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# microBYTES™

A Hardy Diagnostics eNewsletter

 **HARDY**  
DIAGNOSTICS  
*a culture of service...*

April, 2018

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## Micro Musings...



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# Parasites Taking a Toll on Unsuspecting Veterans





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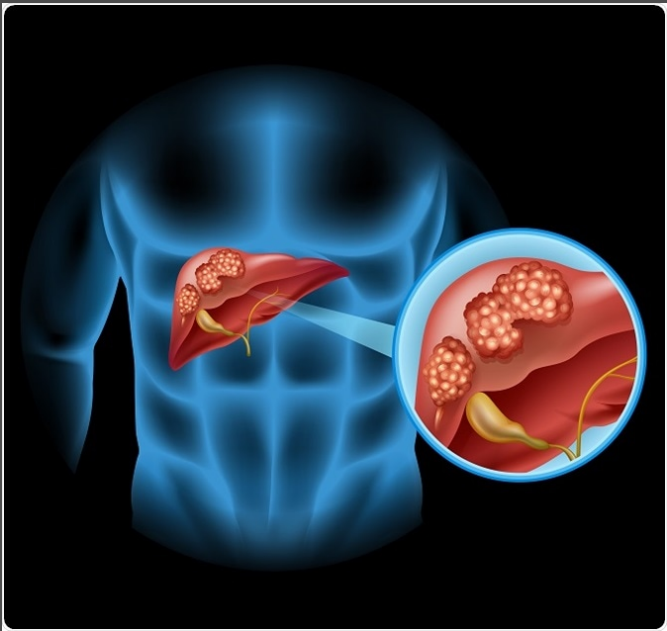
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\* \* \*

*It's Science Project Season!*

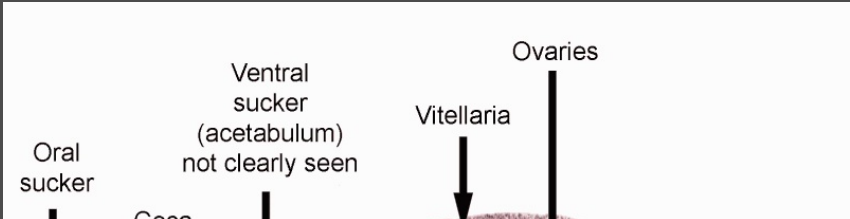


Recently, cases of cholangiocarcinoma (bile duct cancer) and hepatic pain in the United States have been described among Vietnam War veterans. The cause is *Clonorchis sinensis*, one of the most prevalent parasites in the world which is still transmitted in many regions of Asia. It is also known as the liver fluke worm. The fluke worm, *Opisthorchis viverrini* is another potential source of infection and has the same lifecycle as *C. sinensis* with habitat overlap, according to the Centers for Disease Control and Prevention (CDC).



Cases of liver fluke are rare in the United States as the parasite is not endemic to North America. In 2017, the Department of Veterans Affairs commissioned a study to investigate prevalence of liver fluke antibodies in 50 blood samples from Vietnam War veterans collected at a New York facility. Out of the 50 samples tested, more than 20% were positive. This study was issued after about 700 veterans with cholangiocarcinoma cases were observed by the Department of Veterans Affairs over the past 15 years.

Many claims for service-related benefits were not submitted, or if submitted, were rejected because the possible connection to Vietnam was unknown at the time. In 2016, 41 claims were submitted, and 60 claims were submitted in 2017. Although this type of cancer is rare, it is important for veterans and physicians to know the symptoms and tests available to diagnose this parasitic infection.





