I. **Announcements**
Quiz 5 first 15-20 min. Q? Presentations Group III next T immediately > Dr. Bradshaw's lecture. Reminder about .ppt/.pptx & guest lecturer feedback. Q?

II. **Dedication to Dr. Allen Harlor & Family**

III. **Medical Physiol News**

IV. **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) +...
Dedicated to the Memory of Dr. Allen D. Harlor  
March 23, 1936 to February 4, 2013

Pediatrician Extraordinaire, Loving Father, Avid Skier  
& BI 358 Medical Physiology Guest Lecturer!

http://www.musgroves.com/obituary.cfm?name=Dr.%20Allen%20Harlor%20Jr.
Don’t Be Dense
Trim calories per bite to trim pounds

Typical dinner

Volumetrics dinner
5 times per wk? \(\equiv\) 106,600 calories/yr \(\equiv\) \(\pm\) 30.5 lb fat/yr

Starbucks Cinnamon Dolce Latte, whipped cream, Venti (20 oz.) \(\equiv\) 410 calories

Jogging \(\equiv\) 50 min.
Neonate = “newly born,”
newborn infant
1st 4 wk > birth

Pediatrics = Gr. paidos, “child”; branch of medicine which treats child; development, care, treatment of diseases
<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 ♂ 150</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>300</td>
<td>[\frac{1}{17}] x 5000</td>
</tr>
<tr>
<td>CO/\dot{Q} (mL/min)</td>
<td>50</td>
<td>[\frac{1}{100}] x 5000</td>
</tr>
<tr>
<td>BP (mm Hg)</td>
<td>70/50</td>
<td>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
Organogenesis

$t = 0$  $3 \text{ wk}$  Embryo  $8 \text{ wk}  \geq 9^{th} \text{ wk}$  Fetus =

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

24 hr/d

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>4</th>
<th>8</th>
<th>12</th>
<th>16</th>
<th>20</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cells</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>16</td>
<td>32</td>
<td>64</td>
</tr>
<tr>
<td>$2^0$</td>
<td>$2^1$</td>
<td>$2^2$</td>
<td>$2^3$</td>
<td>$2^4$</td>
<td>$2^5$</td>
<td>$2^6$</td>
<td></td>
</tr>
</tbody>
</table>

$\geq 9^{th} \text{ wk}$  distinct human appearance

<table>
<thead>
<tr>
<th></th>
<th>20</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cells</td>
<td>32</td>
<td>64</td>
</tr>
</tbody>
</table>

~38-40 wk

...100 trillion!

Baby

56 d

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

27 cm

J Langman 1981 Medical Embryology p 80
As a Pregnant Female –

<table>
<thead>
<tr>
<th>Where you’ll gain the weight</th>
<th></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>
</tbody>
</table>

**Total** 22 to 32½ pounds

Surprise!

Head
Level 2 Ultrasound

Fluid

Lungs

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

G&H
### 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>1/476</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>1/378</td>
<td>1/192</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 $\rightarrow$ Eggs Are Abnormal

Normal ♀

Down Syndrome ♂

Quad Screen? 4 Blood Chemistry Tests

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

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

**hCG:** human chorionic gonadotropin, placenta

**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  
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
eg, Cystic Fibrosis

RVJ, Mayo Clinic p 61.


f = 4 in 10,000 live births
CFTR gene, 7q31.2
long arm chromosome 7
Most Common Position. Ideal!!

RVJ, Mayo Clinic p 317.
Occiput Posterior/Sunnyside up! Oh No!  
...Yikes!

Largest presenting diameter!

RVJ, Mayo Clinic p 318.
Breech!

eg, Frank
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

RVJ Mayo Clinic p A5
### Apgar Scores: How Healthy Is Your Newborn?

<table>
<thead>
<tr>
<th>Sign</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance (color)</td>
<td>Pale or blue</td>
<td>Body pink,</td>
<td>Pink</td>
</tr>
<tr>
<td></td>
<td></td>
<td>extremities blue</td>
<td></td>
</tr>
<tr>
<td>Pulse (heartbeat)</td>
<td>Not detectable</td>
<td>Below 100</td>
<td>Above 100</td>
</tr>
<tr>
<td>Grimace (reflex irritability)</td>
<td>No response to</td>
<td>Grimece</td>
<td>Lusty cry,</td>
</tr>
<tr>
<td></td>
<td>stimulation</td>
<td></td>
<td>cough or sneeze</td>
</tr>
<tr>
<td>Activity (muscle tone)</td>
<td>Flaccid (no or weak</td>
<td>Some movement of</td>
<td>Active motion</td>
</tr>
<tr>
<td></td>
<td>activity)</td>
<td>extremities</td>
<td></td>
</tr>
<tr>
<td>Respiration</td>
<td>None</td>
<td>Slow, irregular</td>
<td>Good, crying</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.
**Figure 83-9**

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.

Courtesy Dr. Allen Harlor, PeaceHealth Medical
Cholesterol
Brain Weight
DNA

INCREMENTS Percent Adult / five weeks

Weeks
0 20 40 BIRTH 6 12 18 24

MONTHS
0 2.5 5 7.5 10

Courtesy Dr. Allen Harlor PeaceHealth Medical
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 ¾ yr!!

All 12 ¾ yr!!