



BI 358 Lecture 13

Now!

- I. Announcements Quiz 4 1st 15-20 min. Q? Presentations Group I today! Today's lecture prep for Dr. St. Germain's & Dr. Bradshaw's guest lectures, Mar 2nd+7th. Reminders: Sign-in, attendance, guest feedback, .pptx vs Prezi vs...Q?
- II. Neonatal & Pediatric Physiology Prep for Dr. Bradshaw
 - A. What's a *neonate*? Age range for pediatric patients?
 - B. Some differences?
 1. Markers to predict problems (NB: rare ~95% OK!)
 2. cf: Neonate vs. adult human values (selected)
 3. Body fluid composition? Intake & excretion
 4. Heart differences?
 5. More frequent, yet still uncommon problems: congenital genetic defects, Tetralogy of Fallot, Down syndrome, Edward's syndrome, Cystic fibrosis
 - C. Development & Pediatrics tour, Tanner scale. Ref: Moore, Persaud, Shiota (MPS); Johnson (RVJ) +...



Neonate
Gr. neos/new
L. -nat/born

infant
1st 4wk > birth



Charles A. Hoffmeister, MD
Neonatal/Perinatal Specialist

Examination of the Newborn

An Evidence-Based Guide
Second Edition



EDITED BY ANNE LOMAX



WILEY Blackwell



Dr. Deanna St. Germain, DO
Medical Director
Kids' **FIRST**



Change Their World and it Will Change Yours!

PROVIDING INTERVENTION AND ADVOCACY FOR CHILDREN WHO ARE VICTIMS OF OR WITNESSES TO CRIME.

Life-long
education...



Safety,
prevention...

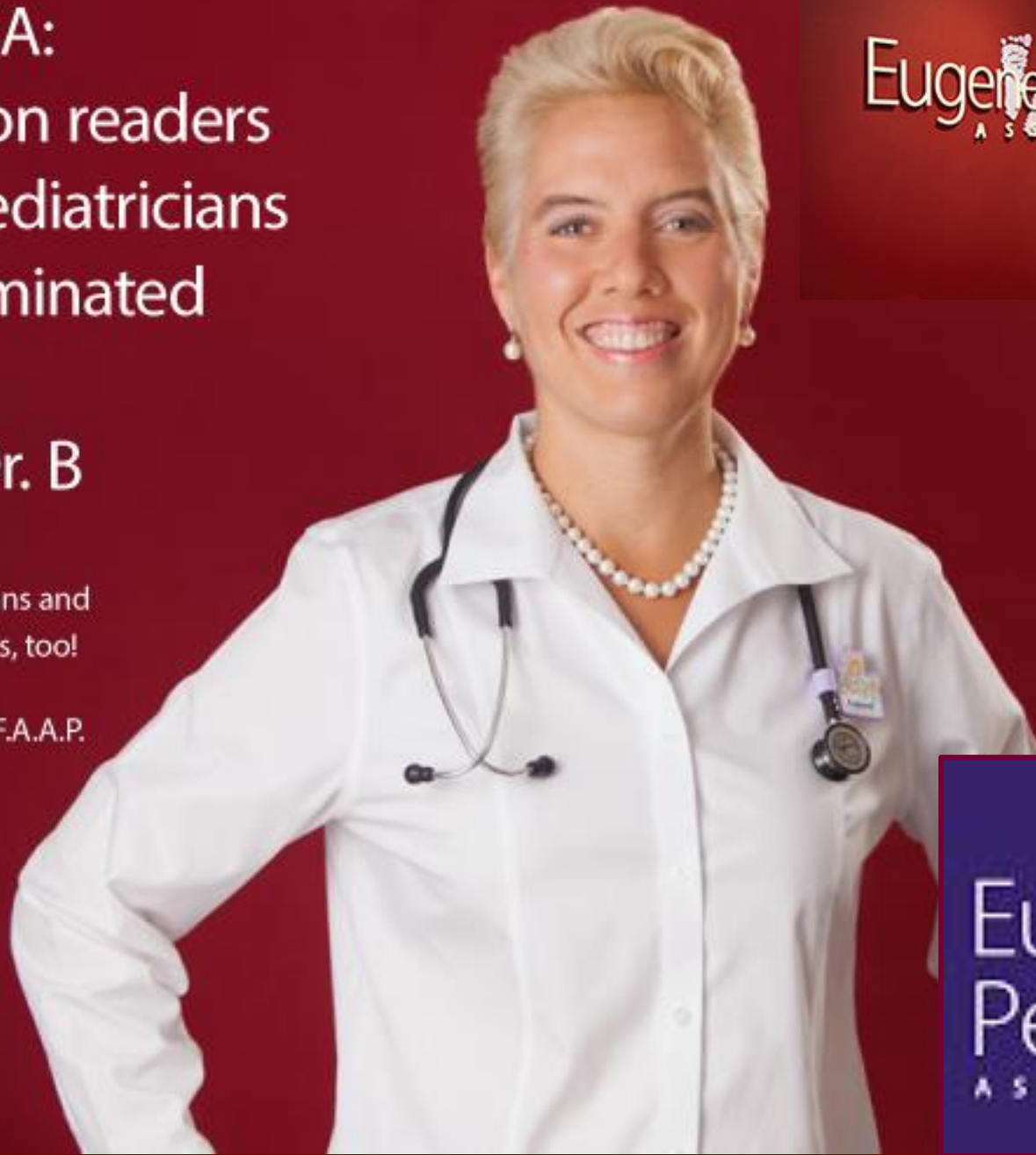
Pediatrics = *Gr. παιδιά/paidiá/children*
Γιατρός/Giatrós/physician

medical branch that treats child:
development, care, disease treatment










In the USA:
13.4 million readers
57,695 pediatricians
2,100 nominated
7 chosen
1 is our Dr. B

You're one of our
favorite pediatricians and
Parents magazine's, too!

Pilar Bradshaw, M.D., F.A.A.P.



VARIABLE**NEONATE****ADULT**

WT (lb)	7 <i>< 6.0 premature</i>	♀ 110 ♂ 150
WT (lb, range)	4.5  11	wide variation
HR (b/min)	130 	<i>~2 x 70</i>
RR (breaths/min)	40 	<i>3 x 12-15</i>
BV (mL)	<i>! 16.7 x 300</i> 	<i>$\frac{1}{17} x 5000$</i>
CO/ \dot{Q} (mL/min)	<i>100 x 50</i> 	<i>$\frac{1}{100} x 5000$</i>
BP (mm Hg)	70/50 	<i>?? x 120/80</i>
BMR (relative)	2x Adult	 1
FLUID Δ (relative)	 7x Adult	 1

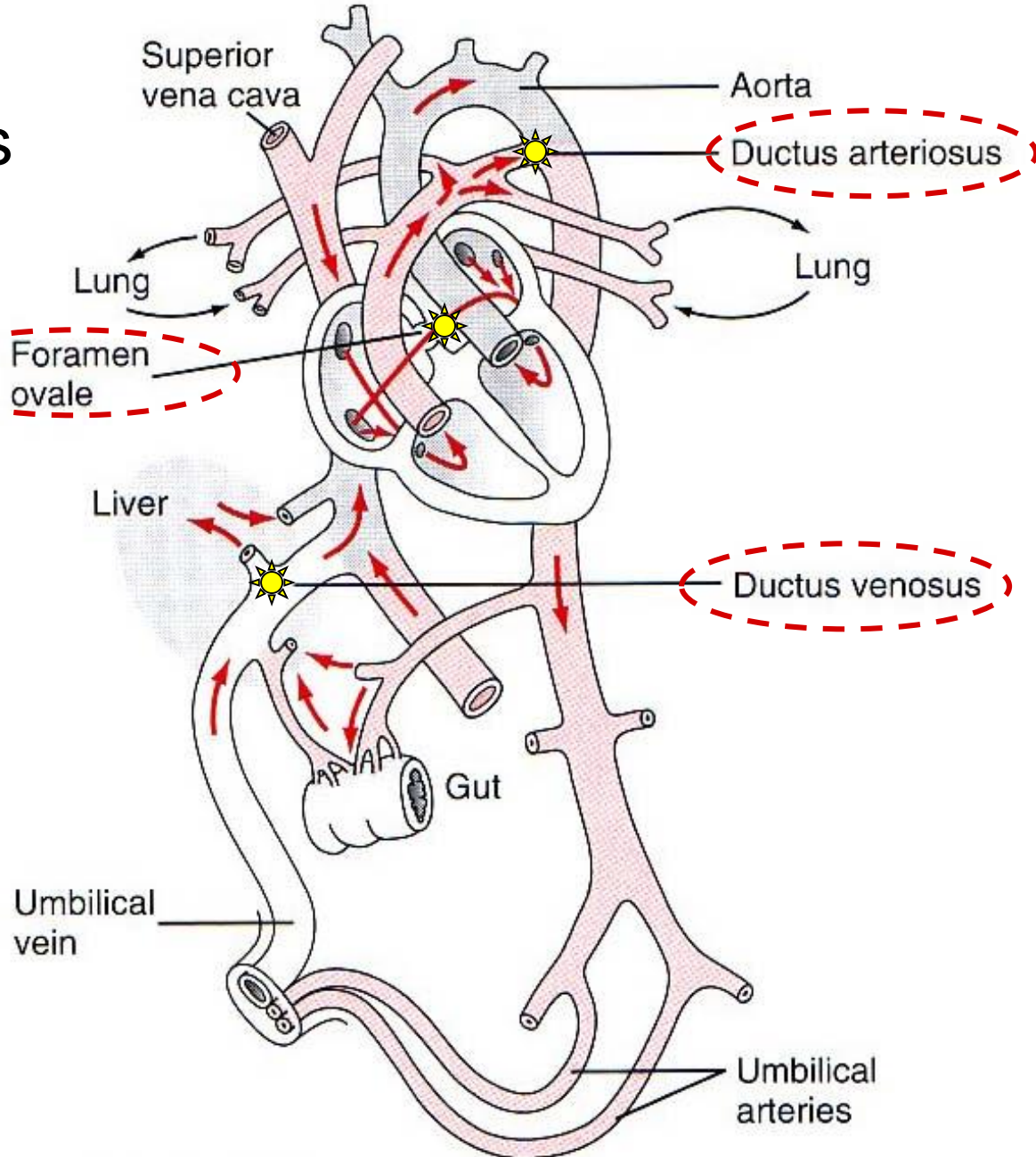
H₂O Homeostasis!

Fetal Circulation: Aqua Animal!

① Ductus Arteriosus

② Foramen Ovale

③ Ductus Venosus



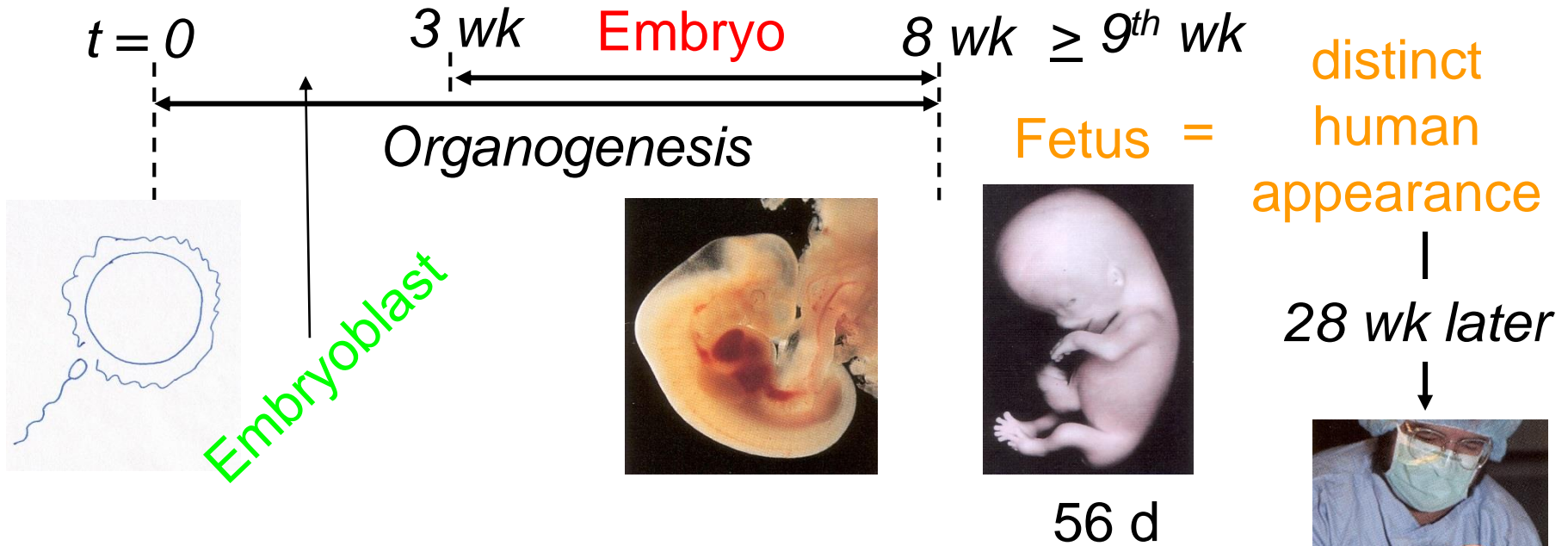


5 wk

RV Johnson (RVJ)
1994 Mayo Clinic p A2



6 wk



How so fast? Cell divisions in as little as 4 hr!

