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microBYTES™

A Hardy Diagnostics eNewsletter

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

February, 2018

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Micro Musings...



"THERE ARE MILLIONS OF BACTERIA IN YOUR INTESTINES, ANYWAY.
WHAT HARM COULD ONE OR TWO MORE DO?"

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It's Science Project Season!

Which gut organisms can promote cancer?

According to the American Cancer Society, "colorectal cancer is the third most common cancer diagnosed in both men and women in the United States, excluding skin cancers"





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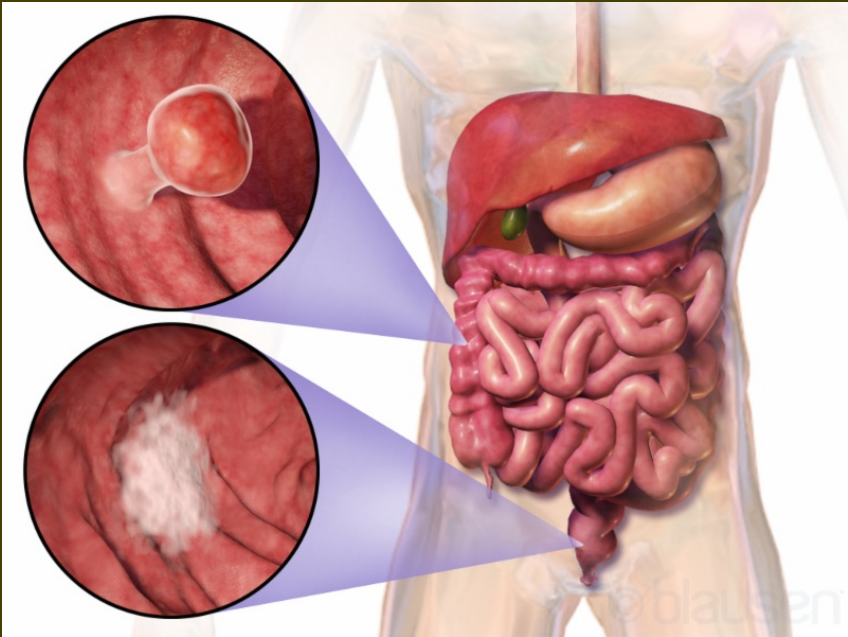


For the detection
of Group B Strep...

Carrot Broth One-Step



and is responsible for over 50,000 deaths annually.



Two examples of colorectal cancer

In a recent newspaper article published in New York Times, *"Gut Microbes Combine to Cause Colon Cancer, Study Suggests"* by Gina Kolata, researchers have found a potential link of toxin-producing *Bacteroides fragilis* and *Escherichia coli* strains to the exacerbation of colonic tumors in patients with familial adenomatous polyposis (FAP). The genes for these oncotoxins, specifically colibactin and *Bacteroides fragilis* toxin, were found to be expressed in FAP patient colonic mucosa at a higher frequency than those of patients without FAP.

These bacteria work together to form their own habitat (biofilm) within the intestinal barrier, where they flourish and cause chronic inflammation, DNA damage, and the possibility of subsequent tumors. It was also shown that, in subjects colonized with only one bacterial strain or the other, tumor onset was not as rapid as when colonized with both bacterial strains.

Subjects colonized with both bacterial strains also suffered increased mortality when compared to subjects colonized with only one strain or the other.

Colibactin is a bacterial genotoxin shown to be one of the potential precursors of inflammation-induced colorectal cancer and has also been linked to the hyper-virulence of other bacterial species (such as *Klebsiella pneumonia* - responsible for bacterial meningitis). Genotoxins are known for causing DNA mutations that, oftentimes, lead to cancer. The part of the bacterial genome responsible for the production of the genotoxin colibactin in certain strains of *E.*



