verbal or nonverbal information. These disorders affect learning in individuals who otherwise demonstrate at least average abilities essential for thinking and/or reasoning. As such, learning disabilities are distinct from global intellectual deficiency”

https://www.ldac-acta.ca/official-definition-of-learning-disabilities/

What does this look like?

- **It can affect**:
  - language
  - memory
  - attention
  - processing speed
  - executive functions

- That may manifest as difficulties in:
  - mathematics
  - listening
  - speaking
  - reading
  - writing
  - overall school performance
  - and others!

https://www.ldac-acta.ca/official-definition-of-learning-disabilities/
http://wikiclipart.com/child-thinking-clipart_39090/ (image)

A bit more info

- Can range from mild to severe
- May affect more than one aspect of learning
- Are permanent
- Usually due to genetics or injury to the brain

- Important to be identified early!

- Need individualized interventions to help them learn best!

https://www.ldac-acta.ca/official-definition-of-learning-disabilities/

Autism Spectrum Disorder

Everyone with Autism presents a little differently than another person with Autism.

That is because this is a spectrum disorder.

Three Core Characteristics

1) Disordered verbal and nonverbal communication

2) Impairments in social interaction

3) Repetitive behaviour and restrictive interests

https://autismcanada.org
https://www.emedicinehealth.com/autism

Vaccine Safety
Specific Vaccines +
Common C
Adjuvants
Autism −
CDC Statement: 2004 Pediatrics Paper on MMR and Autism
Fainting (Syncope)
Febrile Se
Guillain-Barré Syndrome
Multiple Vaccines and the Immune System
Sudden Infant Death Syndrome (SIDS)
Thimerosal in Vaccines +
Vaccines I

Vaccines Do Not Cause Autism

Autism spectrum disorder (ASD) is a developmental disability that is caused by differences in how the brain functions. People with ASD may communicate, interact, behave, and learn in different ways. Recent estimates from CDC's Autism and Developmental Disabilities Monitoring Network found that about 1 in 68 children have been identified with ASD in communities across the United States. CDC is committed to providing essential data on ASD, searching for causes of and factors that increase the risk for ASD, and developing resources that help identify children with ASD as early as possible.

There is no link between vaccines and autism.

Some people have had concerns that ASD might be linked to the vaccines children receive, but studies have shown that there is no link between receiving vaccines and developing ASD. In 2011, an Institute of Medicine (IOM) report on eight vaccines given to children and adults found that with rare exceptions, these vaccines are very safe.

A 2013 CDC study [PDF – 204 KB] added to the research showing that vaccines do not cause ASD. The study looked at the number of antigens (substances in vaccines that cause the body's immune system to produce disease-fighting antibodies) from vaccines during the first two years of life. The results showed that the total amount of antigen from vaccines received was the same between children with ASD and those that did not have ASD.

Vaccine ingredients do not cause autism.

Attention Deficit Hyperactivity Disorder

What is it?

Mental disorder that has been characterized by 3 main problems:

1) Regulating activity level
2) Attention
3) Impulsivity

Children with ADHD often are described as:

- Lazy
- Impatient
- Careless
- Struggles to follow instructions
- Disruptive

→ Most common mental disorder in childhood

https://cmha.bc.ca/documents/attention-deficithyperactivity-disorder-in-children-and-youth/
http://caddac.ca/adhd/understanding-adhd/in-general/

Who is affected?

- Roughly 5% of children
- Disproportionately affects boys (3:1!)
- Often runs in families
- Co-occurs with other behavioural or mental disorders

- The cause is not completely known, but it is likely a combination of genes and environment
    - It is more commonly seen if there has been cigarette smoking in pregnancy

https://cmha.bc.ca/documents/attention-deficithyperactivity-disorder-in-children-and-youth/
http://caddac.ca/adhd/understanding-adhd/in-general/

If you are concerned about a child in your life, please speak to your Doctor or School Counsellor for more information and testing :)

“Be who you are and say what you feel because those who mind don't matter and those who matter don't mind.

- Dr. Seuss

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