	24 hr/d						
	0	4	8	12	16	20	24
Cells	1	2	4	8	16	32	64
	2^0	2^1	2^2	2^3	2^4	2^5	2^6

...100 trillion!

Embryo?
Fetus?
Baby?

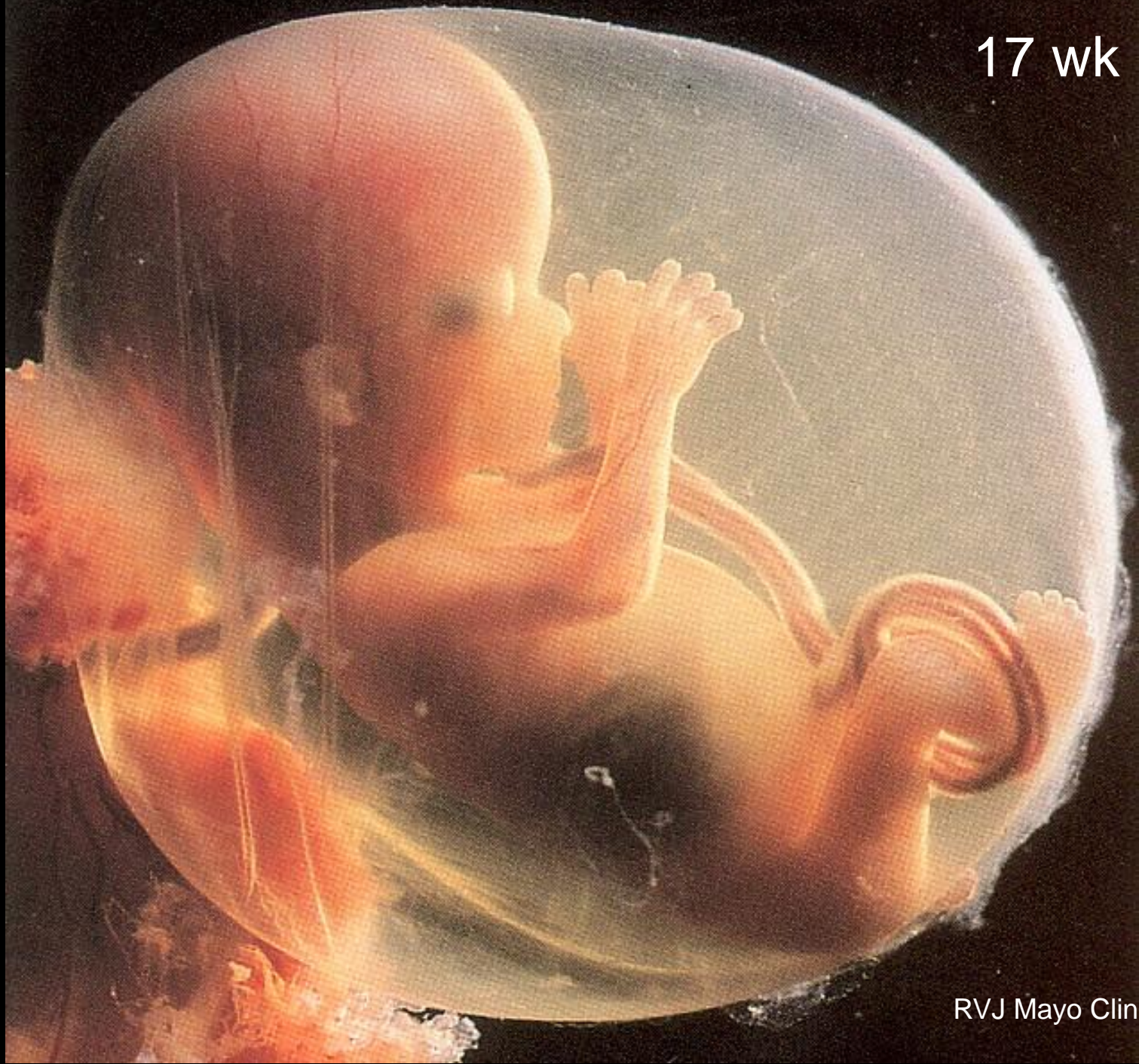


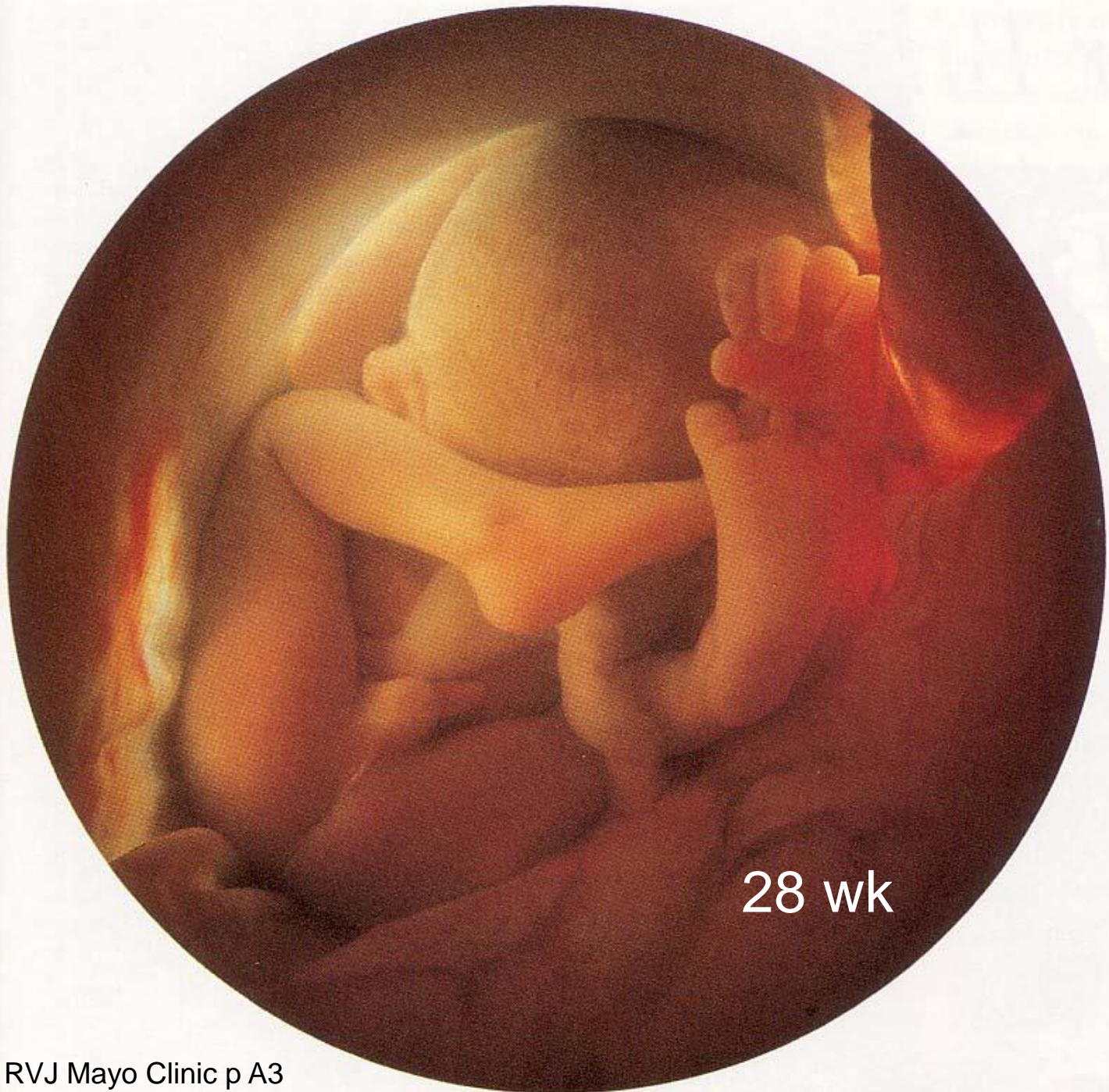
TW Sadler 2004
Langman's
Essential
Medical
Embryology