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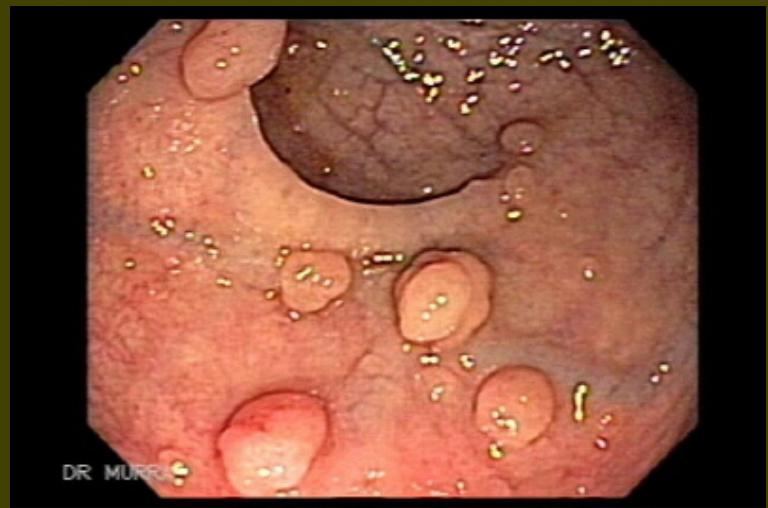
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* * *

E. coli (of phylogenetic group B2) is known as the pks genomic island. Cells exposed to *E. coli* with this pks genomic island showed a marked increase in the frequency of genetic mutations, leading researchers to believe that this may contribute to the development of colonic tumors in colonized patients.

Bacteroides fragilis toxin, also known as fragilysin, is an enterotoxin responsible for the activation of E-cadherin. E-cadherin is a tumor suppressor protein that, when cleaved, increases the permeability of the intestinal barrier, thereby reducing its functionality. When the cellular adhesion within the tissue is decreased, it allows for infiltration of cancer cells into surrounding tissues. Cleavage of E-cadherin may also lead to overexpression of β -catenin, an adhesion and gene transcription protein, which has been associated with colorectal and other cancers.



Polyps seen during endoscopy of the colon.

Both *Bacteroides* spp. and *E. coli* have been found in increased numbers in patients with irritable bowel disease (IBD). Increased numbers of *Lactobacillus* spp. are associated with a decreased occurrence of IBD, thus encouraging the practice of taking probiotic supplements that contain that organism. Additionally, increased numbers of

Bacteroides spp are found in those that consume more animal protein, as opposed to vegans.

Seeing that both colibactin and *Bacteroides fragilis* toxin are potential contributing factors leading to increased inflammation and tumorigenesis, one can certainly speculate that, when combined, the effect may be intensified. This is even more true of patients with FAP, who are commonly colonized with both oncotoxin producing bacterial strains, though it is not known if biofilms are present before polyps form. If biofilms are found to be present before polyp formation and are detected by way of stool analysis, this may

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formation and are detected by way of stool analysis, and may give doctors the head start they need for a less invasive solution for colorectal tumor prevention.

*By Sara Hylton and Andre Hsiung
Technical Services department of Hardy Diagnostics*

References

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Phraseology...

"Pleased as Punch"



"As pleased as punch" usually means you're satisfied. This phrase has some rather gruesome origins. The punch does not refer to a beverage but to the children's puppets Punch and Judy, whose repertoire included wife beating, baby squashing, and murder. The puppet shows became a staple in England during the late 1600s.

The plot line generally followed the same theme: Something angered Punch, and he would go on a killing spree, murdering everyone with his "slapstick." Usually Punch would kill his child, then his hysterical wife, Judy, then any authority figure - policeman, doctor, concerned citizen - who came to investigate. He would laugh and say, "That's the way to do it!" after each killing. As macabre as that may be, Punch and Judy shows still exist in Britain today, nearly 400 years later!

Trio Bas Air Samplers



Two heads are better than one!

Now with Bluetooth capability!

Trio Bas from Orum International has a robust impact air sampler for every type of use. Single, double, or triple heads

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* * * * *

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"The two heads of TRIO BAS DUO air sampler was one of the best investments during the last two years. The laboratory staff responsible of the bacteriological sampling is able to double the number of environmental microbial cycles per day. This means more efficiency and lower cost, together with the possibility to increase in the future the number of sampling in other areas of the premises."

* * *

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Simple Solutions...



