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Can soft drinks speed aging?

Drinking 8 ounces of sweetened soda daily inflicts 1.9 extra years of aging on your cells, a new study concludes

Soft drinks may quench your thirst and provide an energy boost. They also can do a lot of damage — beyond expanding your waistline. Drinking sweetened sodas daily can speed how fast the body's cells age, a new study indicates.

Regularly downing sugary soft drinks can boost the risk of chronic diseases, including type 2 diabetes, heart disease and liver disease. These long-lasting conditions have no cure. Today, three-fourths of all American healthcare dollars go to manage such ailments. What researchers hadn't worked out was *why* overindulging in sugary drinks leads to such diseases.

Researchers at the University of California, San Francisco, or UCSF, wondered if the link might lie with a marker of cellular aging. It's called the telomere(端粒). Telomeres are the repeated sequences of DNA that cap the ends of our chromosomes. Like the plastic tips that keep shoelaces from fraying, telomeres protect our DNA from damage, explains UCSF's Cindy Leung. As an epidemiologist, she probes the links between diet and health.

Telomeres shorten each time a cell divides. But "if the telomere gets too short," she notes, "the cell can stop dividing and die." As such, telomere shrinkage is said to reflect — and possibly even determine — a cell's biological age. Studies show that shorter telomeres also raise a person's risk for diabetes, heart disease and some cancers.

To scout for a link between sugary beverages and telomere length, her team combed through a lot of health data. These came from a nationwide survey of 5,309 U.S. adults between 1999 and 2002. (This survey has been ongoing since the early 1960s. Over its history, it has collected health data on more than 140,000 people.) At mobile exam centers, survey participants get their height and weight measured, give blood samples and answer questions about their lifestyle and other behaviors. During those interviews, each volunteer also reports everything he or she had eaten or drunk in the past day.

From this information, Leung's team calculated how much sugar from beverages each volunteer had consumed. But since a one-day report doesn't always reflect general habits for all other days, the scientists also asked about factors that can vary among participants. Such *variables* included their age, gender, what ethnic group they belonged to, whether they were married, where they live, whether they smoke and if they had been surveyed on a weekday or weekend. Many of these factors can affect how well the single-day report reflects a person's*usual* habits.

The other piece of information that Leung's team needed was telomere lengths. To measure them, they extracted DNA from each participant's blood. Then they ran those samples through a test, or *assay*. It looked for a special, repeated stretch of six DNA building blocks, called nucleotides. This particular combo of six nucleotides is found only in human telomeres, not in the rest of our chromosomes' DNA.

Leung's UCSF coworker, Elizabeth Blackburn, shared the 2009 Nobel Prize in Medicine for discovering how chromosomes are protected by telomeres. Members of Blackburn's lab assayed the telomeres for the new study.

Then the researchers determined how average telomere length varied depending on traits and behaviors such as age, race, how much someone exercised and how much schooling they'd had. Then, taking this information into account, the scientists homed in on the variable they wanted to study — daily intake of sweet drinks. They looked at soft drinks sweetened with sugar, sweet non-carbonated beverages (such as sports drinks), diet soft drinks and fruit juices.

After crunching the numbers, "drinking an 8-ounce serving of soda was associated with 1.9 additional years of cellular aging," Leung told *Science News for Students*. That means people who guzzle a 20-ounce bottle of some sugary soft drink daily are inflicting roughly 4.6 additional years of biological wear and tear on their cells. About one-fifth of study participants reported drinking at least 20 ounces of sweetened soft drinks each day. Leung's team reported its findings October 16 in the *American Journal of Public Health*.

In a 2008 study, for instance, Blackburn and her coworkers reported that good habits can lengthen telomeres. They studied a three-month regimen in people. It consisted of eating healthy, getting regular exercise, not smoking, getting social support and managing stress.

Right now, sports drinks and energy drinks are on the rise, particularly among teens and young adults. That is why Leung suspects that "if we were to repeat the study today, we would expect to see the same association (with shorter telomeres) that we found with sugary sodas, in all these other sugary drinks.