9 wk

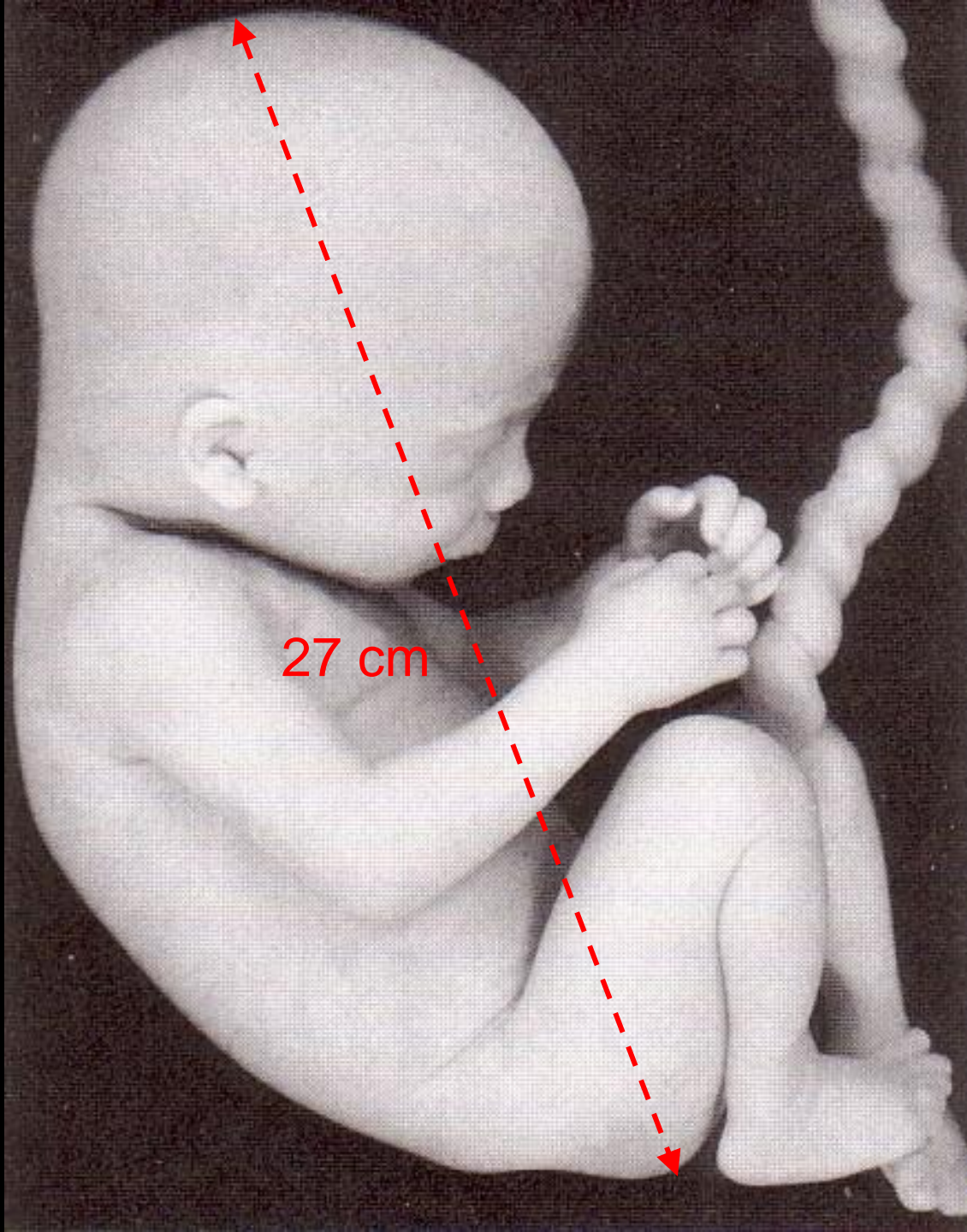


17 wk





28 wk



Fetus @ 28 wk
or 7 mo
1100 g (1.1 kg)
≈ 2.5 lb

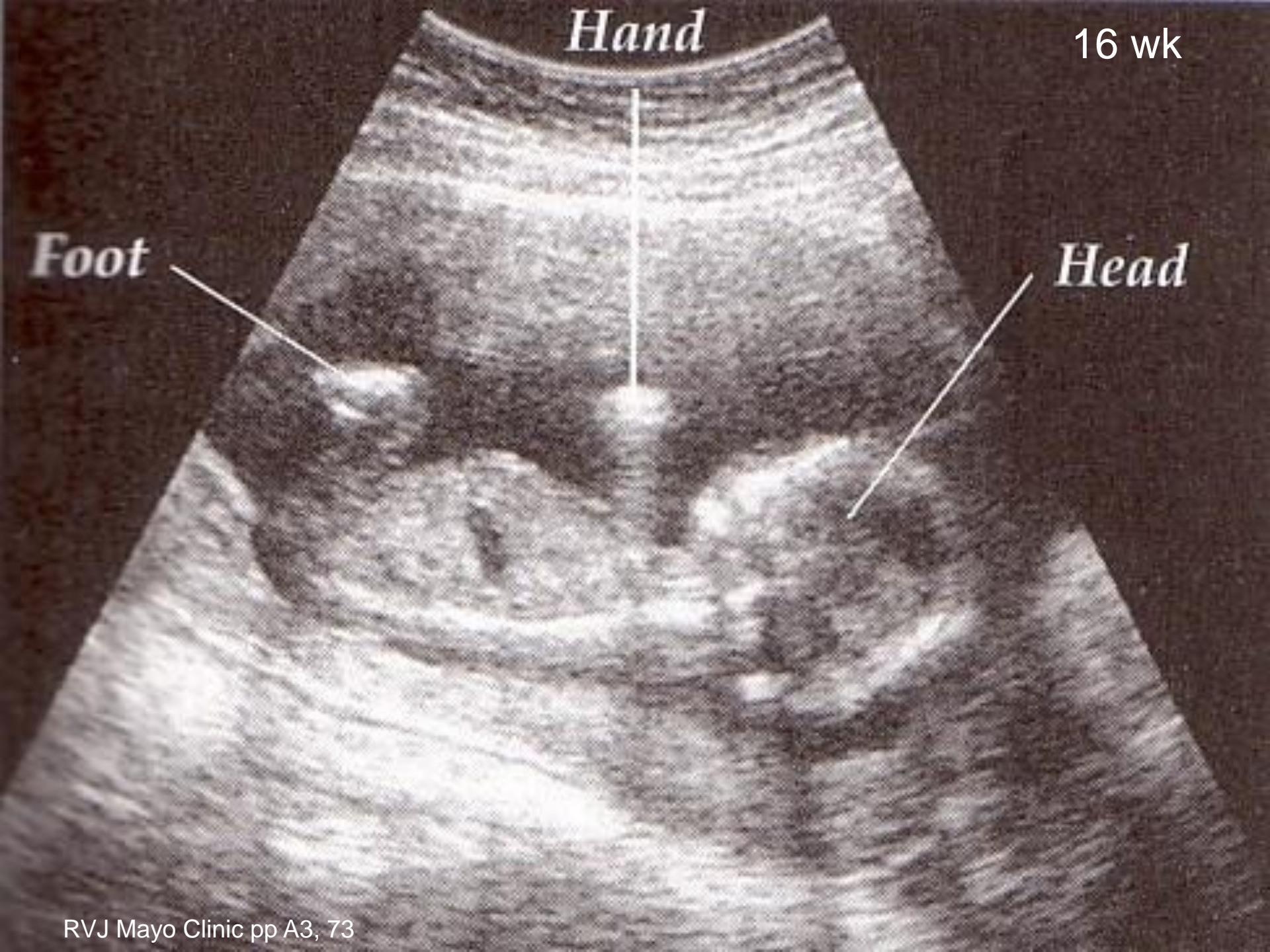
27 cm

As a Pregnant Female –

Where you'll gain the weight

Your baby	6½ to 9 pounds
Placenta	1½ pounds
Amniotic fluid	2 pounds
Breast enlargement	1 to 3 pounds
Uterus enlargement	2 pounds
Fat stores and muscle development	4 to 8 pounds
Increased blood volume	3 to 4 pounds
Increased fluid volume	2 to 3 pounds

Total 22 to 32½ pounds



Hand

16 wk

Foot

Head

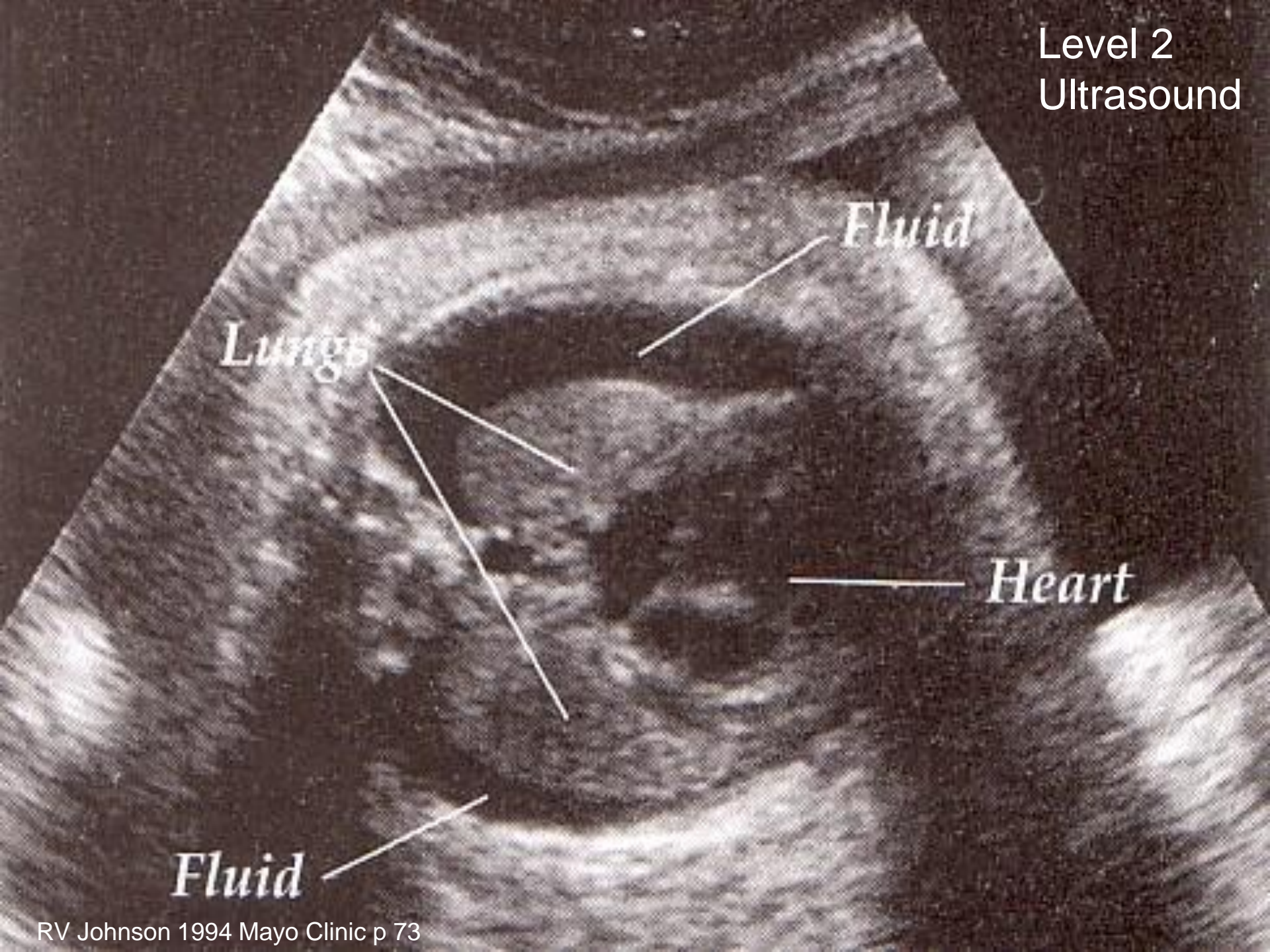
Surprise!

Head

Head



Level 2
Ultrasound



Lungs

Fluid

Heart

Fluid

What are my chances of having a child with a birth defect? $\leq 5\%$

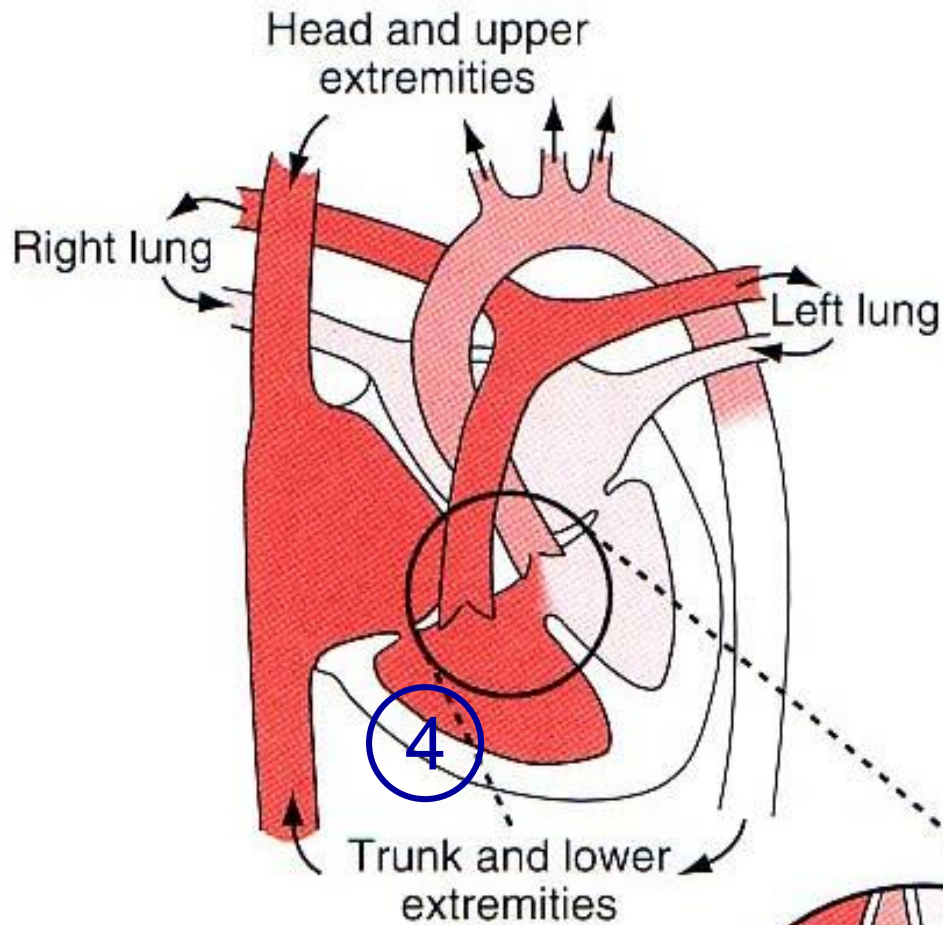
Of every 100 babies born in the United States, 95 to 97 are born healthy (no major medical or surgical intervention is necessary). According to the March of Dimes Birth Defects Foundation:

- One of every 175 is born with a congenital heart defect.
- One of every 400 is born with clubfoot.
- One of every 700 is born with cleft lip and palate.
- One of every 800 is born with Down syndrome.
- One of every 2,000 is born with spina bifida.

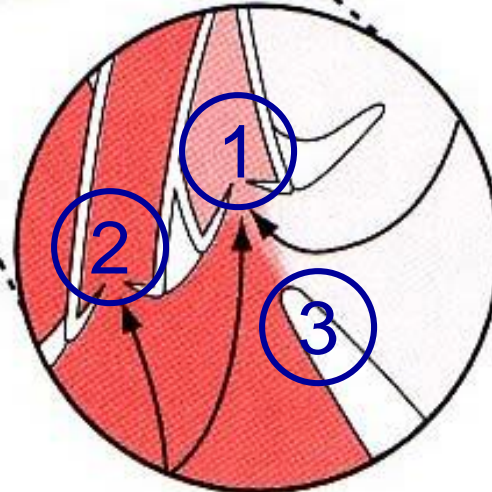
To put this list into perspective, consider the following:

- The odds of having twins are about one in 100.
- The odds of having triplets are about one in 8,000.

Tetralogy of Fallot



- ① Aorta Displacement
- ② Pulmonary Stenosis
- ③ Ventricular Septal Defect
- ④ R Ventricular Hypertrophy



f = 3.3 per 10,000 live births
15% TOF 22q11 deletion
7% TOF trisomy 21
≥ 4% TOF NKX2.5 mutation

Chromosome abnormalities: What are your risks?

