THE POLHILL REPORT
Dedicated to Lifelong Learning
A Quarterly Newsletter of the UAB Pediatric Emergency Department

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Back to Basics...Part 2

Well, I hope everyone enjoyed the trip "Back to Basics" in the most recent issue…'cause we're doing it again!

This time you are seeing a 7 year old female who is previously healthy, with fever, abdominal pain, and vomiting. In your office, she is mildly ill appearing with a temperature of 102° F, HR 125, RR 24, BP 98/67. Her HEENT exam is clear, she has no murmur, and her breath sounds are clear. Her abdomen is diffusely TTP with some RLQ guarding and occasional grunting noted. Her skin is warm with brisk capillary refill and no rash.

I don't know about you, but the first, second and third items on my differential is acute appendicitis. Labs are supportive of this with an elevated CRP, left-shifted WBC count, and normal urinalysis. I'm still feeling pretty good about this...so much so, that I have paged the surgery resident to ask for a consult.

> "...*(β-lactam)* resistance is relative...and can be overcome by increasing the antibiotic dose."

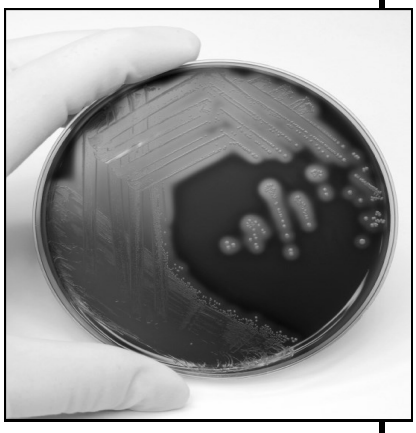
Well, you can imagine my surprise when I pick up the phone (yes, I am slowly learning how to use the phones in the new ED...I apologize if you have been left on hold!) expecting it to be the radiologist telling me about this girl's inflamed appendix and instead he tells me the appendix is normal. What?? Inconceivable (in honor of The Princess Bride's recent 25th anniversary)!! And then he utters the words that I hadn't even considered, "But, there is a right lower lobe pneumonia." Ugh. So, explaining to the surgery resident that I didn't need a consult was easy enough. Explaining to Dr. Glaeser why I was using a CT to diagnose pneumonia was going to be a little trickier...

Community acquired pneumonia (CAP) can be difficult to diagnose and, at times, challenging to treat. Estimates suggest that there are up to 2.6 million cases of pneumonia annually in developed countries, with 1.5 million hospitalizations and around 3,000 deaths in children < 5 years of age. This is compared with ~640 deaths due to meningitis annually. Of note, however, there has been a 30-40% reduction in pneumonia hospitalizations since the introduction of PCV7.

The classic causes of pneumonia change with age, with viral causes being the most prominent in the preschool (but older than neonatal) age group. Although viruses are still a prominent cause of CAP in school-aged children, we are going to focus on the most common bacterial causes, namely *Streptococcus pneumoniae* and *Mycoplasma pneumoniae.*

Streptococcus Pneumoniae

Streptococcus pneumoniae is a gram + cocci that grows in pairs and chains, differentiating it from Staphylococcal species which are also gram +, but appear in clusters It is alpha-hemolytic, meaning it causes oxidation of iron in hemoglobin molecules creating partial hemolysis on an agar plate, giving it a greenish color around the bacteria. This is in contrast to beta-hemolytic (*Streptococcus pyogenes* or GAS) which demonstrates complete hemolysis, and a complete clearing around the bacterial on the plate. Gamma-hemolytic species cause no hemolysis. In interest of full disclosure, the picture shown below is actually of beta-hemolytic strep, but you get the idea. You would be really surprised how difficult it is to find a usable picture of alpha-hemolytic strep. Who knew?