~沒有電阻的材料－超導材料(Super Conductor)

金屬是電的良導體，電阻比較小，尤其是銀、銅和鋁。但是日常所用的導電材料都有電阻，因此在輸電過程中會有大量的電能損失，甚至達總電能的 15%。零電阻的超導材料便成為人們最期盼的東西。

在尋找超導材料的過程中，首先想到的是金屬。科學家發現金屬的電阻隨著溫度降低而減小，因此在超低溫下或許可獲得較小的電阻，甚至是零電阻。隨著超低溫技術的發展，人們逐漸獲得了不同程度的低溫，如攝氏零下 140 度（133K）的液氧溫度、零下 196 度（77K）的液氮溫度、零下 253 度（20K）的液氫溫度、零下 263 度（10K）的液氦溫度等。這些超低溫技術為超導材料的發現創造了成功的條件。

1911 年，荷蘭物理學家昂納斯（Heike Kamerlingh Onnes）教授在研究金屬汞的低溫性能時發現，當汞的溫度降低到 4K 時，電阻會下降到零。人們把這種零電阻現象叫做「超導性」，具有超導性的材料叫做「超導材料」，而出現零電阻的溫度叫做「超導溫度」，並用符號 TC 表示。因此，金屬汞成了人類認識的第 1 個超導體，從此探索和研究超導材料成為科技界的熱門課題，昂納斯教授也因這項成就在 1913 年獲得諾貝爾物理學獎。

為什麼超導體達到「超導溫度」時會完全失去電阻呢？金屬導電是由於金屬晶體的自由電子在電場的作用下做漂移運動，在漂移過程中所受到的阻力就是電阻。當溫度下降時，金屬晶體的原子趨於被「凍住」，兩個自旋相反的自由電子會因與晶格作用出現微弱引力而趨向形成「電子對」，而且電子對之間也會出現弱的組合而趨向有序化（玻子凝結），這些變化會因溫度持續降低而增大。

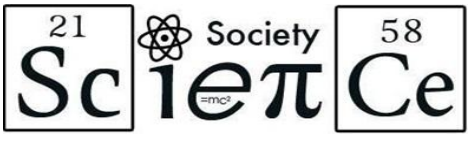
當溫度降到臨界溫度以下時，這些高度有序化的自由電子會沿一定方向暢通無阻地流動，在宏觀上就表現出零電阻的現象。這有些像（但不完全像）電影院散場時，如果大家毫無秩序地湧到出口處，往往會塞在門口，很難出去；反之，若大家排好隊有秩序地出場，就會十分順利，毫無阻力。

目前，新的超導金屬氧化物系列不斷湧現。人們用釔（Sc）代替釓（Y）、用鍶（Sr）代替鋇（Ba），並在金屬氧化物的配比方面進行調整，結果發現鉍、鍶、鈣、銅氧化物（Bi－Sr－Ca－CuO），以及鉈、鋇、鈣、銅氧化物（Tl－Ba－Ca－CuO）等材料，都可以達到 120K 以上的超導溫度。

現在，人們更進一步期盼室溫超導材料的出現。因為室溫超導材料具備了實用化和工業化的價值，對現代科學技術，如電力輸送、超導發電機、大型電子計算機、磁浮高速列車、核融合反應控制等領域，都會產生極大的影響。