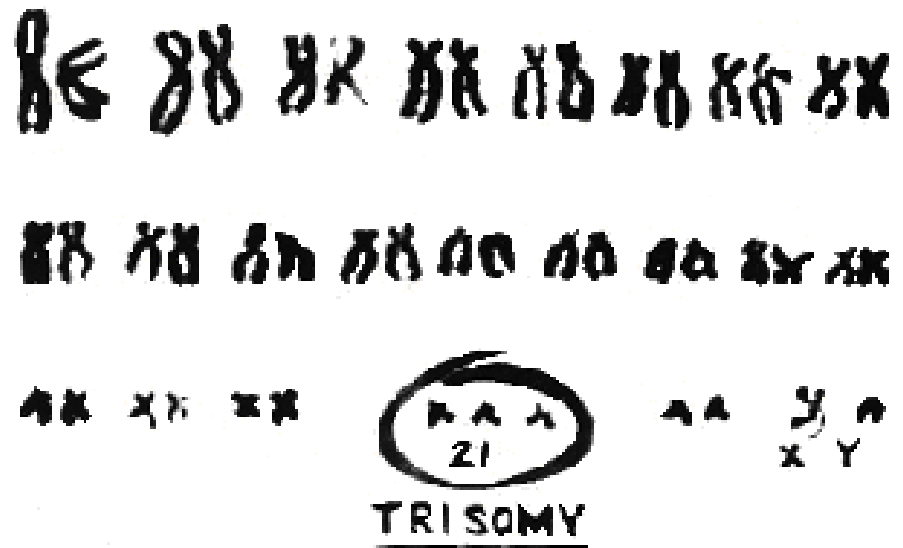
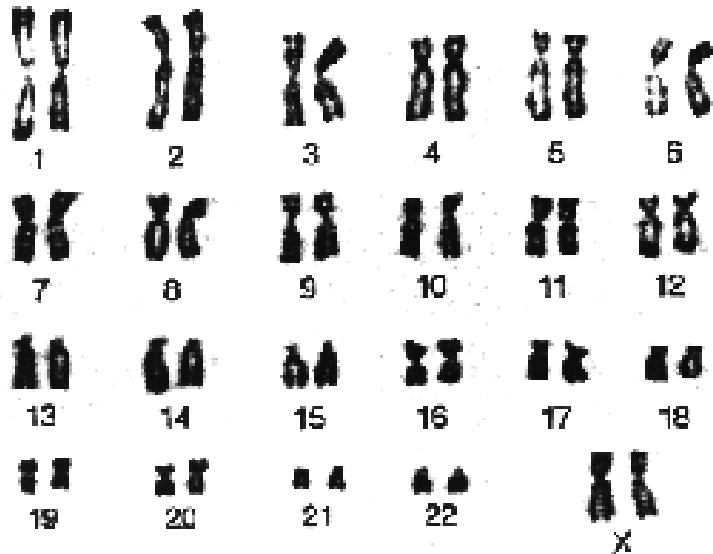
Age	Risk for Down syndrome	Total risk for clinically significant chromosome abnormalities
20	1/1,667	1/526
21	1/1,667	1/526
22	1/1,429	1/500
23	1/1,429	1/500
24	1/1,250	1/476
25	1/1,250	1/476
26	1/1,176	1/476
27	1/1,111	1/455
28	1/1,053	1/435
29	1/1,000	1/417
30	1/952	1/385
31	1/909	1/385
32	1/769	1/322
33	1/602	1/286
34	1/485	1/238
35	1/378	1/192
36	1/289	1/156
37	1/224	1/127
38	1/173	1/102
39	1/136	1/83
40	1/106	1/66
41	1/82	1/53
42	1/63	1/42
43	1/49	1/33
44	1/38	1/26
45	1/30	1/21

Implications relative to Dr. Kaplan's lecture & delaying pregnancy!

95% of Down Syndrome Trisomy 21 90% of Cases → Eggs Are Abnormal

Normal ♀

Down Syndrome ♂



<http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001992/>

<http://www.ds-health.com/trisomy.htm>

Quad Screen? 4 Blood Chemistry Tests

2nd trimester, neural tube defects & chromosomal abnormalities, 81% sensitivity, 5% false +

High, neural tube defects (spina bifida)

AFP: *alpha-fetoprotein*, fetal liver

High, Down syndrome (Trisomy 21)

hCG: *human chorionic gonadotropin*, placenta

Low, Edward's syndrome (Trisomy 18)

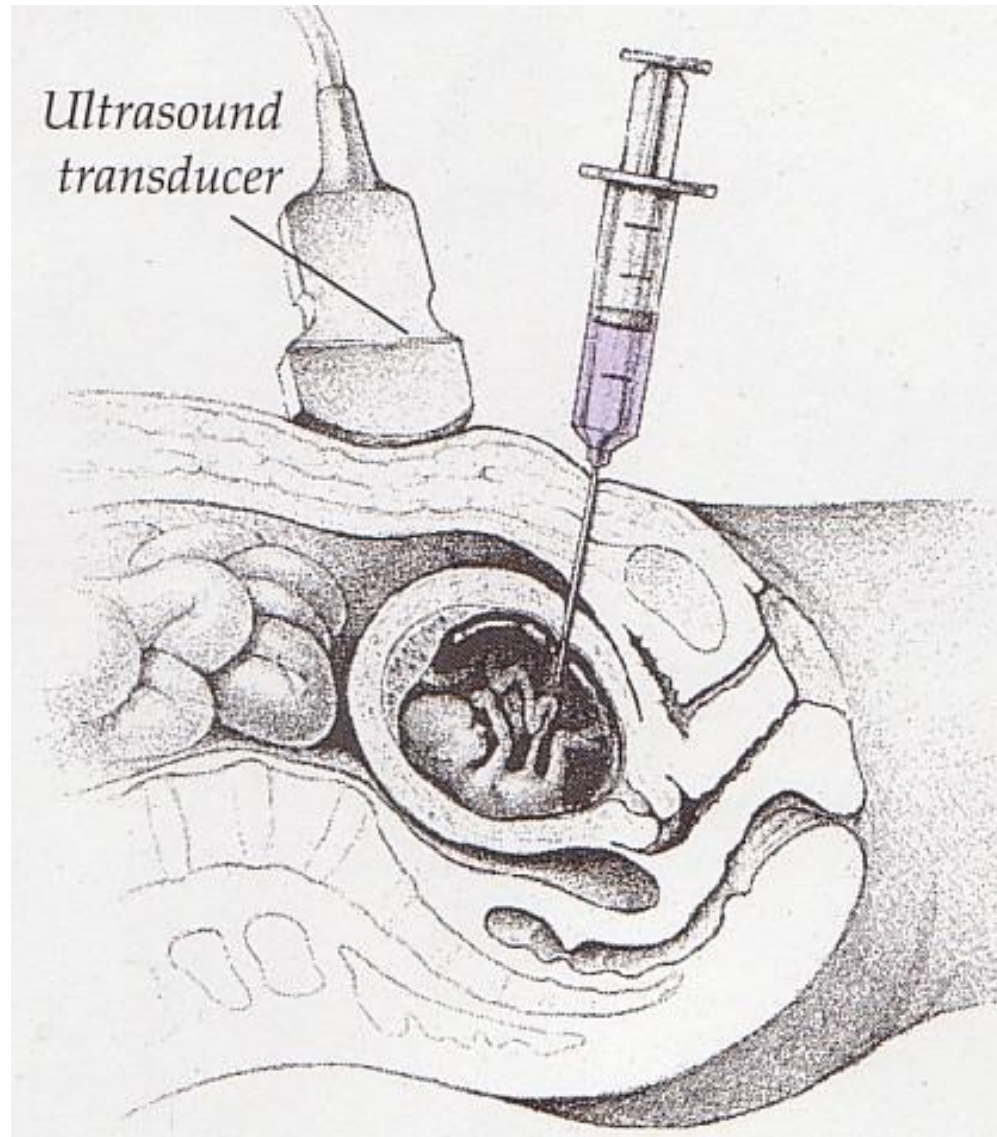
Estriol: placenta + fetal liver

Inhibin-A: placenta + ovaries

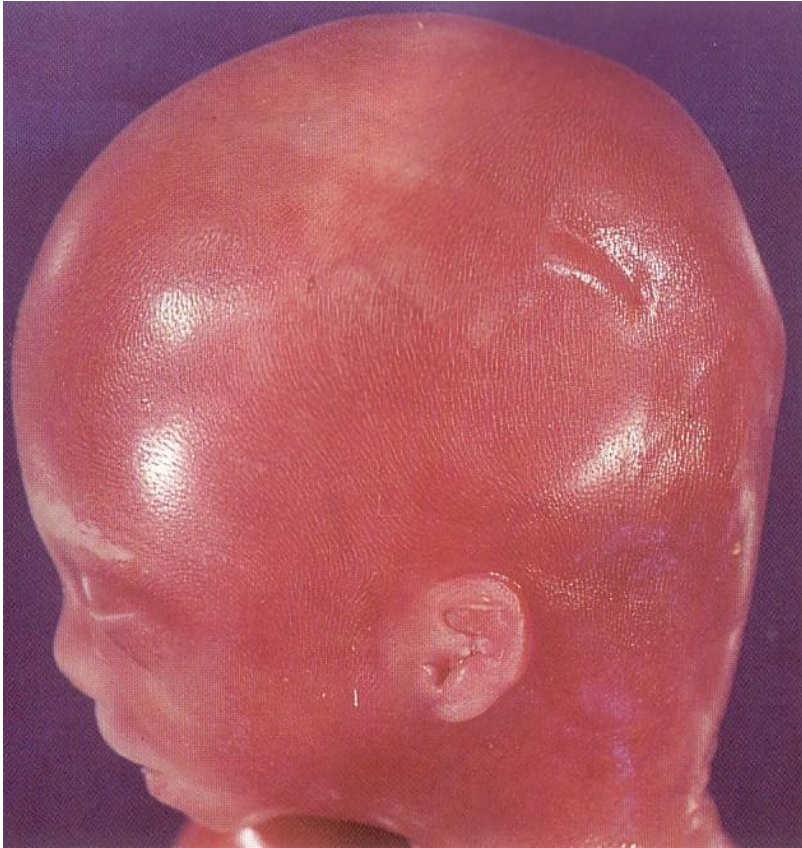
<http://www.mayoclinic.com/health/quad-screen/MY00127>

<http://www.americanpregnancy.org/prenataltesting/quadscreen.html>

Amniocentesis or Chorionic Villus Sampling?



Down Syndrome Fetus



NB: 1:1400 incidence for maternal age 20-24; 75% spontaneously aborted.
Flat frontal facies, anomalous auricles, simian crease, clinodactyly.

SOURCE: KL Moore, TVN Persaud & K Shiota (MPS)1994
Color Atlas of Clinical Embryology p 109

DOWN SYNDROME NEONATE

10 KEY FEATURES (Hall)

- | | |
|---|-----|
| 1. Facial profile flat | 90% |
| 2. Hypotonia | 80% |
| 3. Poor Moro reflex | 85% |
| 4. Joint hyperflexibility | 80% |
| 5. Skin excess nape of neck | 80% |
| 6. Palpebral fissures slanted | 80% |
| 7. Pelvic dysplasia | 70% |
| 8. 5 th finger mid-phalynx dysplasia | 60% |
| 9. Auricles anomalous | 60% |
| 10. Simian crease | 45% |