Brushing to Prevent Pneumonia

Can a build up of bacteria in a patient's mouth make them more susceptible to hospital acquired pneumonia? A study at the Sutter Healthcare system in Northern California designed a study to find out. When non-ventilator patients were encouraged to brush their teeth on a regular basis, the incidence of pneumonia dropped by 37% in the initial study, then by 70% in a later study.

Another study that involved brushing just twice a day at the VA Hospital in Virginia, led to a 92% reduction in hospital acquired pneumonias.

It is estimated that a single case of pneumonia can cost upwards of \$40,000. In addition, a CDC study found that hospital acquired pneumonia can be deadly in 31% of the cases. Tooth-brushing appears to be a simple and inexpensive way to prevent this devastating disease.

[Reference 1](#)

[Reference 2](#)

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Brainteasers



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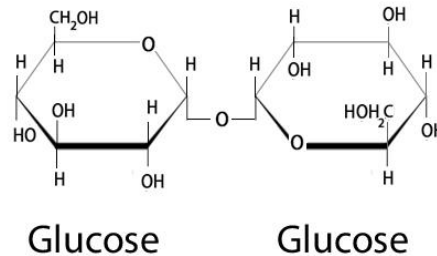


A Not So Sweet Relationship?

Trehalose and *C. difficile*

Dietary sugar and *Clostridium difficile* are not usually two things you hear of in one sentence, but it was recently discovered that a sugar additive, trehalose, may encourage the virulence of *Clostridium difficile*.

Trehalose



The supporting study titled "Dietary trehalose enhances virulence of epidemic *Clostridium difficile*" was very recently published in January 2018 in Nature, International Journal of Science (Collins et al.,

2018). The study discusses two ribotypes of *C. difficile* that have been associated with major outbreaks of hospital-acquired infections in recent years: ribotypes 027 and 078 (Collins et al., 2018). Researchers believe that fluoroquinolone resistance is partly responsible for the RT027's role in causing epidemics but many other strains of *C. difficile* are also fluoroquinolone-resistant but not responsible for major epidemics. As a result, scientists at Baylor College of Medicine set out to explore the relationship between trehalose and *C. difficile* in these two ribotypes (Pathak, 2018).

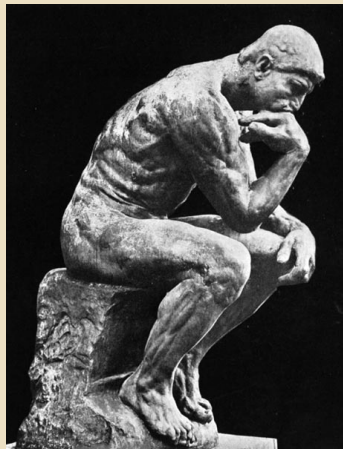
Trehalose is a sugar that is commonly used in biochemical pathways of many bacteria. However, the researchers at Baylor noticed that RT027 and RT078 were able to utilize concentrations of trehalose that



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Think about it...



- * I went to the air and space museum...but there was nothing there.
- * I need professional help! Like a maid, butler, and chauffeur.
- * There's a new restaurant on the moon...the food was good, but there is no atmosphere.
- * I really want to start growing my own food...but I can't find bacon seeds.
- * A wise man once said. . . nothing.

* * *

Wisdom to Ponder...

were 1,000 times lower than the concentration of trehalose required by other lineages of *C. difficile*. This quickly sparked their interest, as it appeared that RT027 and RT078 lineages of *C. difficile* had optimized their ability to use trehalose.