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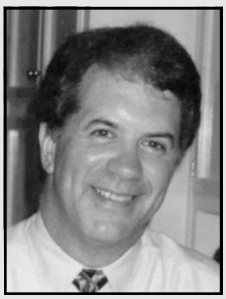

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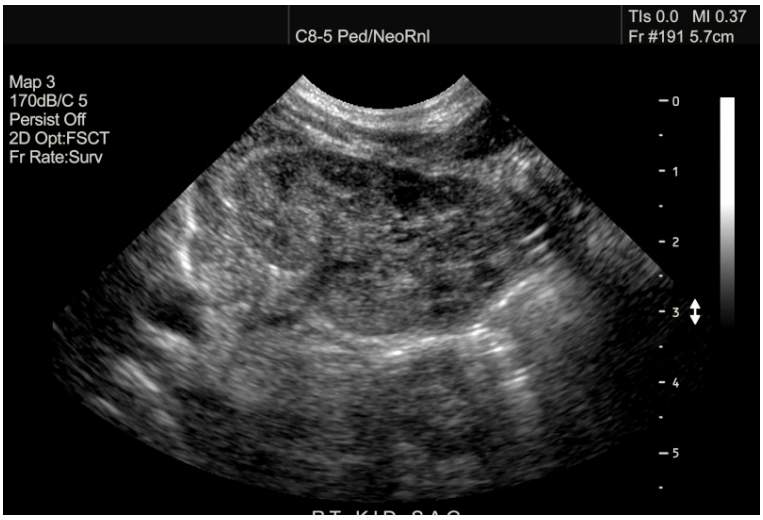
Journal search



Comparison of 2-View Abdominal Radiographs with Ultrasound in Children with Suspected Intussusception

Henderson AA et al
Pediatr Emer Care 2013;29:145-150

We all do it. OK, I do it. When I am concerned about intussusception, I get "screening" abdominal films. In the back of my mind, I know that even a normal x-ray does not effectively eliminate the possibility of intussusception, but it makes me feel better to do it. And, the radiologists like to see them. Previous studies have reported very high sensitivity and specificity with a three view abdominal series, but most institutions (including our own) does two view. Are they worth doing?

This retrospective study of children looked at children ages 3 months to 3 years with suspected intussusception who had both plain films and ultrasound (US) performed. Plain films were considered negative for intussusception if there was air in the ascending colon on two views and transverse colon on the supine view. What they found was that **plain radiography had a sensitivity of 62% and a specificity of 87%, while US had a sensitivity and specificity of 98% and 96%, respectively. US had a greater negative predictive value, and plain films had a higher false-positive and false-negative rate.**

So, all in all, it seems that two view abdominal films are not good in screening for intussusception. If your clinical suspicion is high, consider going straight to US, or even enema for diagnosis and treatment. Will I stop doing plain films on these kids? Maybe, if my suspicion is high. But in the child with isolated vomiting that I'm not convinced is intussusception? Probably not.

Fever Literacy and Fever Phobia

Wallenstein MB et al
Clinical Pediatrics January 24, 2013 online
DOI: 10.1177/0009922812472252

Fever is the most common chief complaint in pediatrics...but I don't need to tell you that. You live it every day. And fever phobia (the belief that fever can cause physical harm to a child) is a phenomenon that is still going strong since the term was coined in 1980 by Dr. Barton Schmitt. His top suggestion to help educate parents with fever phobia is to discuss with them the true definition of fever (≥ 38° C).

This study was a survey given to caregivers who were being seen at pediatric urgent care centers. With the goal answer being between 38.0°C and 38.3°C, **none of the parents were able to correctly define fever. Interestingly, the definition of fever was lower among caregivers who were college graduates, English speakers, and those seen in the private clinic as compared with the county clinic. The vast majority of respondents (93%) believed that fever could cause brain damage, and that held true across all socio-economic classes. The majority would also give antipyretics to comfortable children with perceived fever (temperature <38°C).**

This should not surprise us. Mark Baker showed us similar findings in our own patient population not too long ago. I'm the first to admit that I likely perpetuate fever phobia, especially when I tell people to return to the ED for fever. Or, tell parents to treat fever with antipyretics in the well appearing, comfortable child. It's easier to do that. And, that's something I need to work on. Maybe we can work on it together.