Dizygotic Twins Discordant for Down Syndrome



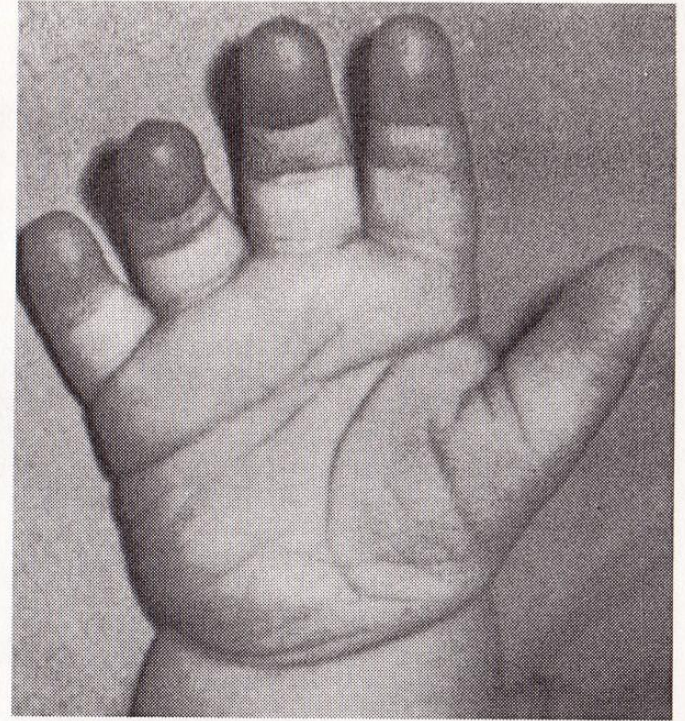
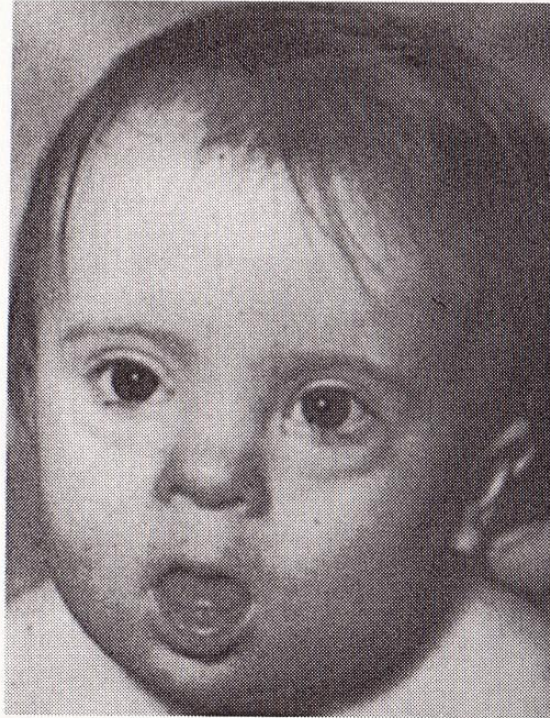
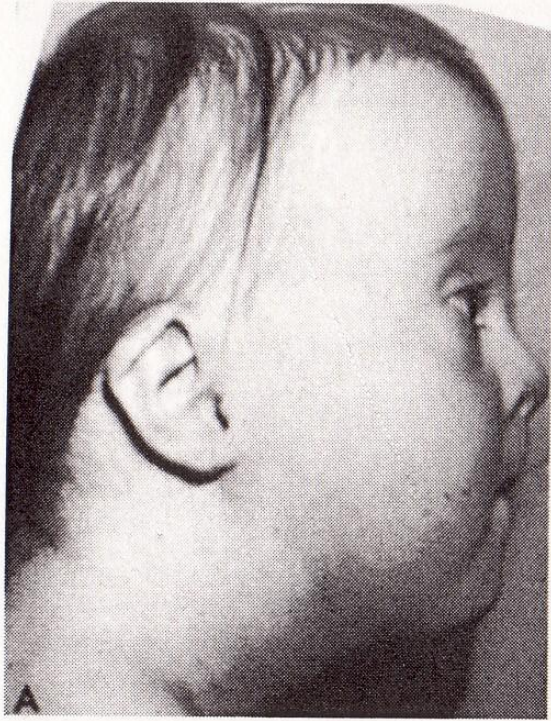
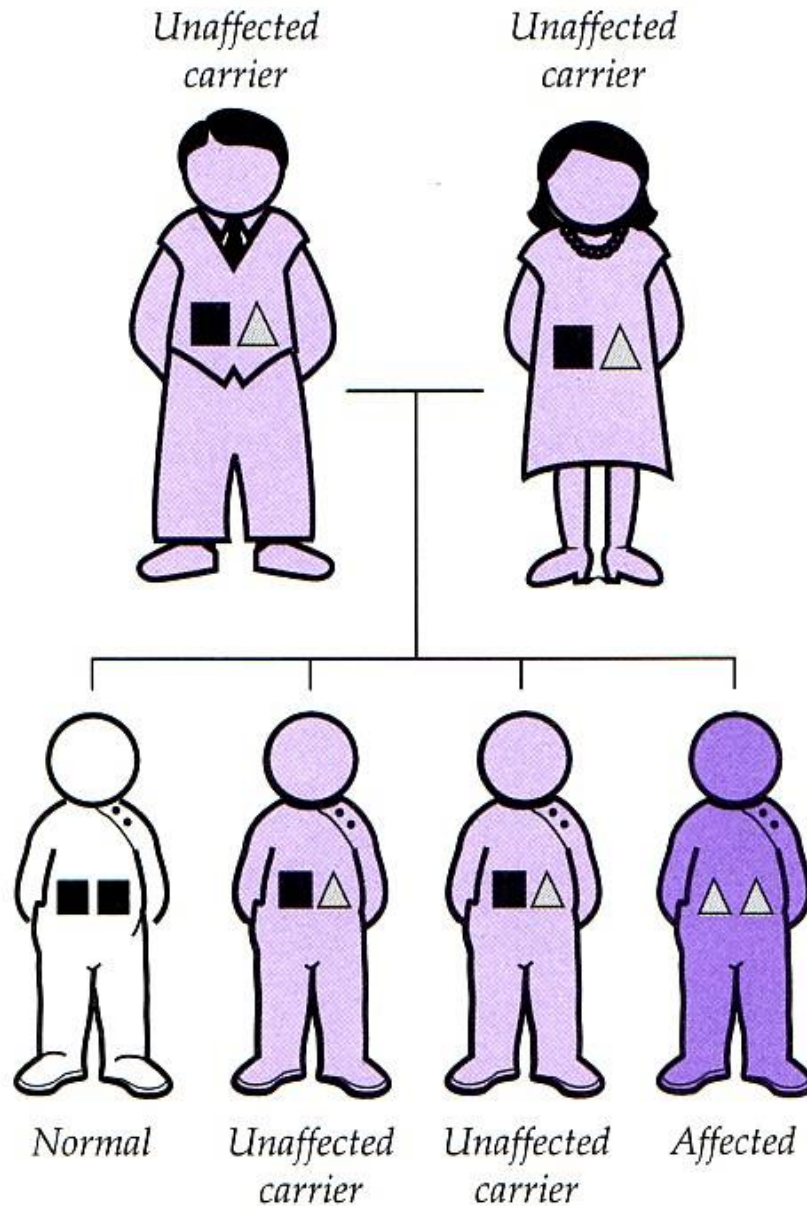


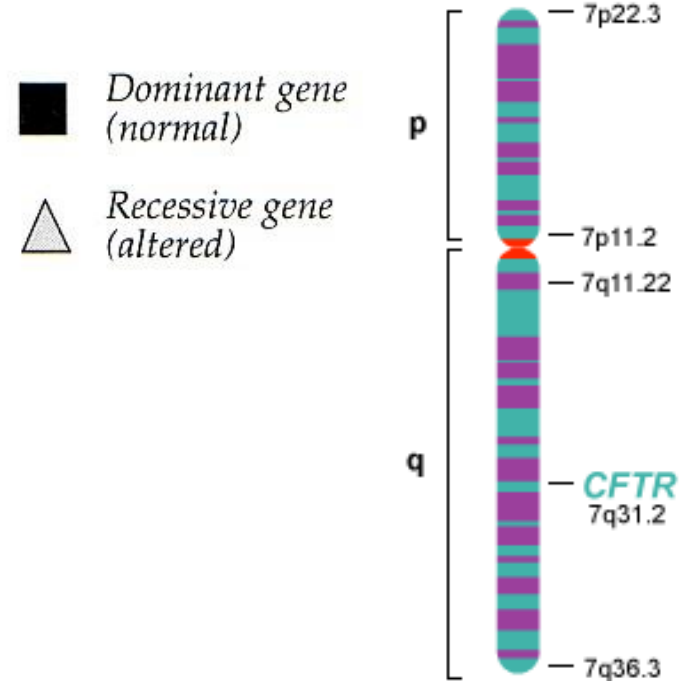
FIGURE 2. Down syndrome. *A*, Young infant. Flat facies, straight hair; protrusion of tongue; single crease on inturned fifth finger.

Recessive Disorders eg, Cystic Fibrosis

RVJ, Mayo Clinic p 61.



Chromosome 7



f = 4 in 10,000 live births
CFTR gene, 7q31.2
long arm chromosome 7

http://www.mja.com.au/public/issues/183_10_211105/mas10561_fm.html

<http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001167/>

<http://ghr.nlm.nih.gov/gene/CFTR>

Most Common Position. Ideal!!



RVJ, Mayo Clinic p 317.

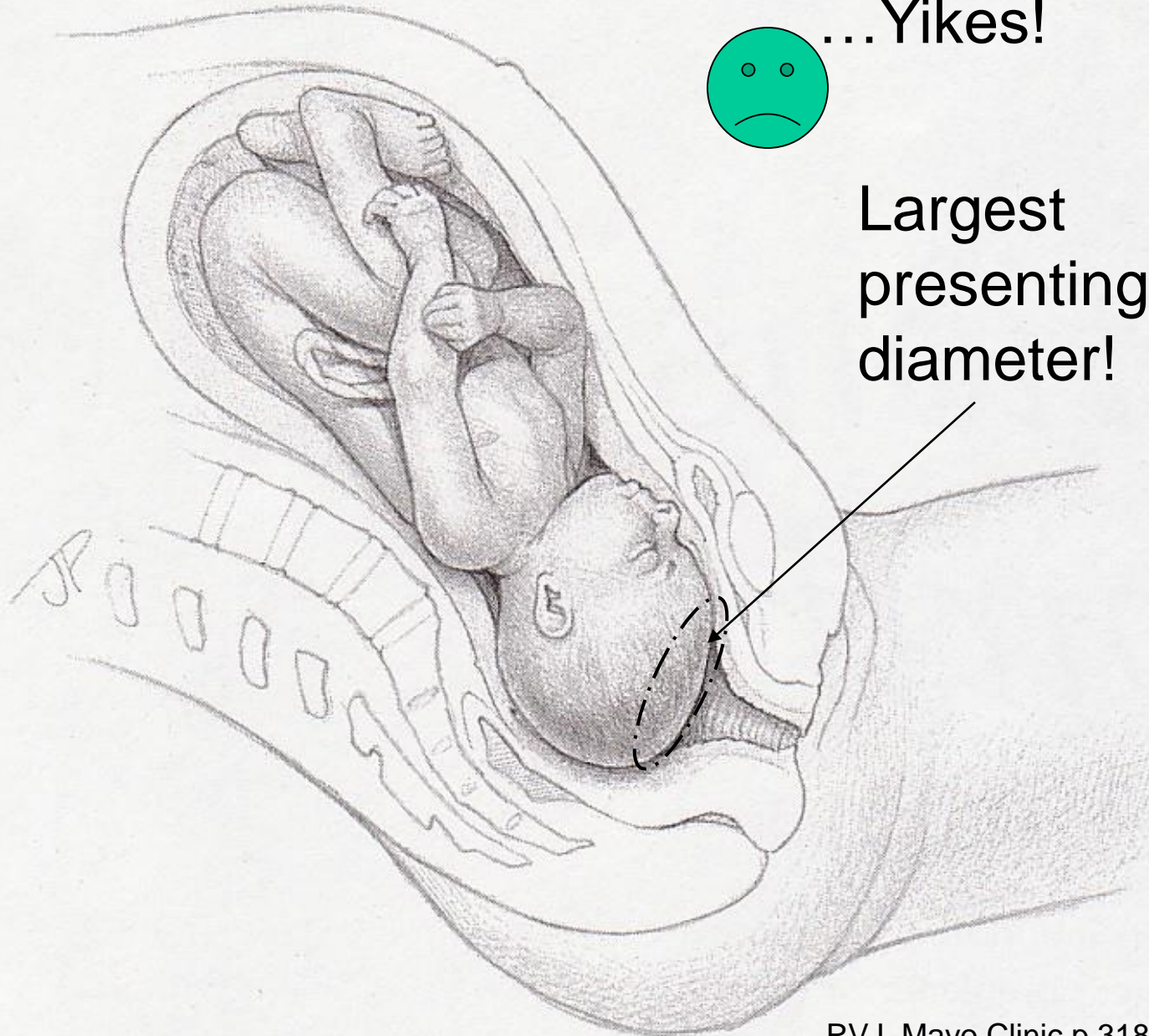
cf: G&H 2016 fig 83-9
G&H 2011 fig 82-9

Occiput Posterior/Sunnyside up! Oh No!

...Yikes!



Largest
presenting
diameter!



Breech!
eg, Frank



Transverse!



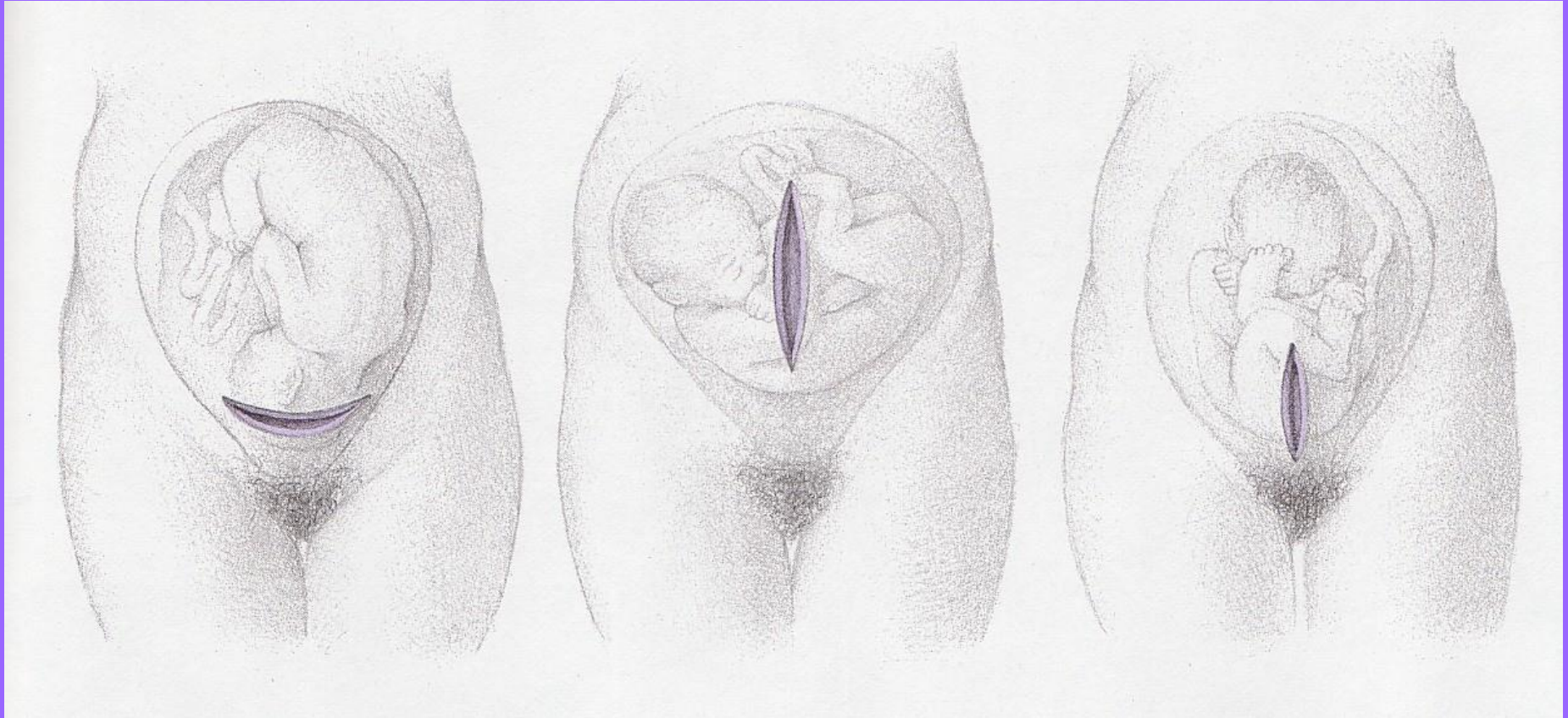
Experienced
Midwives &
OB-GYN MD
may be able to
massage into
position?