Researchers used a mouse model of *C. difficile* infection to further investigate this finding. Mice were infected with either the RT027 or RT078 lineage of *C. difficile* in conjunction with a diet that either contained low trehalose levels or no trehalose. It was found that the mortality rate was higher in the group of mice infected with *C. difficile* that consumed a diet with more trehalose than those who consumed a diet without trehalose. Continued studies using the mouse model of infection demonstrated that it was not so much the number of *C. difficile* present in the mice that

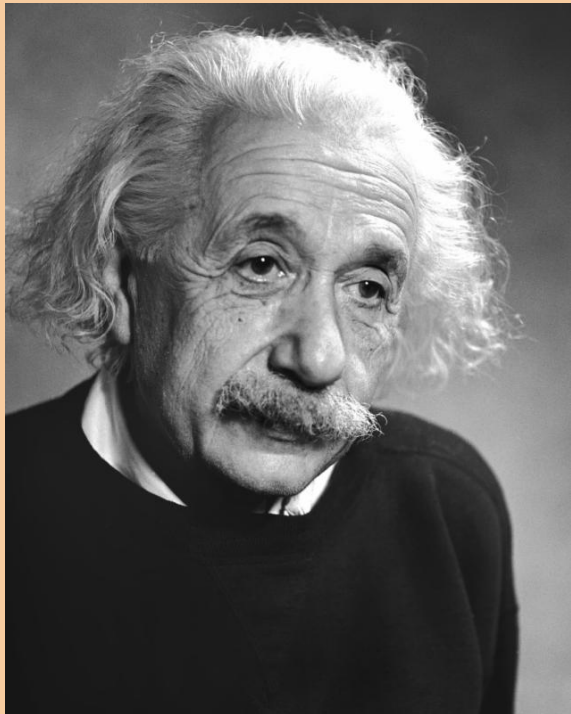
caused disease severity but rather the level of trehalose consumed by the mice that resulted in increased production and release of toxins by RT027 lineage of *C. difficile* (Pathak, 2018).

Furthermore, the researchers at Baylor found underlying evidence for this study at the molecular level. It appears that the genome of these two strains encodes a trehalose repressor protein called TreR. In the RT027 lineage, they found that this repressor has undergone a single point-mutation which has allowed this protein to gain increased sensitivity to trehalose by more than 500-fold. Before this mutation had occurred, TreR was only activated when the concentration of trehalose was high (Collins et al., 2018).

The researchers at Baylor draw an interesting conclusion suggesting that the addition of trehalose to the human diet may have played a role in the selection of these two ribotypes and their hypervirulence. This conclusion is supported by the fact that trehalose was approved as a food additive in the United States in the year 2000, which allowed trehalose to be included in foods such as sushi, ice cream, desserts, and even vegetables.

It was in the following three years that major outbreaks involving RT027 and RT078 began to occur (Pathak

involving K1027 and K1078 began to occur (Patnak, 2018). As a result, this preliminary study strongly suggests that there may be a relationship between dietary trehalose and hypervirulence of *C. difficile*.



Albert Einstein

1879 ~ 1955

German-born theoretical physicist who developed the theory of relativity. He published over 300 scientific articles and 150 non-scientific works. Einstein became an American citizen in 1940.

"The hardest thing in the world to understand is the income tax."

"The true sign of intelligence is not knowledge but imagination."

"One thing I have learned in a long life: that all our science, measured against reality, is primitive



Cargill, a major manufacturer of trehalose for the use in food, states the following on [their website](#):

"Trehalose is an ideal ingredient for generating exciting market possibilities for your latest product concepts and also for adding new life to existing food and beverage brands. It is especially well suited for sweetening nutritional drinks and other energy products used by consumers as part of their daily eating habits. As a multi-functional sugar with nearly half the sweetness of sucrose, trehalose will strongly improve the taste, texture and appeal of your foods and beverages. Trehalose can bring out the best in your products and your processes, enhancing functionality and improving stability in several key ways."

According to a report by the Centers for Disease Control and Prevention (CDC), *C. difficile* is responsible for about 500,000 infections among patients in the United States in a year. People aged 65 years or older are especially vulnerable to this fatal

and childlike -- and yet it is the most precious thing we have."

"Blind belief in authority is the greatest enemy of truth."

"To know what is impenetrable to us really exists, manifesting itself as the highest wisdom and the most radiant beauty, which our dull faculties can comprehend only in their most primitive forms - this knowledge, this feeling is at the center of true religiousness."