Update in Pediatric Anaphylaxis: A Systematic Review

Chipps BE.
Clinical Pediatrics February 7, 2013
DOI: 10.1177/0009922812474683

I may be mistaken (definitely wouldn't be the first nor the last time), but it seems that we are seeing more kids with allergic reactions and true anaphylaxis. And, although we seem to be seeing it more, it is still frightening when it comes through the door, as treatment is so time sensitive. This systematic review of literature from the past five years was published in February of this year and gives a good overview.

Anaphylaxis is typically defined as a serious allergic reaction that is rapid in onset, typically involves ≥ 2 organ systems, and can result in death. It has been estimated that a food allergy causes an ED visit an average of every three minutes in the U.S., with a food-induced anaphylaxis visit every six minutes. There are many differences in allergic reactions across age groups, with significant issues to be addressed in the pediatric age group.

Outside the hospital, food is the most common trigger for anaphylaxis in the pediatric population, with a prevalence of 5-6%, and account for 150-200 deaths annually. Food triggers vary with age, with peanuts being the most common cause through school aged children, and shellfish/fruits becoming more significant in adolescents. Of note, even the older age groups who presented with anaphylaxis, only about half had a previous episode of food allergy. Most accidental ingestions occur at home, followed by another person's home and then restaurants. Many schools prohibit peanuts, so that was not a place of significant exposure. As children become more independent, there was also increased risk observed. Tolerance to some food allergens may be seen as children age, with cow's milk, eggs, soy, and wheat being the most common. It is less often seen with peanuts, tree nuts, fish, and shellfish.

Other causes of anaphylaxis include insect venom and medications. Insect vemon from Hymenoptera is also commonly seen. It has been reported that up to 16% of patients with insect venom allergy may be at special risk of needing a second dose of epinephrine for a biphasic reaction. Anaphylaxis to medications can be IgE mediated (to penicillins and anesthetics) or non-IgE mediated (NSAIDs and contrast dye). Adolescents may also be exposed to potential allergens when experimenting with recreational drugs.

Signs and symptoms of anaphylaxis vary greatly. Although dermatologic findings were most commonly found, up to 20% of patients may not have any skin findings, which helped guide the clinical criteria for anaphylaxis (Table 1). After dermatologic findings, respiratory issues were most commonly encountered, followed by GI symptoms. Additional signs may include tachycardia, conjunctival erythema/tearing, nasal congestion, AMS, irritability, and LOC. It's important to note that these may be very difficult to discern in the young infant, so a high index of suspicion is needed. The history and physical is the basis of diagnosis, and there aren't any lab tests that will be helpful in the acute setting.

Although there haven't been any randomized controlled studies evaluating the treatment of anaphylaxis, epinephrine is considered the consensus drug of choice as first line treatment. It is the only medication that has been shown to increase survival, and delays in administration have been associated with higher morbidity and mortality as well as increased incidence of biphasic reactions. The typical dosage is 0.15 mg in those weighing < 25 kg, and 0.3 mg in those weighing ≥ 25 kg. It is recommended that exact dosing be used in neonates. Up to 20% of patients may require a second dose, and optimally this should be given within 15 minutes of the first dose. Intramuscular injection in the thigh has been shown to achieve serum concentrations five times greater than those given in the deltoid.

Interestingly, there has been little evidence supporting or refuting the use of antihistamines or steroids in acute anaphylaxis. Antihistamines and beta-agonists may be used for symptomatic treatment. Steroids may help with prevention of a biphasic reaction, and so should be stopped after 2-3 days, when the highest risk has passed.

Pediatric anaphylaxis seems to be on the rise, and we need to be ready to recognize and treat. I hope this helps!