A baby who is positioned horizontally across the uterus, rather than vertically, is in a transverse lie position. Most babies in this position have a cesarean birth.

Low Transverse

Classic

Low Vertical





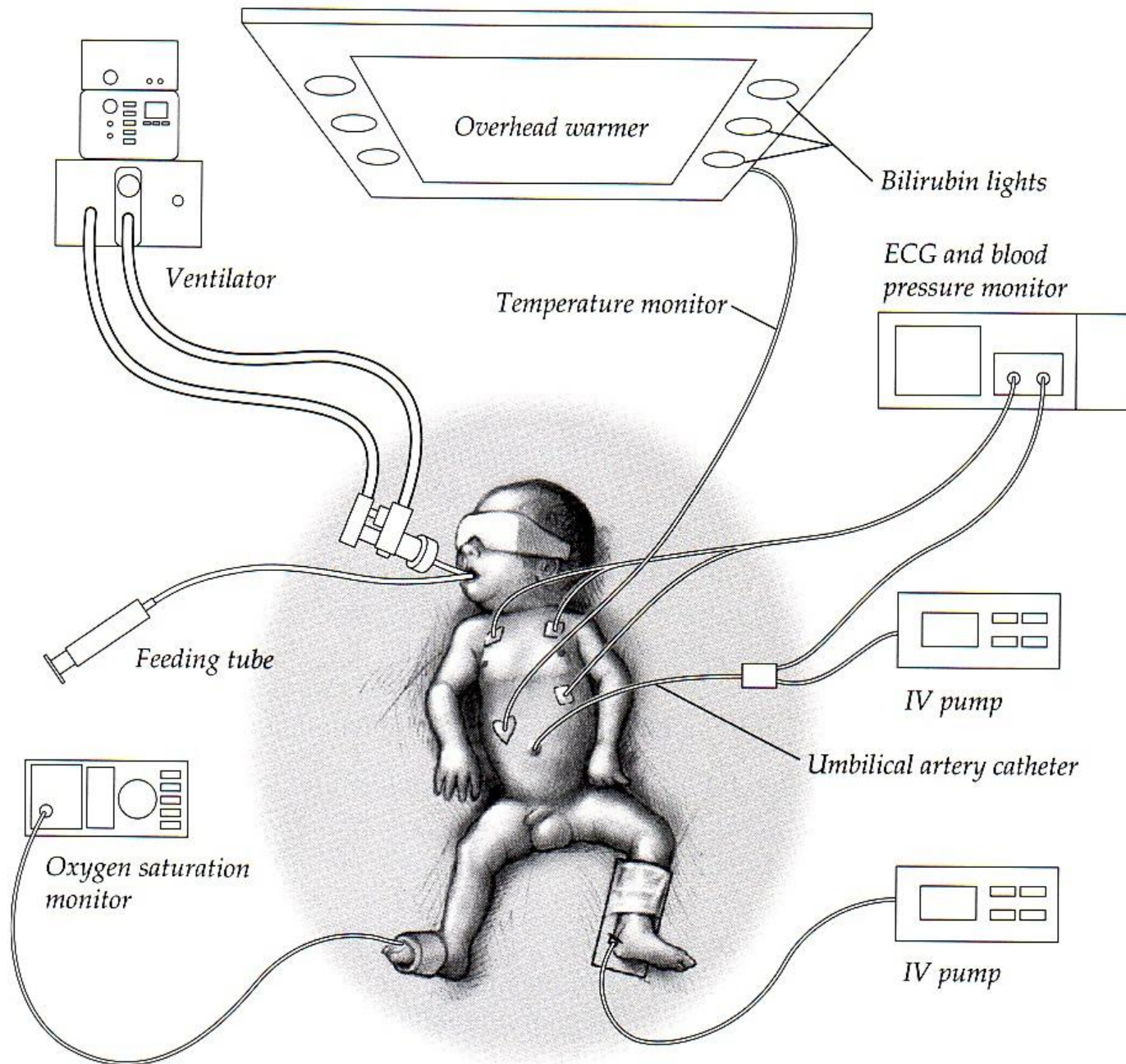
Baby @ birth
38 wk or 266 d
> conception!
3200 g (3.2 kg)
≈ 7 lb

35 cm

Apgar Scores: How Healthy Is Your Newborn?

Sign	Points		
	0	1	2
Appearance (color)	Pale or blue	Body pink, extremities blue	Pink
Pulse (heartbeat)	Not detectable	Below 100	Above 100
Grimace (reflex irritability)	No response to stimulation	Grimace	Lusty cry, cough or sneeze
Activity (muscle tone)	Flaccid (no or weak activity)	Some movement of extremities	Active motion
Respiration	None	Slow, irregular	Good, crying

Scores determined for each sign are totaled. The highest possible score is 10. By 5 minutes of age, most healthy babies have scores of at least 7. A score less than that indicates that the baby warrants careful watching.



♀ 1 lb 15 oz





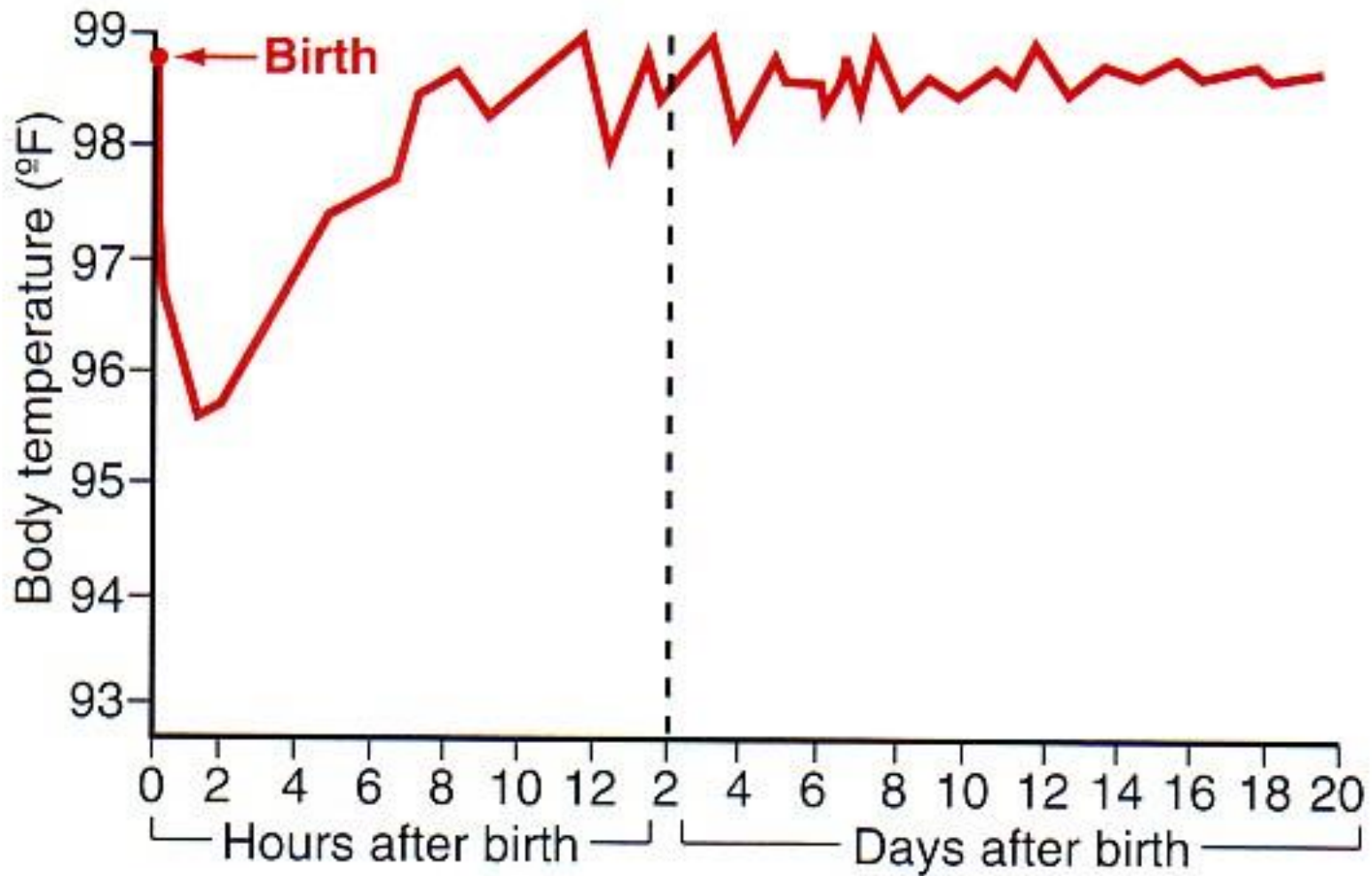
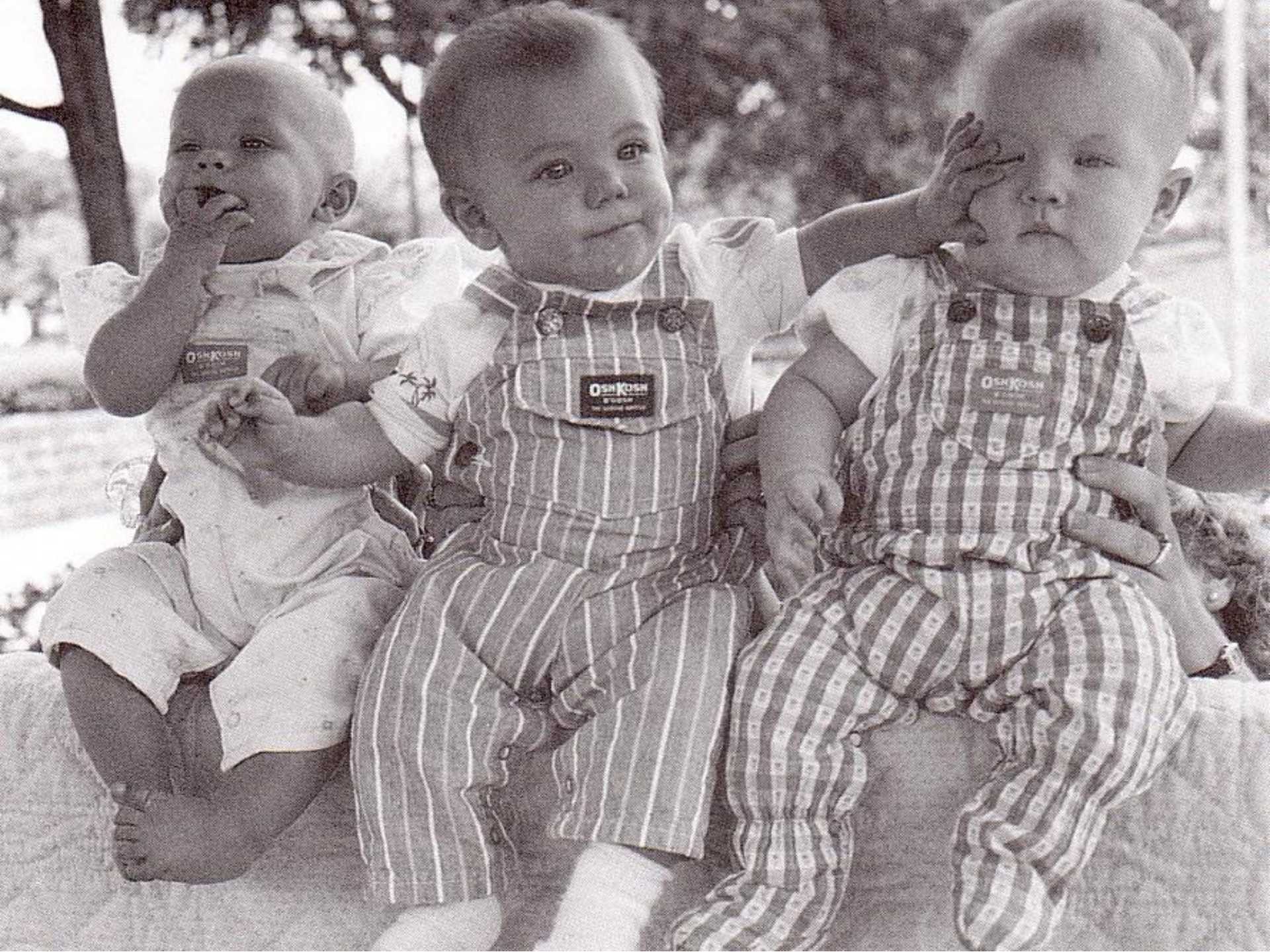


FIGURE 83-7

Fall in body temperature of the neonate immediately after birth, and instability of body temperature during the first few days of life.