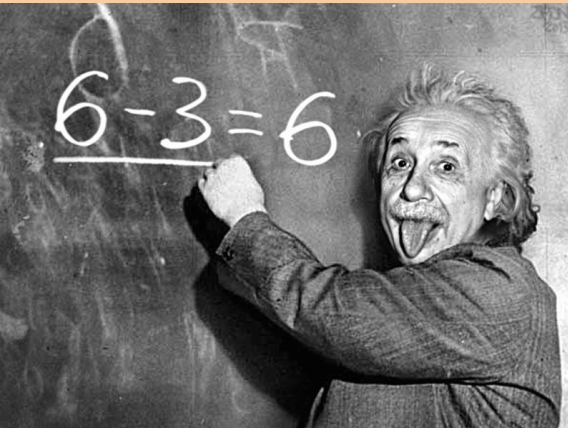
"I have no special talents. I am only passionately curious."

"I want to know God's thoughts - the rest are mere details."

"The most beautiful thing we can experience is the mysterious. It is the source of all true art and all science. He to whom this emotion is a stranger, who can no longer pause to wonder and stand rapt in awe, is as good as dead: his eyes are closed."

"If you want to live a happy life, tie it to a goal, not to people or things."

"If you can't explain it to a six year old, you don't understand it yourself."



* * *

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infection. Within 30 days of the initial diagnosis of *C. difficile*, about 29,000 patients die each year.

By Nasim Delavari
Technical Support Microbiologist
HARDY DIAGNOSTICS

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Optical oddities...



Looks like a normal face of a young woman,
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*"Believe half of what you see
and none of what you hear."*
~ Benjamin Franklin ~

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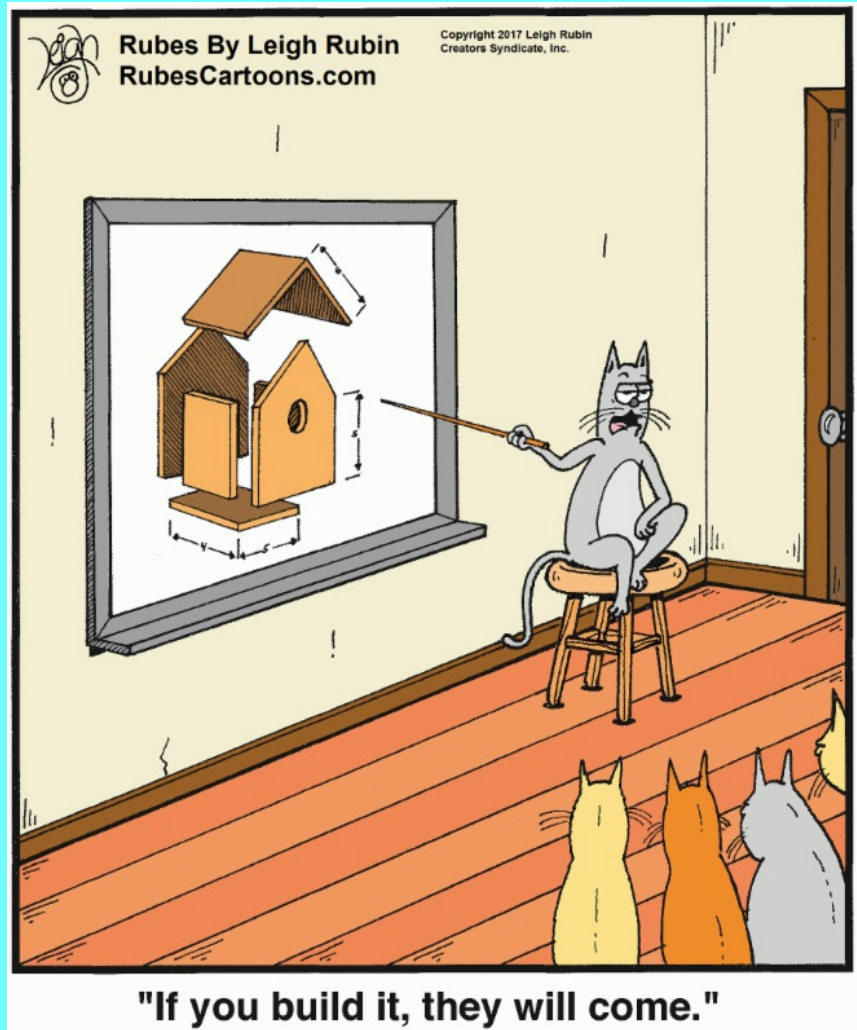
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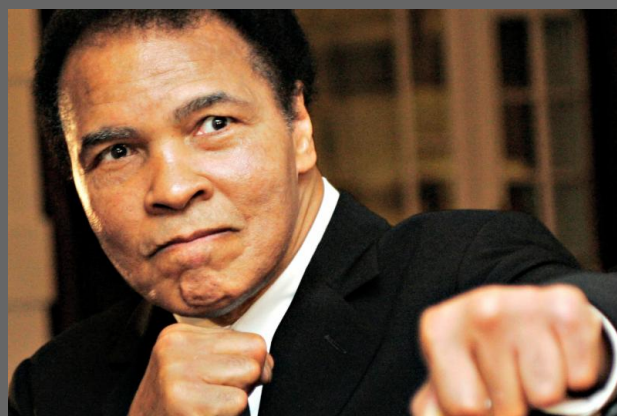
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*"I always try to avoid things
that make me look fat..."*