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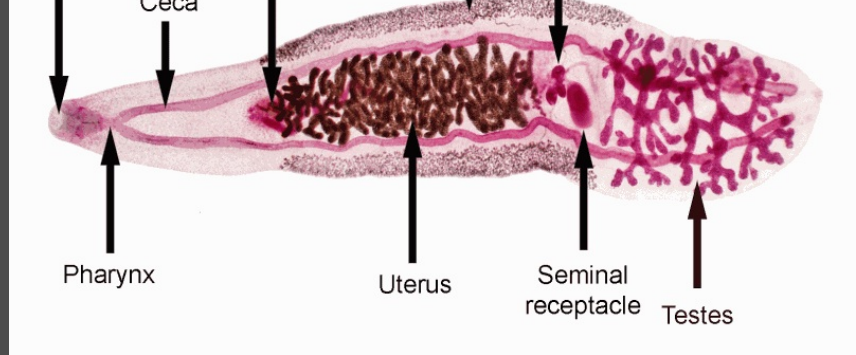


\* \* \*

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The parasite's life cycle begins when eggs are excreted by a human host into the environment. The eggs contain larvae that hatch and begin to thrive once ingested by a snail, the first intermediate host. Inside the snail, the larvae morph into a sporocyst that will eventually lead to a second larval stage. The parasite reproduces asexually, allowing for exponential multiplication of sporocysts within the snail. These larvae exit the snail body and enter freshwater where they attach to a fish. Upon attachment, they bore into fish muscle tissue and form cysts. Many species of fish and shrimp have been recorded as potential secondary intermediate hosts. The definitive, or final host, is a human. The parasite can survive in the muscle of freshwater fish and infects the human host when the fish is consumed, either raw or undercooked. While eating raw and undercooked fish was not any of the veterans' first choice for sustenance, but when rations ran out the soldiers often had to resort to eating whatever was available, including raw fish.

The end of the larval stage occurs when the coating of the cyst is broken down by stomach acid and the larvae enter the bile duct to feed on bile. After about a month of feeding, the larvae mature to adult trematodes and begin to lay eggs.



Up to 4,000 eggs can be produced in a day; the high density of eggs and the prevalence of fish in the diets of people living in these areas are part of what makes the parasite endemic. Over time, the liver and bile duct tissues can become inflamed or obstructed, and liver cancer or cell death can occur.

*C. sinensis* induces an inflammatory reaction and can cause bile duct obstruction by the parasite itself or from its eggs



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of Group B Strep...*

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one duct obstruction by the parasite itself or from its eggs. The liver fluke can be easily treated with praziquantel or albendazole if diagnosed early. While most infected persons do not show any symptoms, infections that last a long time can result in severe symptoms and serious illness. Untreated, infections may persist for up to 25-30 years, the lifespan of the parasite.

Over time, this parasite can cause life-threatening illness as it destroys the liver and can cause liver-related cancer. This pilot study indicates that liver fluke infection is fairly prevalent among Vietnam War era veterans and they should be encouraged them to get confirmatory ultrasounds to detect any abnormalities of the liver or other organs affected by this deadly parasite.

by Anna Klavins  
R&D Microbiologist  
HARDY DIAGNOSTICS

#### Sources:

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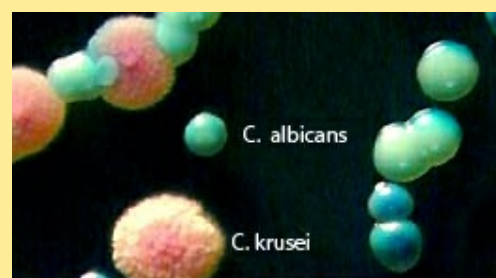
<https://www.cdc.gov/dpdx/clonorchiasis/index.html>

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*Strange ads from the past...*



\* \* \* \* \*

*Phraseology...*

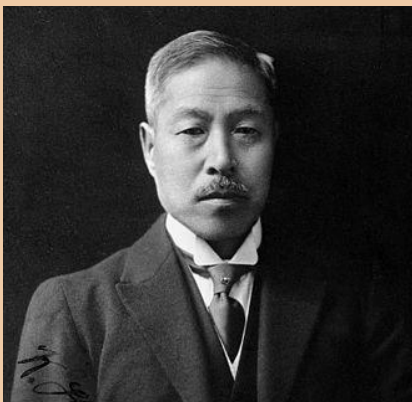
# Charley Horse



The nickname for a leg cramp, "Charley Horse," has a disputed origin; but the most likely is a story that originates in 1889 from a baseball player for Chicago that once had an old lame white horse named Charley, who suffered from pulling heavy loads for too many years. When he developed leg cramps from playing baseball over the years and saw other players hobbling along like an old lame horse, he called the ailment "Charley Horse." This term is only heard in America and not other English speaking countries.