G&H 2016 fig 84-7
 G&H 2011 fig 83-7

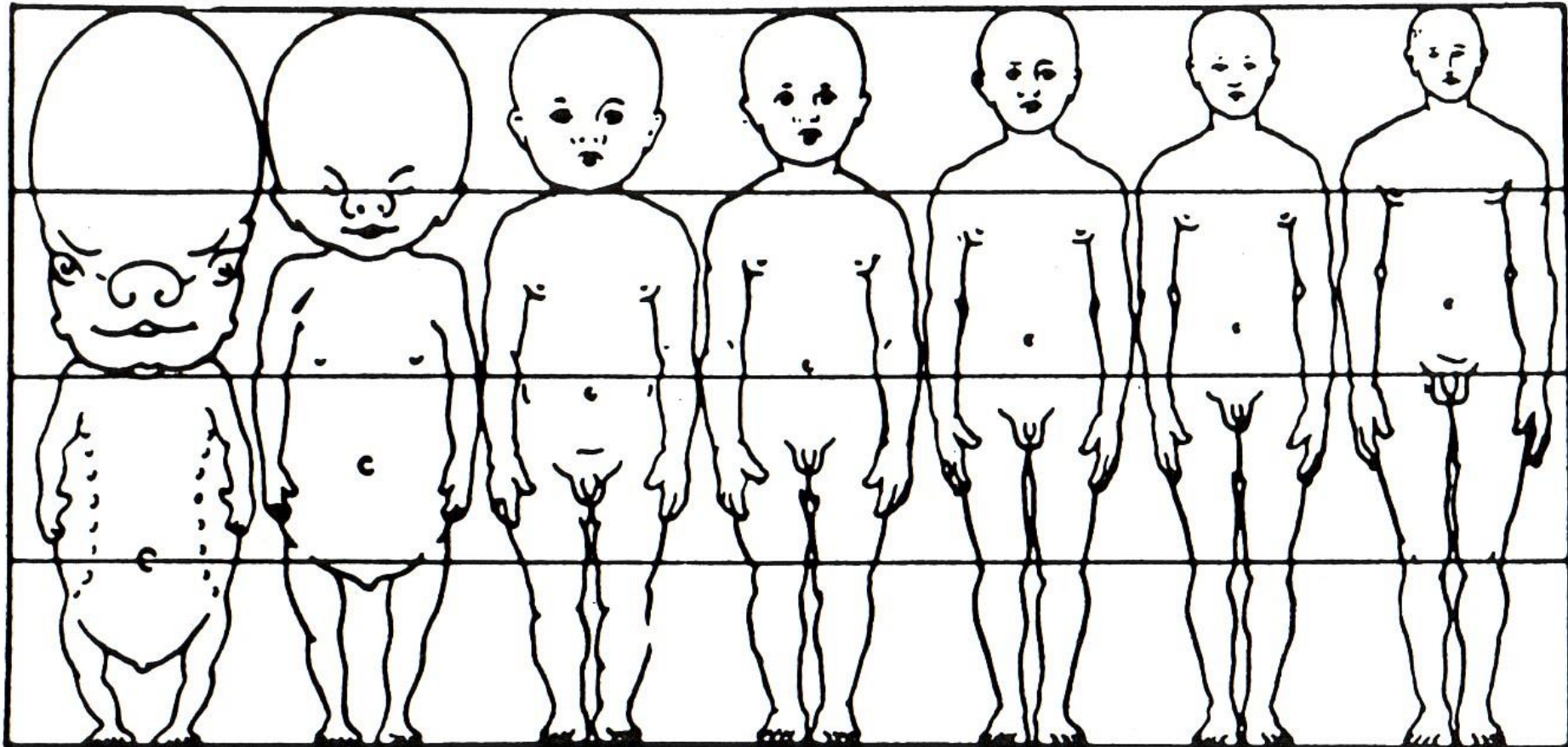




Behavioral development of the infant during the first year of life.



Cephalic to Caudal Development



2 mo. (fetal)

5 mo.

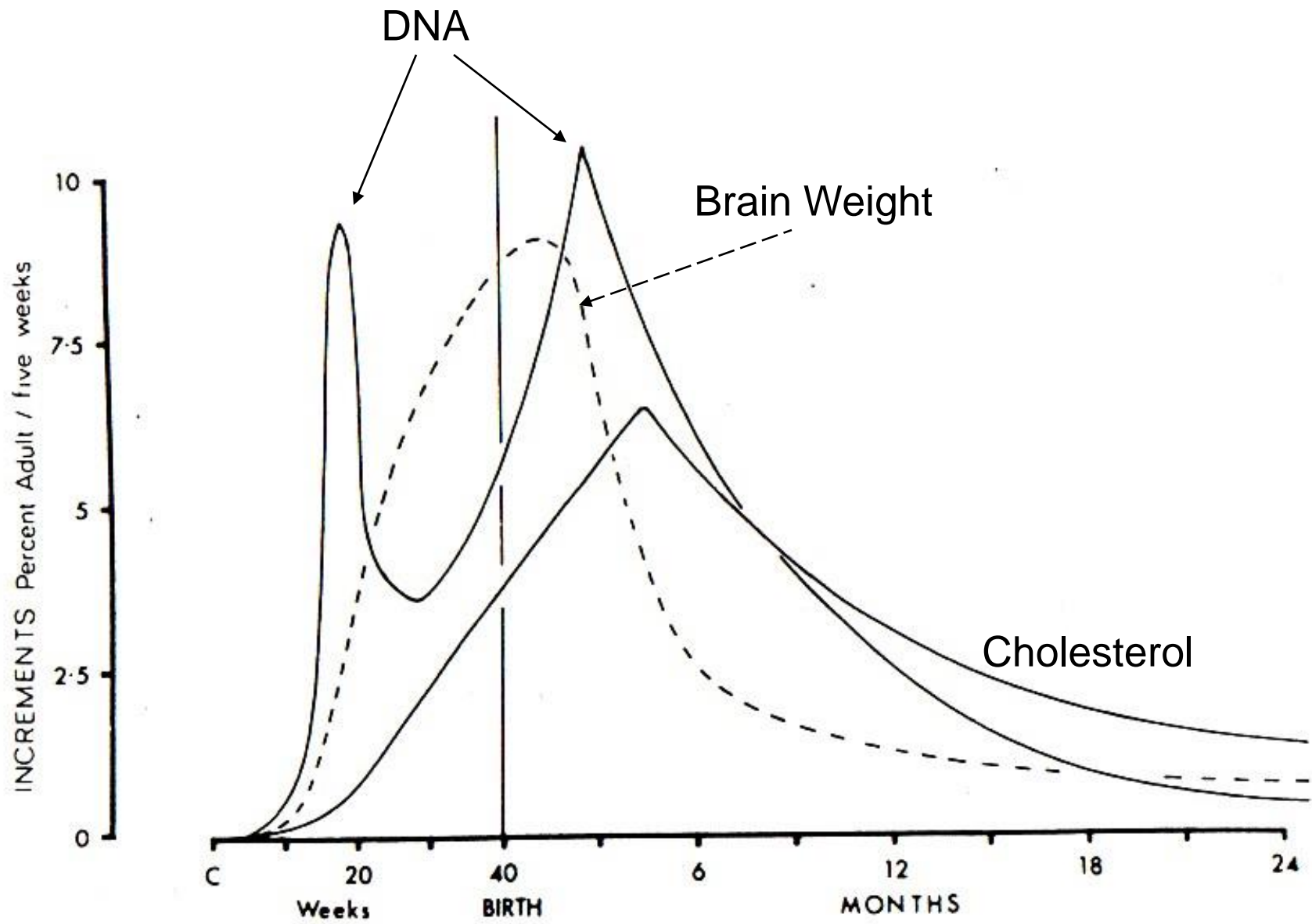
Newborn

2 yr.

6 yr.

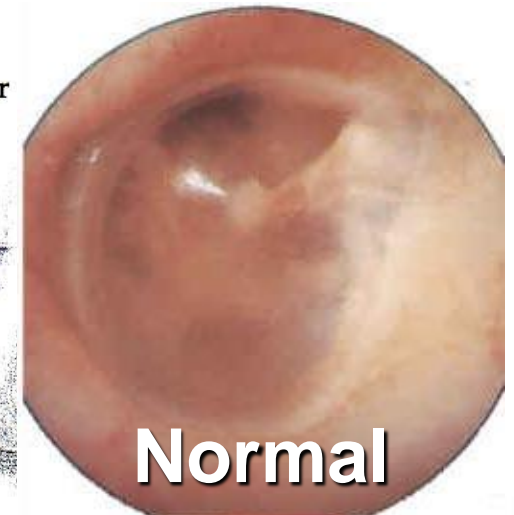
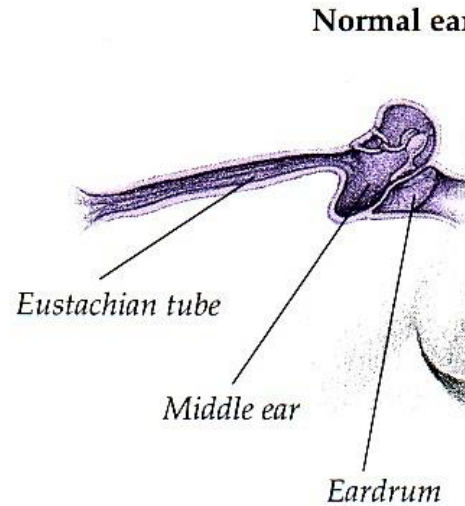
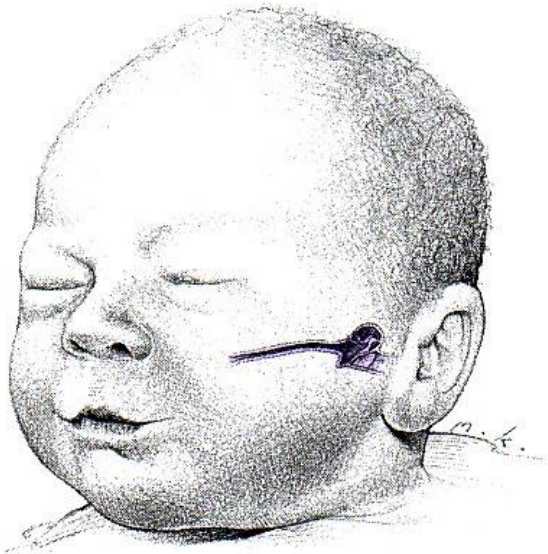
12 yr.

25 yr.



Infant Eustachian tube smaller + more horizontal!