"Like mirrors and scales."

* * *

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Jay Hardy, CLS, SM(NRCM)
President
HARDY DIAGNOSTICS

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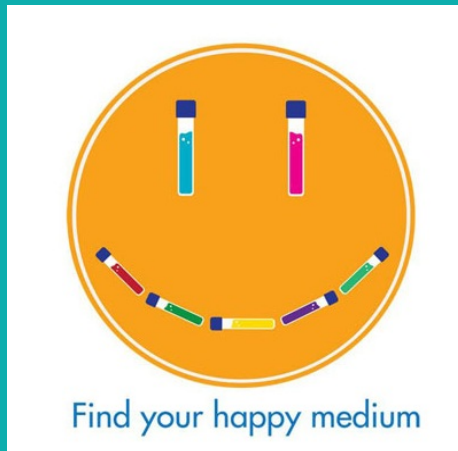


Warning:
**PUN ZONE
AHEAD**





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* Jokes about German sausage are the wurst.

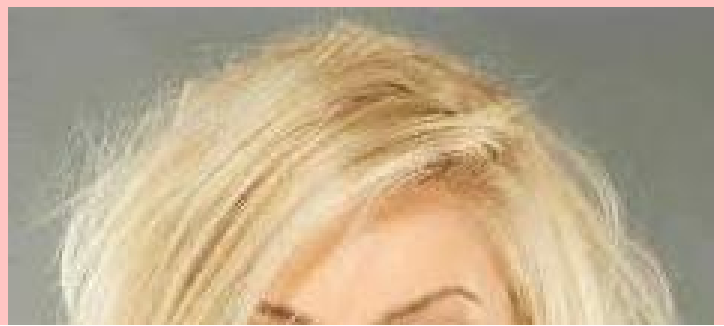
* I know a guy who's addicted to brake fluid, but he says he can stop any time.

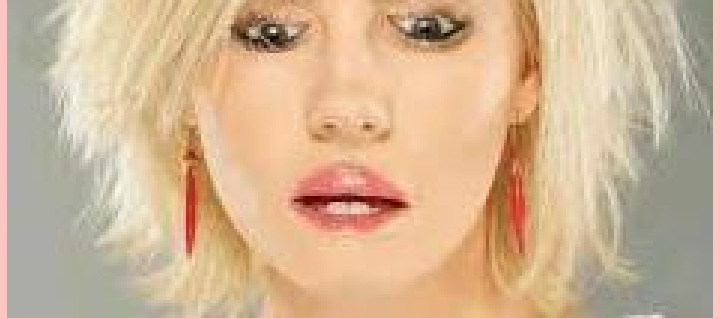
* I stayed up all night to see where the sun went, and then it dawned on me.

* This girl said she recognized me from the vegetarian club, but I'd never met herbivore.

* When chemists die, they barium.

#





Now that the photo is right side up, you can see that the eyes and mouth are actually upside down. Your eyes tricked you into thinking this was normal when the entire photo was

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