Table 1: Clinical Criteria for Diagnosing Anaphylaxis

Anaphylaxis is likely when any of the following 3 criteria are met:

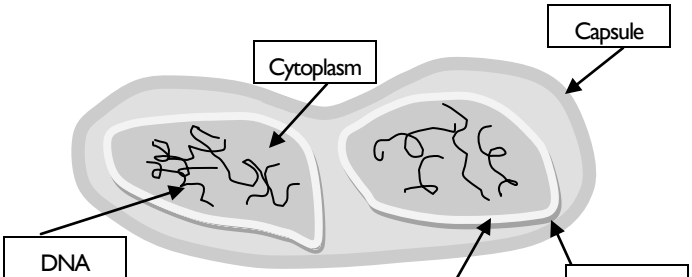
1. Acute onset of an illness with involvement of the skin, mucosal tissue, or both AND at least one of the following:
   - A. Respiratory compromise
   - B. Reduced blood pressure or associated symptoms of end-organ dysfunction
2. Two or more of the following that occur rapidly after exposure to a likely allergen:
   - A. Involvement of the skin/mucosal tissue
   - B. Respiratory compromise
   - C. Reduced blood pressure or associated symptoms of end-organ dysfunction
   - D. Persistent GI symptoms
3. Rapid reduction in blood pressure after exposure to a likely allergen

Back to Basics...Part 2 continued from page 1

S pneumo is a facultative anaerobe (in other words, oxygen? It can take it or leave it…), and requires blood to grow on an agar plate. It has several (83) serotypes, which enhances its virulence. It is also catalase negative. Catalase is located in the peroxisome of a cell. It is used to break down hydrogen peroxide, which can be produced as a by-product of some metabolic processes and cause damage to cells and tissues, into oxygen and water. In the lab, hydrogen peroxide is placed on a slide and then the bacteria in question is added to it. If it bubbles, it is considered catalase positive and if not, catalase negative. Streptococci and Enterococci are catalase negative.

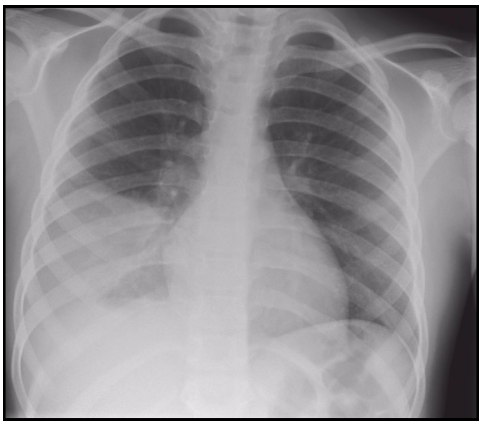
In a tangentially related topic (but one I find of interest as I am getting older), there have been some studies relating the amount of catalase a person has to the process of their hair greying. Essentially, if you have low levels of catalase, you cannot break down hydrogen peroxide which may hasten the bleaching of hair from the inside out. I have wondered what my catalase levels are, but only my hairdresser knows for sure.

Besides having several serotypes, something else that aids in the virulence of *S pneumo* is the fact that it is encapsulated. This polysaccharide coat protects it from being phagocytized. Specific antibodies can neutralize the capsule but, remember, there are 84 different capsule serotypes. So, you could potentially get really unlucky...84 times.



Streptococcus pneumoniae Cell
(Please forgive artist rendering…not my best work, but hopefully you get the gist)

A study that was published in Pediatrics in 1998 evaluated the clinical characteristics and outcomes of children with pneumonia caused by either penicillin sensitive or penicillin resistant *S pneumo*. They found that most patients will present with fever (90%), 70% will have cough, and only half will have tachypnea and/or focal findings on lung exam. You were more likely to require admission if you had other comorbidities, had multi-lobe involvement, or had associated pleural effusions. In terms of treatment, they found that even when dealing with penicillin resistant strains, in otherwise healthy subjects, adequate therapy consisted of β-lactam antibiotics (which, if you remember from the last issue, means containing the β-lactam ring structure that binds to the penicillin binding protein in the bacterial cell wall. AKA all the drugs



Mycoplasma pneumoniae

Mycoplasma pneumoniae is the smallest self-replicating biological system. It is a common cause of both upper and lower respiratory tract infections, responsible for 10 -40% of CAP. It is seen more commonly in larger communities, and there tend to be cyclic epidemics every 3-7 years since the 1980s. The illness is typically mild and self-limited, although antibiotic treatment may be indicated.