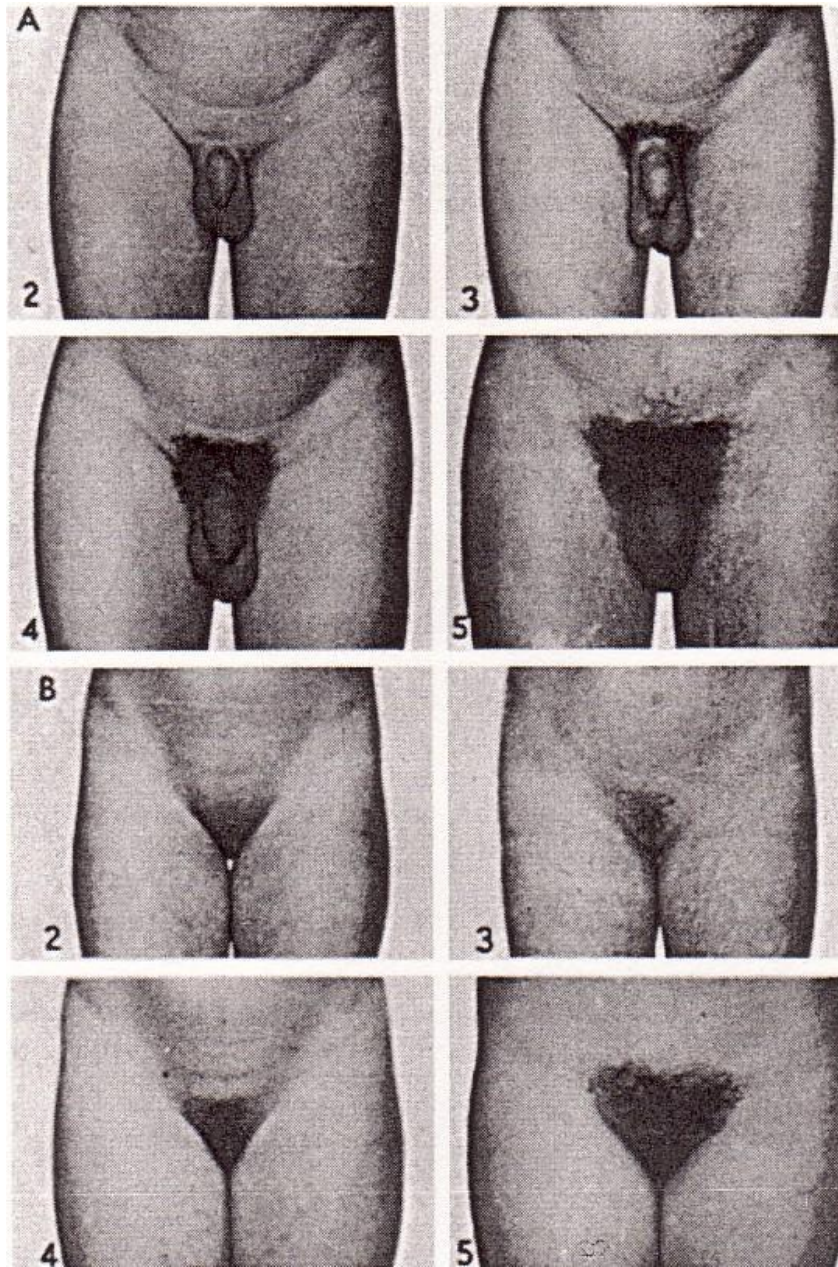
An infant's ear is different from an adult's ear because the eustachian tube is more horizontally positioned. Because of this, drainage from the middle ear occurs less easily, and your baby is at greater risk for an ear infection (otitis media). This condition occurs when the eustachian tube becomes blocked and fluid is trapped. It is marked by swelling and discoloration of the eardrum.



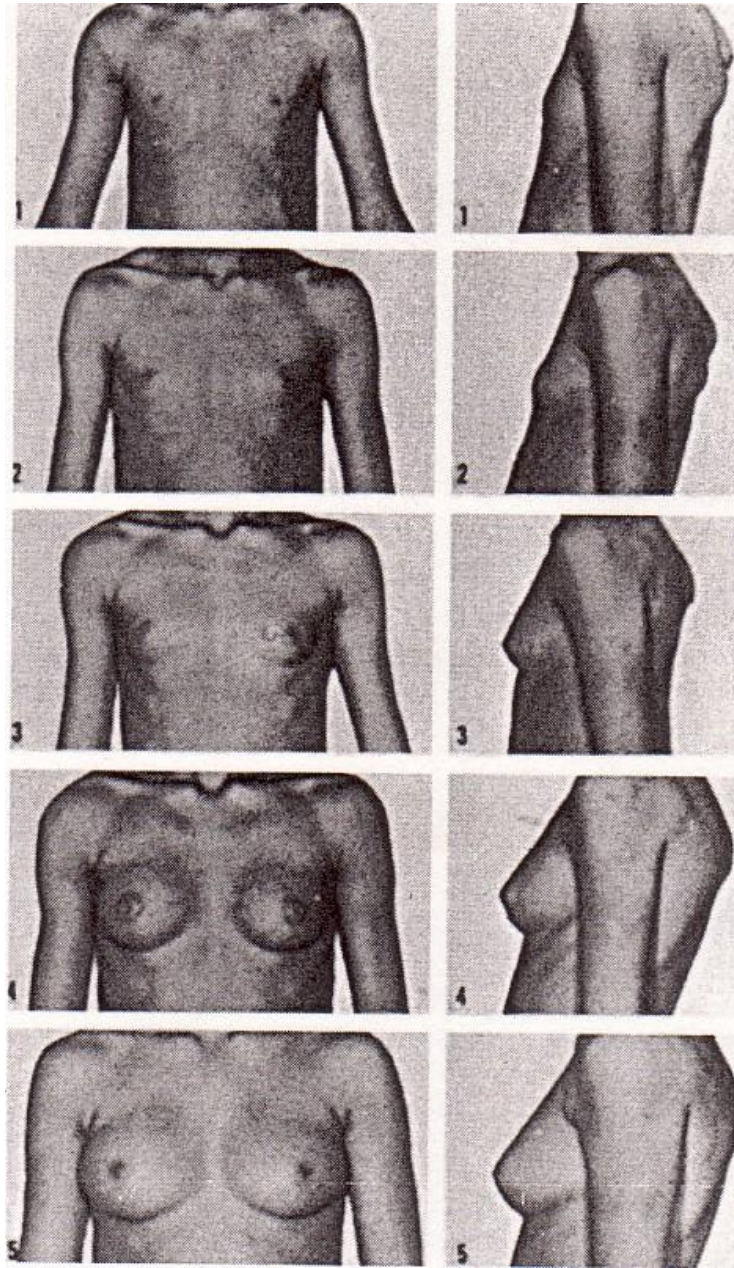
- Fluid-filled middle ear
- Bulging eardrum
- Swelling and inflammation



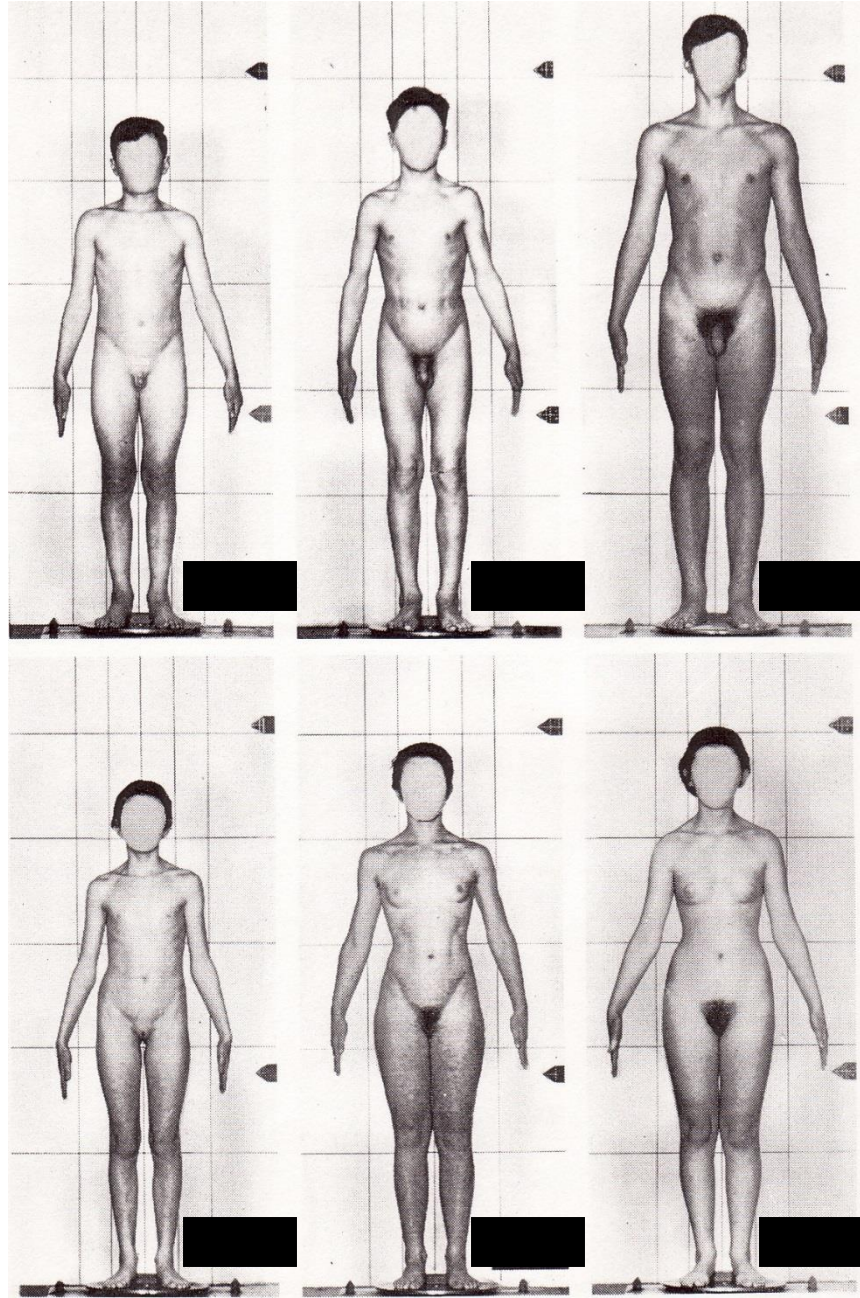
Tanner Stages of Development



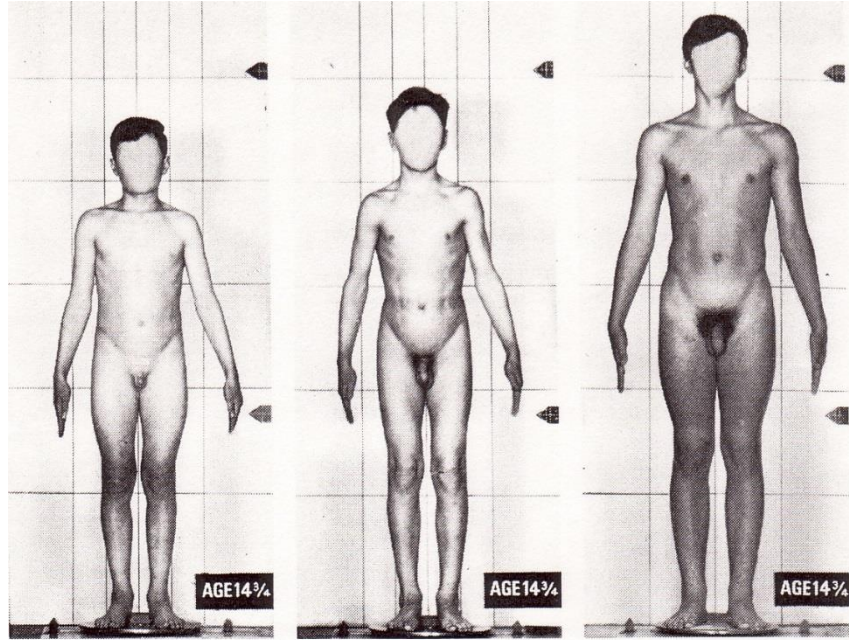
Tanner Stages for Breast Development



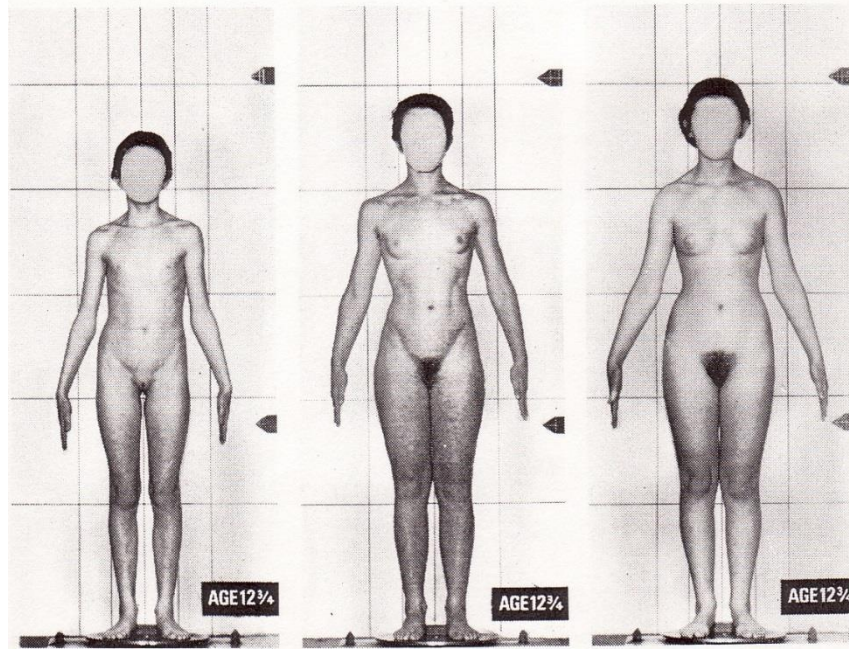
Tanner Stages? What are the Ages?



Tanner Stages? What are the Ages?



All 14 $\frac{3}{4}$ yr!!



All 12 $\frac{3}{4}$ yr!!