\* \* \* \* \*

## Discoverer of Shigella



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\* \* \*

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\* \* \* \* \*



# Dr. Shiga

1871 ~ 1957

Kiyoshi Shiga was born in Sendai, Japan. He graduated from the Medical School of Tokyo Imperial University in 1896 and continued his studies at the Institute for the Study of Infectious Diseases under Dr. Kitasato Shibasaburō.

Shiga became famous for the discovery of *Shigella dysenteriae*, the bacillus causing dysentery, in 1897, during a severe epidemic in which more than 90,000 cases were reported, with a mortality rate approaching 30%.

The bacterium *Shigella* was thus named after him, as well as the Shiga toxin, which is produced by this bacterium as well as other bacteria, such as *E. coli*.

After the discovery of *Shigella*, Shiga worked with Paul Ehrlich in Germany from 1901 to 1905. After returning to Japan, he resumed the study of infectious diseases with Dr. Kitasato. He became a professor at Keio University in 1920. From 1929 to 1931, Shiga was the president of Keijō Imperial University in Keijo (Seoul, South Korea).

\* \* \* \* \*

## What is Hardy all about?

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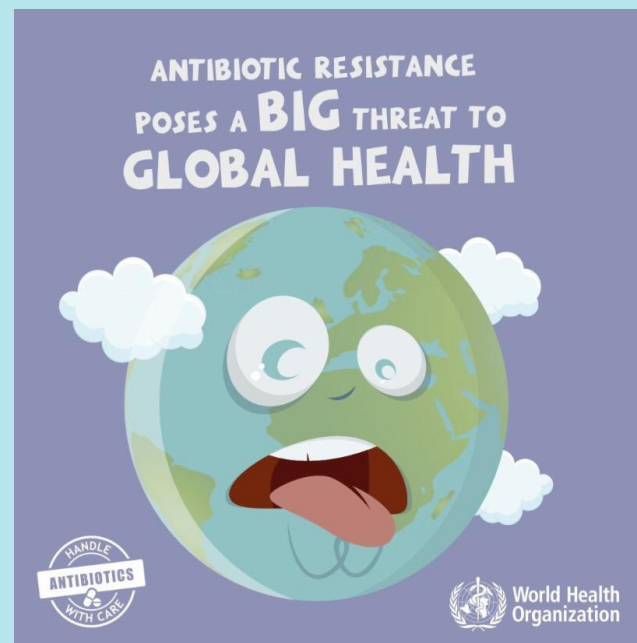


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# The Financial Impact of Resistant Microorganisms

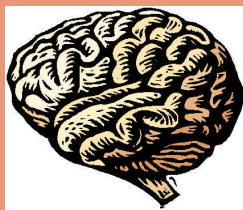
*From 2002 to 2014, the rate of antibiotic-resistant infections doubled from 5.2% to 11% while the overall rate of bacterial infections has remained relatively constant (13.5 million to 14.3 million). Treating an antibiotic-susceptible infection costs an average of \$1,394, while an antibiotic-resistant infection costs an average of \$3,698.*

There were approximately 1.5 million cases of antibiotic-resistant infections in 2014 and the additional cost of treating antibiotic-resistant infections totaled over two billion dollars (1). Antibiotic overuse, misuse, or misapplication has led to selection of bacteria that have resistance to these drugs. As a result, cases of multi-drug resistant pathogens are becoming more common.



The Centers for Disease Prevention and Control (CDC) has identified bacteria from the Enterobacteriaceae family (enterics) and several other Gram-negative pathogens as a growing concern for antibiotic resistance (2). Many of these pathogenic enterics have acquired resistance to most of the commonly used antibiotics. Carbapenem-resistant Enterobacteriaceae (CRE), *Pseudomonas aeruginosa*, and *Acinetobacter baumannii* are of great concern because carbapenems are among the last-resort antibiotics for infections by these organisms<sup>3</sup>. Data obtained by the CDC indicates poor outcomes and high mortality (18-48%) for infections caused by CRE<sup>(3)</sup>. Along with the increasing prevalence of these organisms, the economic

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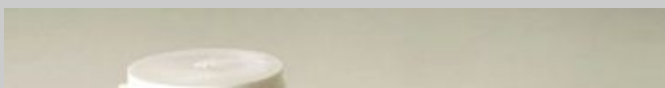
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Along with the increasing prevalence of these organisms, the economic burden and cost for hospitals is expected to rise even further. Carbapenem-resistant bacterial infections are a public health concern and could become an economic burden for hospitals and patients receiving treatment for these infections if the spread of these bacteria is not monitored or controlled.

