I. **Announcements** Quiz 4 1st 20-25 min. Q? Presentations
Group I today! Today’s lecture prep for Dr. Godfrey & Dr. Bradshaw's guest lectures, Feb 28th + Mar 5th. **Reminders:** Sign-in, attendance, guest feedback, .pptx vs Prezi vs...Q?

II. **Congenital Hand Differences** Prep for Dr. Godfrey

III. **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%x OK!)
2. *cf*: Neonate vs. adult human values (selected)
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) +...
Congenital Hand Differences in the Media!

Jenna Godfrey, MD, MSPH
Pediatric Upper Extremity
Adult Hand & Wrist

https://orthoinfo.aaos.org/en/diseases--conditions/congenital-hand-differences
Upper Extremity Bones

- Clavicle
- Scapula
- Humerus
- Ulna
- Radius
- Carpals
- Metacarpals
- Phalanges

Image Source: http://spmsubjects.blogspot.com
Neonate
Gr. neos/new
L. -nat/born

infant
1st 4wk > birth

Charles A. Hoffmeister, MD
Neonatal/Perinatal Specialist
Pediatrics = Gr. παιδιά/paidiá/children
Γιατρός/Giatrós/physician

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

Life-long education...
Safety, prevention...
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.
Dr. Deanna St. Germain, DO
Medical Director
Kids’ FIRST

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

https://kidsfirstcenter.net/
<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>NEONATE</th>
<th>ADULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>WT (lb)</td>
<td>7</td>
<td>♀ 110</td>
</tr>
<tr>
<td>WT (lb, range)</td>
<td>4.5–11</td>
<td>wide variation</td>
</tr>
<tr>
<td>HR (b/min)</td>
<td>130</td>
<td>~2 x 70</td>
</tr>
<tr>
<td>RR (breaths/min)</td>
<td>40</td>
<td>3 x 12-15</td>
</tr>
<tr>
<td>BV (mL)</td>
<td>16.7 x 300</td>
<td>(\frac{1}{17}) x 5000</td>
</tr>
<tr>
<td>CO/Qt (mL/min)</td>
<td>100 x 50</td>
<td>(\frac{1}{100}) x 5000</td>
</tr>
<tr>
<td>BP (mm Hg)</td>
<td>70/50</td>
<td>?? x 120/80</td>
</tr>
<tr>
<td>BMR (relative)</td>
<td>2x Adult</td>
<td>1</td>
</tr>
<tr>
<td>FLUID Δ (relative)</td>
<td>7x Adult</td>
<td>1</td>
</tr>
</tbody>
</table>

H₂O Homeostasis!
Fetal Circulation: Aqua Animal!

1. Ductus Arteriosus
2. Foramen Ovale
3. Ductus Venosus

G&H 2016 fig 84-4
G&H 2011 fig 83-4
$t = 0$

3 wk

Embryo

8 wk $\geq 9^{th}$ wk

Organogenesis

Fetus $=$ distinct human appearance

28 wk later

56 d

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

24 hr/d

<table>
<thead>
<tr>
<th>0</th>
<th>4</th>
<th>8</th>
<th>12</th>
<th>16</th>
<th>20</th>
<th>24</th>
</tr>
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<tr>
<td>Cells</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>$2^0$</td>
<td>$2^1$</td>
<td>$2^2$</td>
<td>$2^3$</td>
<td>$2^4$</td>
<td>$2^5$</td>
</tr>
</tbody>
</table>

...100 trillion!

Baby

$\sim$38-40 wk
Embryo?  
Fetus?  
Baby?
Fetus @ 28 wk or 7 mo
1100 g (1.1 kg) ≈ 2.5 lb

J Langman 1981 Medical Embryology p 80
### Where you’ll gain the weight

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your baby</td>
<td>6½ to 9 pounds</td>
</tr>
<tr>
<td>Placenta</td>
<td>1½ pounds</td>
</tr>
<tr>
<td>Amniotic fluid</td>
<td>2 pounds</td>
</tr>
<tr>
<td>Breast enlargement</td>
<td>1 to 3 pounds</td>
</tr>
<tr>
<td>Uterus enlargement</td>
<td>2 pounds</td>
</tr>
<tr>
<td>Fat stores and muscle development</td>
<td>4 to 8 pounds</td>
</tr>
<tr>
<td>Increased blood volume</td>
<td>3 to 4 pounds</td>
</tr>
<tr>
<td>Increased fluid volume</td>
<td>2 to 3 pounds</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>22 to 32½ pounds</strong></td>
</tr>
</tbody>
</table>

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

\[ f = 3.3 \text{ per } 10,000 \text{ live births} \]
15% TOF 22q11 deletion
7% TOF trisomy 21
\[ \geq 4\% \text{ TOF NKX2.5 mutation} \]

G&H 2016 & 2011 fig 23-5
### Chromosome abnormalities: What are your risks?

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

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

RVJ, Mayo Clinic p 59.
95% of Down Syndrome Trisomy 21
90% of Cases → Eggs Are Abnormal

Quad Screen? 4 Blood Chemistry Tests

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

**AFP**: alpha-fetoprotein, fetal liver

- High, neural tube defects (spina bifida)

**hCG**: human chorionic gonadotropin, placenta

- High, Down syndrome (Trisomy 21)

- 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?
**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
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. 5th 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
e.g., Cystic Fibrosis

\[ f = \frac{4}{10,000} \text{ live births} \]

CFTR gene, 7q31.2
long arm chromosome 7

Dominant gene (normal)
Recessive gene (altered)

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!

RVJ, Mayo Clinic p 318.
Breech! eg, Frank RVJ, Mayo Clinic p 319.
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.
Baby @ birth
38 wk or 266 d
> conception!
3200 g (3.2 kg)
≈ 7 lb
### Apgar Scores: How Healthy Is Your Newborn?

<table>
<thead>
<tr>
<th>Sign</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Appearance (color)</td>
<td>Pale or blue</td>
</tr>
<tr>
<td>Pulse (heartbeat)</td>
<td>Not detectable</td>
</tr>
<tr>
<td>Grimace (reflex irritability)</td>
<td>No response to stimulation</td>
</tr>
<tr>
<td>Activity (muscle tone)</td>
<td>Flaccid (no or weak activity)</td>
</tr>
<tr>
<td>Respiration</td>
<td>None</td>
</tr>
</tbody>
</table>

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.

Virginia Apgar, MD, Anesthesiologist, 1953
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.
Behavioral development of the infant during the first year of life.
Cephalic to Caudal Development
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!!