Teaching Pharmacology in High School

KIM EBERLE-WANG, PH.D.
SPRINGSIDE CHESTNUT HILL ACADEMY
BEFORE SCH ACADEMY

University Of Pennsylvania John Morgan Building

Drexel University College of Medicine

Irwin Lucki  Robert Ricklefs  Marie-Francoise Chesselet  Kenny Simansky
At SCH Academy
Purpose of the SCH Pharmacology Elective

- “What is the difference between a pharmacist and pharmacologist?”

- “I like art but I don’t think I like science

- “Prescription medications are safe because they are legal.”

- “I can take as much Tylenol as I want before a football practice.”

- I think I want to be a forensic scientist.

- Who was Benjamin Rush?
How NOT to teach Pharmacology in High School
### Pharmacological properties of choline esters

<table>
<thead>
<tr>
<th>Choline Esters Synthetic drug</th>
<th>Susceptibility to cholinesterase</th>
<th>Muscarinic</th>
<th>Nicotinic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CVS</td>
<td>GI</td>
<td>UB</td>
</tr>
<tr>
<td>Acetylcholine</td>
<td>+++</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Methacholine</td>
<td>+</td>
<td>+++</td>
<td>++</td>
</tr>
<tr>
<td>Carbachol</td>
<td>-</td>
<td>+</td>
<td>+++</td>
</tr>
<tr>
<td>Bethanechol</td>
<td>-</td>
<td>+/-</td>
<td>+++</td>
</tr>
<tr>
<td>Pilocarpine</td>
<td>-</td>
<td>+/-</td>
<td>++</td>
</tr>
<tr>
<td>Arecoline</td>
<td>-</td>
<td>+</td>
<td>++</td>
</tr>
</tbody>
</table>

Choline esters are highly hydrophilic so that they are poorly absorbed and poorly distributed into CNS (high doses: cortical arousal response in cats). They all are hydrolyzed in the GI tract, thereby less active by the oral route. These amines are chiefly cleared by kidney (accelerated by acidification of the urine).
How NOT to teach Pharmacology in High School

Slide Courtesy of Dr. Hoau-Yan Wang, Sophie Davis School of Medicine, CUNY
How NOT to teach pharmacology in High School
Why USE PBL: PROJECT BASED LEARNING

PROBLEM-BASED LEARNING IS FUN, RELEVANT, and EFFECTIVE
PROJECT #1

FDA Approved Drugs for Back to School-itis

- Drug Package Inserts
- The Role of FDA
- Therapeutic Effect
- Side Effects
- Dose
- Lot Numbers
- Route of Admin
- Market Research
PROJECT #1

FDA Approved Drugs for Back to School-itis

SCENT-FULL

For Men

BY CLINT CORP.

Smell Better in seconds!

FDA Approved

take 2-3 Times a day
Every 6-8 hours
only meant for people under the age of 80
under 18, tak 1/2 a tablet 2-3 times a day

ONLY $10.99

OVER THE COUNTER AT
YOUR LOCAL PHARMACY

Side Effects include: itching, skin rash, dry throat, and stomach ache when not taken with food.
Project #2 The History of Medicine in Philadelphia: Pennsylvania Hospital and The Mutter Museum

- **Original Student Film about the Project and Trip**

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**The First Operating Room in America at PA Hospital Philadelphia**

We are discussing early general anesthesia and the lack of antisepctic techniques with Ms Essie Karp of PA Hospital and Burpee Grow to Learn Program
Project #3: Developing a Novel Antibiotic

Testing “novel” tea tree oil, eucalyptus oil, garlic, honey and other herbal compounds Compared to penicillin, tetracycline, amoxicillin, cephalosporin, antibiotics

SAMPLE STUDENT COMMERCIA: The Honey Pill – Dem Drugs Inc
Project #4 The Effect of Nose Drops on Blood Vessels in the Earthworm

Over the counter decongestant solutions with phenylephrine work well when died blue with food coloring and diluted 1:10 in a stock dilution to generate a dose response curve in the worm blood vessel.

The percentage of constriction under the different dose of phenylephrine

PROSCope magnifying cameras permit visualization of blood vessels in real time.
More Projects, Activities and Games

- Drunken Flies: The genetic basis of alcohol addiction
- Friends don’t let friends drive with a BAC>0
- CNS Disorders go to the Movies (“Awakenings”)
- Route-A-Rama (where do the drugs go if it’s “p.o.”)
- Pharmacology “Bingo”
- Sherlock Holmes and The Reinch Test
SCH Pharmacology Topics

- Pharmacokinetics
- FDA Drug Approval Process
- Autonomics
- Analgesics
- Drugs of Abuse
- CNS Disorders and their treatment
- History of Medicine
- Antibiotics
- Toxicology
HAiku Learning Management System

Pharmacology B block with Dr. Wang 2012-2013

What is Pharmacology?

Design Thinking Project: A New Drug for Back to School Blues

Class project
All students can view, edit, and comment on this WikiProject.
Due at: Sep 12, 2012, 02:00 pm

Goal: to invent a new drug to treat "Back to School - It's"

Each Group should post its files, images and commercials (links to YouTube or mp4 files) on a separate Wiki Haiku Page. If you need help to do this as me during class!

Create: A drug label which includes: name of the drug, the therapeutic use, the dose (mg/tablet), the dosing schedule (how often to take it), the route of administration, the name of your drug company, the side effects, the lot number and the date of expiration. Neatness and creativity counts (15 pts)

Create: Type the text of a commercial describing the above properties of your medication. In addition explain how your drug works and also that it is FDA approved. Total time for the commercial 30 sec - 2 min. You may use iMovie, Garancehand or any other program with which you are familiar (15 pts).
Some Numbers from SCH Upper School

- 75% of total GW Carver Sci Fair Medals won by SCH students
  - 50% of first place winners at GW Carver Science Fair

- 75% 1st place at PJAS Science Fair

- 30% students take more than one science

- 20-40% go on to major in science in college
SCH high school Science Courses Offered

- Biology (CP, H and AP)
- Chemistry (CP, H)
- Physics (CP, H and AP)
- Physiology
- Oceanography
- Forensic Science
- Pharmacology
- Environmental Science
- Applied Physics and Design
- Independent Research for Science Fairs
Why were you interested in learning about pharmacology in high school?

ASHLEY’s ANSWER

Timmy’s Answer
WISH LIST

- A pharmacology textbook for HS students
- ASPET : High School Teacher Resource Page
- A Pharmacology Project/Research Contest for HS students
- More Scientist Mentors
Goals
THANK YOU

- Sonny Singh (UNT Health Science Center)
- Kelly Karpa (Penn State Medical Center)
- Hoau-Yan Wang (CUNY Sophie David School of Medicine)
- my students for the past 18 years at SCH
QUESTIONS?

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