In clinical settings, initiatives should be taken to follow an antibiotic stewardship program (ASP) in order to reduce overall costs and improve patient treatment outcomes. The CDC estimates that 30-50% of all antibiotics prescribed in the U.S. are unnecessary or inappropriate (4). To help prevent the spread of antibiotic-resistant bacteria, the CDC encourages hospitals to implement ASPs. These programs are designed to optimize treatment and prevent the use of antimicrobials in an ineffective manner, such as for infections that are caused by a microorganism that is unaffected by the prescribed drug.

Table

### CDC's seven core elements of antimicrobial stewardship

1	Leadership commitment	
2	Accountability	
3	Drug expertise	
4	Action	
5	Tracking	
6	Reporting	
7	Education	

Healio

It has been reported that hospitals that implement ASPs have seen an increase in patient cure-rates through correct diagnosis, reduced rates of nosocomial infections, and reduced costs (4).

Some pathogens acquire antibiotic resistance in the environment or among animals, which in turn can infect human populations (5). Eighty percent of all antibiotics produced are being given to farm animals. The broad use of antibiotics in livestock feed is a public health concern since the resistant bacteria have been tracked from animal populations to humans by the National Antimicrobial Resistance Monitoring System for Enteric Bacteria (NARMS) (5). While non-pathogenic organisms are regular inhabitants of human and animal guts, other enterics with resistance traits will survive when antibiotics are administered.







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The antibiotic-resistant enterics can be carried asymptotically in the intestines of livestock and shed in feces. They are then spread to humans directly by contaminated meat and poultry products, or indirectly through the environment. Currently, however, the FDA has prohibited the addition of cephalosporins and fluoroquinolones to animal feed due to the overlap of these drug classes with human medicine.

In the arms race between humans and bacteria, some strains of bacteria

have countered every new antimicrobial agent thrown at them and continue to evolve rapidly while new drugs are developed. This is not only a health problem, but also an economic problem because as the prevalence of infections caused by antibiotic-resistant bacteria are increasing, so is the cost of patient care. Longer hospitalization stays, surgery, lost wages and productivity due to illness, and future complications caused by antibiotic-resistant bacteria are some of the additional factors that lead to the increased cost associated with these infections.

While the development of new antibiotics may not be the main focus point for the pharmaceutical industry, new agents have been launched recently (i.e. ceftolozane/tazobactam, ceftazidime/avibactam, meropenem/vaborbactam, and delafloxacin) and many newer antimicrobial candidates are in the pipeline between now and 2022.

However, there is still hope. Besides traditional antimicrobials, there are a variety of newer options that have yet to be fully explored, such as phage therapy and lytic enzymes (6). Although selective pressures and evolution by point mutations may be favoring the bacteria, cumulative efforts to practice antibiotic stewardship by industry and hospitals that utilize antimicrobials can help curb the rise of antibiotic-resistant pathogens.

#### References

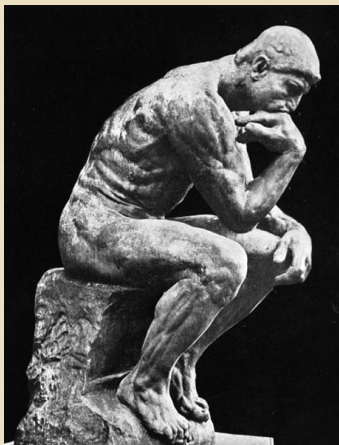
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*By Michael Wade and Anna Klavins  
R&D Microbiologists  
HARDY DIAGNOSTICS*