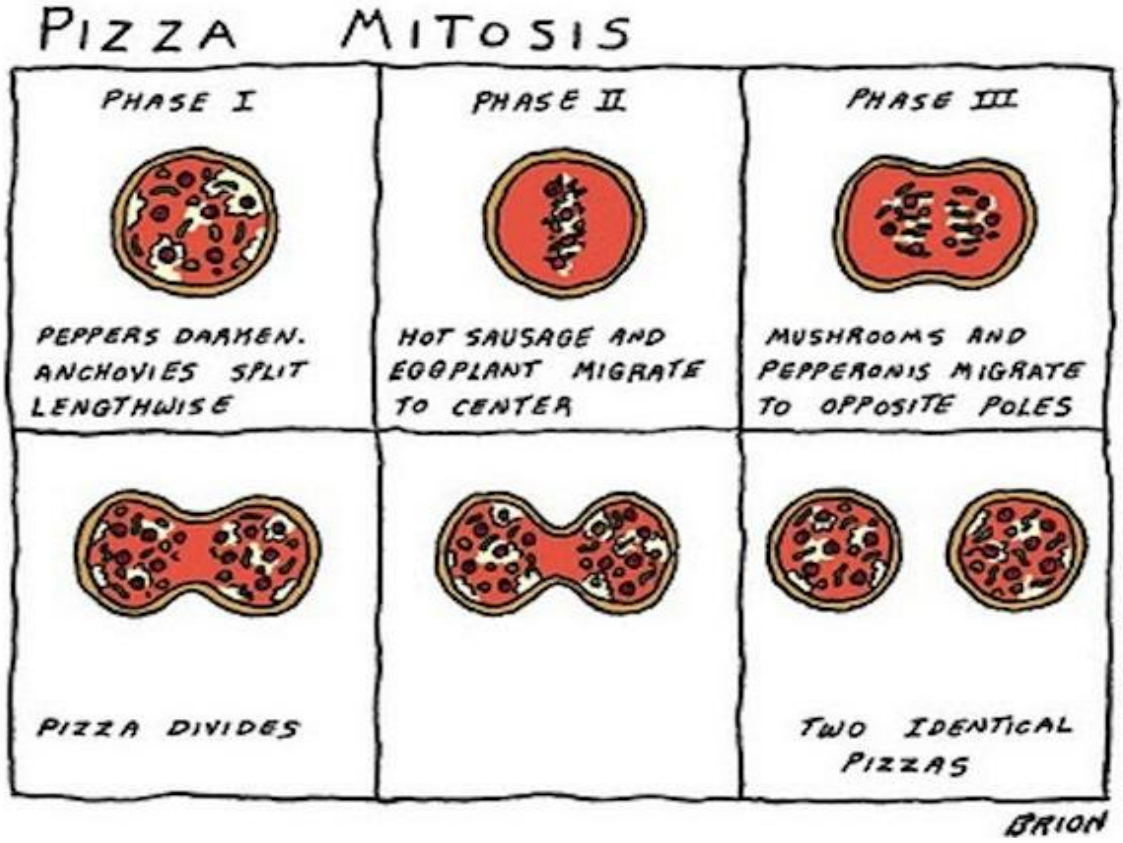
電力輸送: 應用超導材料於電力輸送，是人們首先想到的用途。從發電站把電力送到用戶端全靠電線、電纜，但現在所用的電線和電纜都有電阻，電力因此而損耗，而且損耗量相當大，幾達百分之十五。將來若能改用超導材料做電線和電纜，由於電阻為零，輸電過程中就不再有電力損失

超導發電機: 「超導材料」應用的第 2 個構想，是製造超導發電機。目前，發電機單機的功率是 1 百萬千瓦，預計到 21 世紀末需增加到 1 千萬千瓦，這個規模以現有的發電機是無法達到的。發電機的重要零件是線圈和磁體，由於導線中有電阻，發電過程會導致線圈嚴重發熱，發電容量越大，線圈發熱現象也會越嚴重。很明顯的，發電機的線圈是影響發電容量的重要因素。如果這些線圈能改用超導材料，發電過程中線圈就不會發熱，發電容量自然可以大幅提高了。



Seminar	~Relaxing time ~
3/12/2014 Topic: What can and what could physics do for biochemistry and medicine Venue: Chemistry Laboratory Time: 16.00 to 16.40 13/12/2014 普及科學講座:「香港的城市熱島效應」 講者：黃文聲教授 Venue: 香港科學館 Time: 14.30	1 7 9 | . . . | . . . . 5 . | . . 1 | . . 3 . . . | . 8 . | . . . . . 1 | . . . | . 3 . . 2 . | 3 . 5 | . 7 . . 4 . | . . . | 8 . . . . . | . 4 . | . . . 7 . . | 5 . . | . 9 . . . . | . . . | 7 1 4

Comic Corner



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Answer

1	7	9	4	5	3	6	2	8
8	5	6	7	2	1	9	4	3
4	3	2	6	8	9	1	5	7
5	6	1	8	7	4	2	3	9
9	2	8	3	6	5	4	7	1
3	4	7	1	9	2	8	6	5
2	1	3	9	4	7	5	8	6
7	8	4	5	1	6	3	9	2
6	9	5	2	3	8	7	1	4