M pneumoniae is prokaryotic (lacking a nucleus or other membrane bound organelles). It does not have a cell wall (only a sterol packed cell membrane) meaning it does not pick up gram staining, and it is resistant to antibiotics that attack the cell wall (β-lactams).

The most common clinical manifestation of *M pneumoniae* is pneumonia, but it can also cause pharyngitis, acute otitis media, and croup. There is a proven association with *M pneumoniae* and asthma and may precede the asthma diagnosis, exacerbate the symptoms, or contribute to chronic symptoms. In non-respiratory illnesses, it has been associated with rash, encephalitis, and on occasion, Guillain-Barre syndrome. It has been suggested that immunopathogenetic factors are involved with extra-pulmonary manifestations.

As stated above, the symptoms of *M pneumoniae* CAP are typically more mild, have an incubation period of 1-3 weeks with pleomorphic and interstitial patterns on CXR. It has been given the term "walking pneumonia" because of the milder course typically encountered.

Management

In 2011, the Infectious Diseases Society of America published their executive summary for otherwise healthy infants and children with CAP with the goal of decreasing morbidity and mortality. They came to these recommendations after critically reviewing the literature and evidence we have regarding the subject. Here are their answers to a couple of the more common questions...

Who needs to be admitted?

I don't think there will be anyone too surprised with these answers:

- Those with moderate-severe disease:
  - Sustained age appropriate tachypnea
  - Increased WOB
  - Hypoxia
  - Apnea
  - Altered mental status
- Infants < 3-6 months of age
- Suspected pathogen with increased virulence (ex. CA-MRSA)
- Any concern for treatment compliance

Who needs diagnostic testing (and what)?

⇒ Blood cultures?
  ⇒ Only if not improving or have clinical deterioration

⇒ Viral testing?
  ⇒ Yes...as it may modify clinical decision making and antibiotic use

⇒ CBC?
  ⇒ Not really that helpful...let's be honest.

⇒ Acute phase reactants?
  ⇒ Not helpful (ironically) in the acute phase, but may help gauge response to therapy

⇒ Initial chest x-ray?
  ⇒ Not necessary if well enough to be treated as an outpatient; should be obtained if hypoxic, if respiratory distress present, and those not responding to therapy

⇒ Follow-up chest x-ray?
  ⇒ Not needed if recovery is uneventful
  ⇒ If not responding to therapy, a film should be obtained to evaluate for effusion, necrotizing pneumonia, or pneumothorax

The nice thing about treating CAP is that resistance is relative. Typically, the β-lactam resistance can be overcome by increasing the antibiotic dose. This does not hold true for other resistant pneumococcal infections such as meningitis, but CAP in otherwise healthy and immunized children can usually be treated effectively with amoxicillin (preferred dose 90 mg/kg/day ÷ TID). For those that are penicillin allergic, clindamycin (30-40 mg/kg/day ÷ TID) is an acceptable alternative. Additional therapy with macrolides should be considered for those with higher risk of infection with atypical organisms (azithromycin 10 mg/kg on day one, followed by 4 days of 5 mg/kg daily).

Use of antivirals is always of consideration, but is a whole other topic. Effective treatment of influenza infection is warranted in high risk patients, with first line therapy being oseltamivir, if other contra-indications don't exist. Adequate treatment length is felt to be 7 days, although shorter courses have been shown to be effective in preliminary studies. More research is needed to confirm this proposal.