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**Optical oddities...**

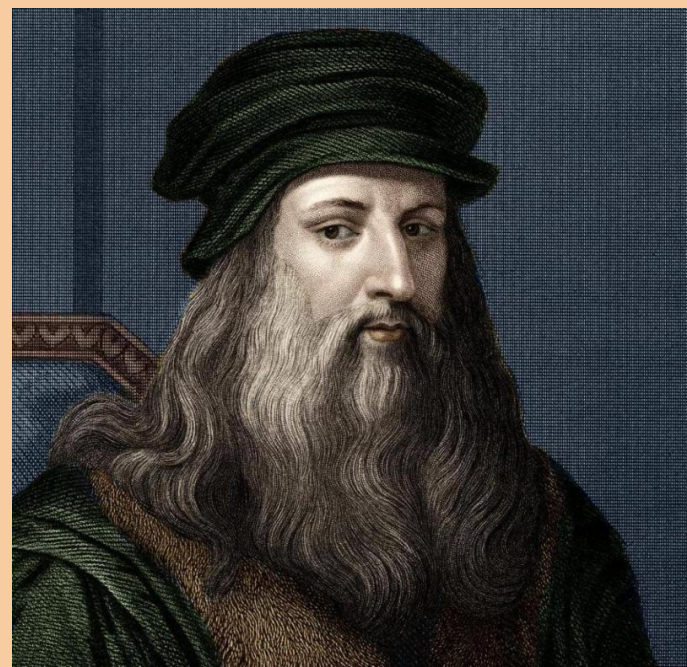
**Think about it...**



- \* Why do they put braille on the number pads of drive through bank machines?
- \* If nothing sticks to Teflon, how do they stick Teflon on the pan?
- \* How do they get a deer to cross at that yellow road sign?
- \* What's another word for Thesaurus?
- \* What would we have called the color orange if it wasn't a fruit?
- \* Why is it that when you're driving and looking for an address, you turn down the volume on the radio?

\* \* \*

Wisdom to Ponder...



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1452 ~ 1519

*An Italian genius that excelled at painting, sculpting, architecture, science, music, mathematics, literature, engineering, anatomy, geology, botany, and astronomy. He has been credited with the invention of the parachute, helicopter, and military tank.*

- "Tears come from the heart and not from the brain."
- "Simplicity is the ultimate sophistication."
- "While I thought that I was learning how to live, I have been learning how to die."
- "Learning never exhausts the mind."
- "Why does the eye see a thing more clearly in dreams than the imagination when awake?"



Can you find the three lady bugs?  
How about the three baby's faces?

Give up?  
Scroll to bottom...

*"Believe half of what you see  
and none of what you hear."*  
~ Benjamin Franklin ~

(actually they are the same)

RUBES



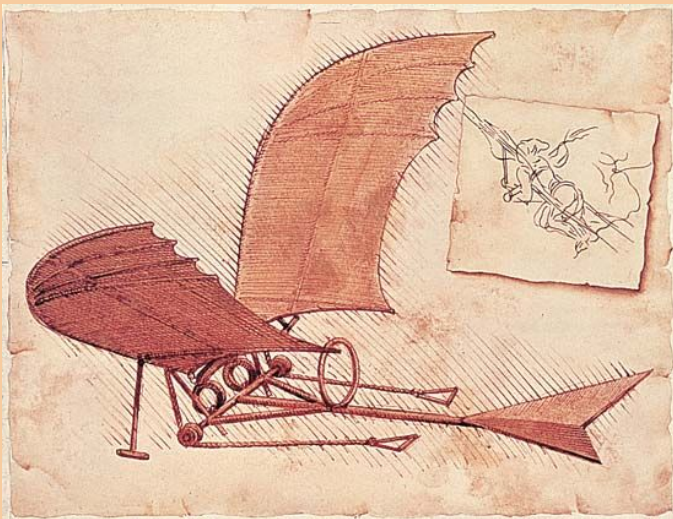
"The noblest pleasure is the joy of understanding."

"Knowing is not enough; we must apply. Being willing is not enough; we must do."

"The human foot is a masterpiece of engineering and a work of art."

"Time abides long enough for those who make use of it."

"I have always felt it is my destiny to build a machine that would allow man to fly."



\* \* \*

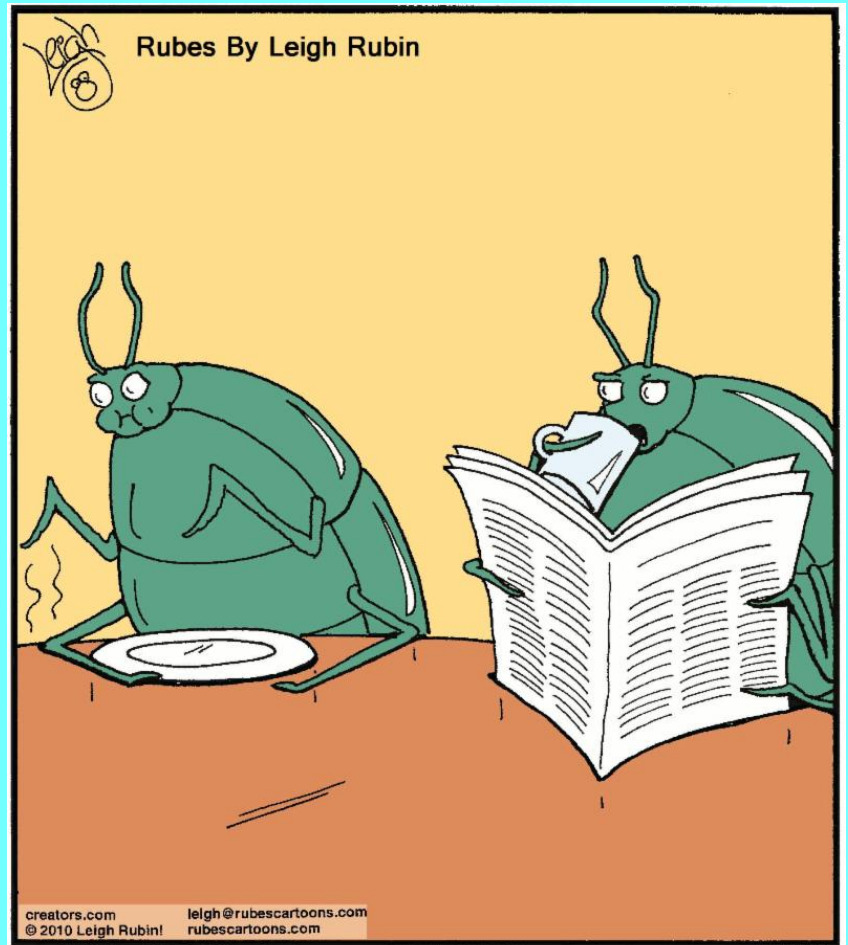
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to name other items...*

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- DEFIBRILLATORS: Hearty Startie
- BUMBLE BEES: Fuzzy Buzzy
- PREGNANCY TESTS: Maybe Baby
- BRAS: Breastie Nestie
- FORKS: Stabby Grabby
- SOCKS: Feetie Heaties
- HIPPOPOTAMUS: Bloatie Floatie
- NIGHTMARES: Screamy Dreamy

\* \* \*

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\* I think every morning that I'm going to make pancakes, but I keep waffling.

\* Pencils could be made with erasers at both ends, but what would be the point?

\* The dead batteries were given out free of charge.

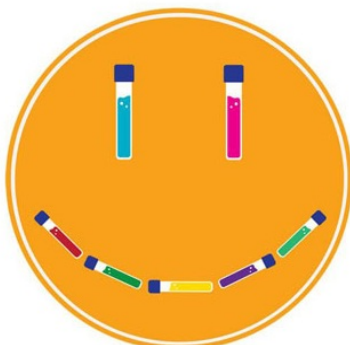
\* My fear of roses is a thorny issue. I'm not sure what it stems from, but it seems likely I'll be stuck with it.

\* Broken puppets for sale. No strings attached.

\* John Deere's manure spreader is the only equipment the company won't stand behind.

\* Two peanuts were walking in a tough neighborhood and one of them was a-salted.

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