Community acquired pneumonia in children is not going away. We are fortunate, however, that we still have tolerable, affordable (amoxicillin is free at Publix®), and effective therapy that can be used as an outpatient in the vast majority of cases. At least that might help us feel a little more prepared for the season ahead.

References:

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5. Bradley JS et al. Executive Summary: The Management of Community-Acquired Pneumonia in Infants and Children Older Than 3 Months of Age: Clinical Practice Guidelines by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America. *CID* 2011;53:617-630.
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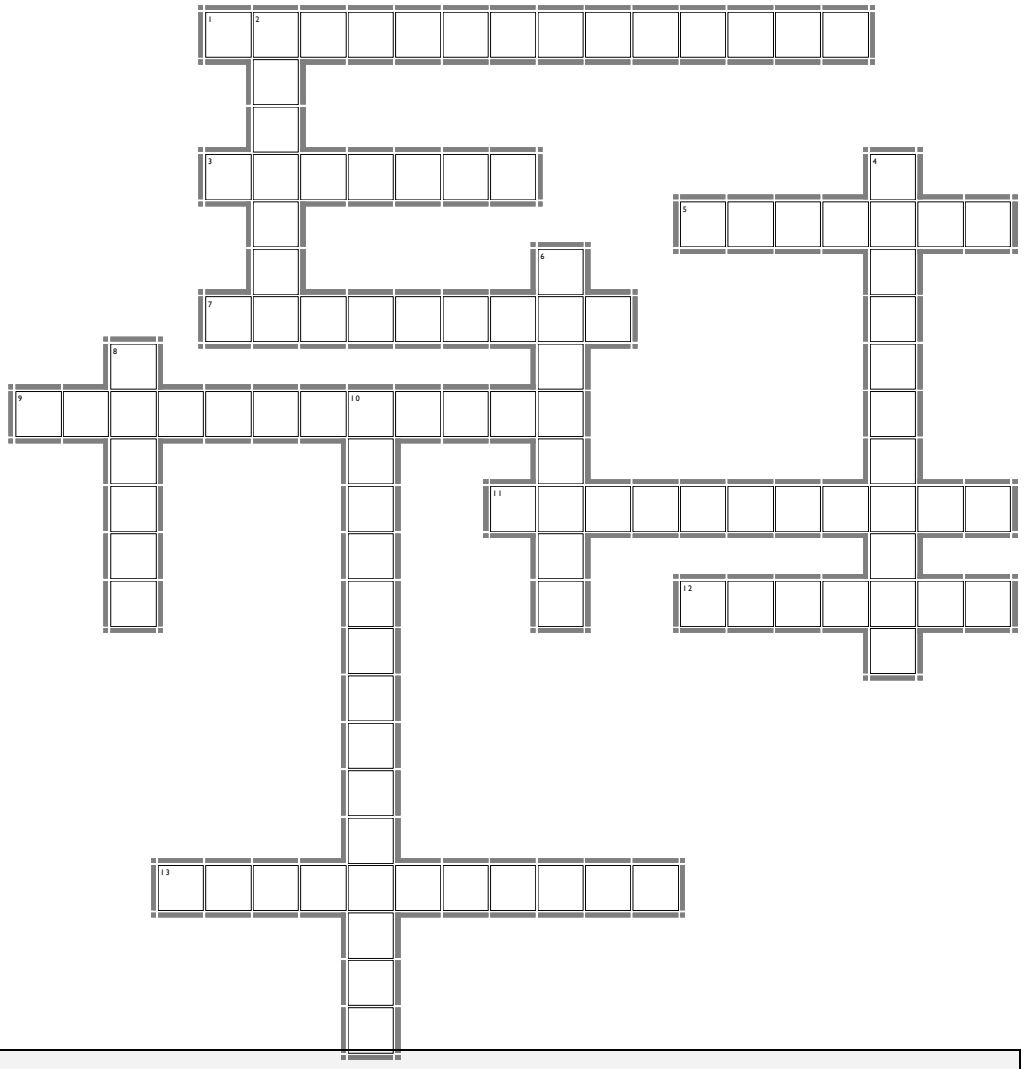
Toxicology Puzzler



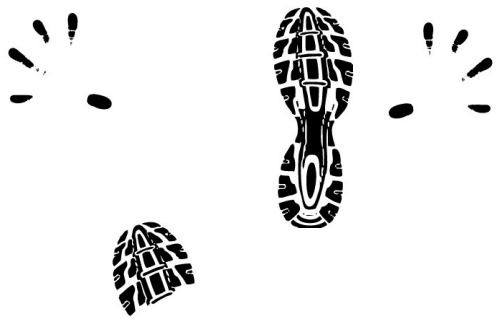
Across

1. Ingestion of this toxin will cause your urine to fluoresce under ultraviolet light
3. Considered the antidote for symptomatic calcium channel blocker overdose
5. This is known as the "All American Drug" on the street
7. This drug, used to treat tuberculosis, can cause an increased anion gap metabolic acidosis
9. The primary metabolic derangement in ethanol toxicity
11. Methyl-salicylate smells like this
12. This toxin smells like bitter almonds.
13. This is the treatment for TCA induced QRS widening

Down

2. This toxin paralyzes ventilator muscles
4. The presence or absence of this can help distinguish an anticholinergic overdose from a sympathomimetic overdose
6. Excessive amounts of this can cause increased intracranial pressure
8. This toxidrome is the classic triad of coma, pinpoint pupils, and respiratory depression
10. Ingestion of this agent can be visualized on abdominal x-ray

Answer on Page 7

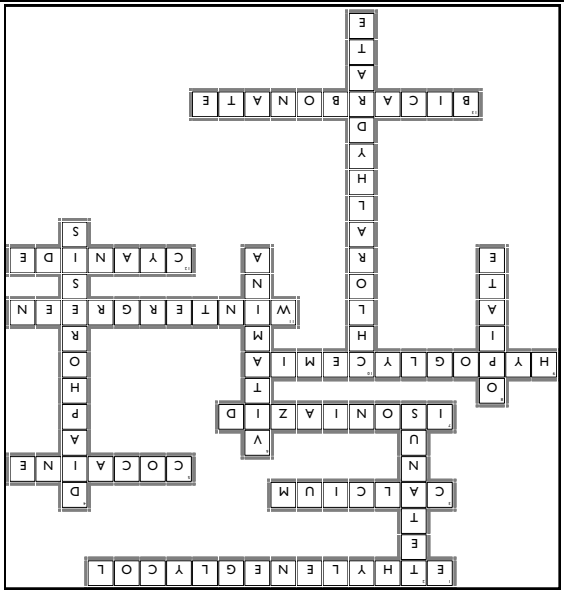


Get your running shoes out! The next annual Spring Scramble benefitting the weight management clinic is Saturday May 18, 2013 in downtown Homewood.

Get more details at springscramble.org.

Spring Scramble 2013

Toxicology Puzzler Answer



Upcoming Events

Everyone needs a night out for a good cause. Well, here is your next one. Come to The Best Medicine Show, presented by the students of the UASOM. It will be held at the Alabama Theater on Friday, March 1st. All proceeds will go to benefit Equal Access Birmingham, a student run initiative providing medical care to Birmingham's underserved.

For more information, visit bestmedicineshow.com. And check out some videos from previous shows on the media tab. If I haven't convinced you to go, this will. Hope to see you there!

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Your feedback is important to us. Questions, comments and suggestions for this newsletter can be sent to:
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Mark Your Calendars!!!

Annual Rud Polhill Memorial Lecture

Thursday April 18, 2013
Bradley Lecture Center
Noon

Speaker: Andrew Garner MD, PhD
Rainbow Babies and Children's Hospital
Cleveland, Ohio