



LESS RESISTANCE: American silver medalist Julia Mancuso skis down Whistler Creekside in the ladies' downhill alpine skiing event on Feb. 17. EVAN NING/THE EPOCH TIMES

Altitude affects performance of winter olympians

By HELENA ZHU
Epoch Times Staff

VANCOUVER—Most would think that at a higher altitude, athletes would perform worse due to lack of oxygen, but an exercise physiologist has said that the lower air pressure at high-altitude venues can actually help some athletes.

According to Dr. Robert Chapman, an expert in altitude training at Indiana University, the altitude of a sports venue can have a significant impact on performance. At a higher altitude, a reduction of air density of 3 percent per 1,000 feet can result in faster skiing, snowboarding, and skating due to less aerodynamic drag.

"Many athletes perform thousands upon thousands of moves so they get a certain motor pattern ingrained," said Chapman in a press release. "In an endurance sport such as cross-country skiing or biathlon, for competition at altitude it takes about 10–14 days to adjust. For a skill sport, it's harder to judge how long it will take to acclimate to the reduced air density at altitude. Hopefully, these athletes have incorporated this into their training, maybe in the last year or for a period of time, not just the two weeks leading up to competition."

The Vancouver 2010 Winter Olympic Games runs from Feb. 12 to 28, and the Paralympic Games runs from March 12 to 21. Most of the ice events are at nearly sea level. Sledding (bobsled, luge, and skeleton) events are at around 2,600 feet, and downhill skiing events are at about 5,000 feet.

Chapman said fans cannot expect

too many record times in speed skating events due to the low altitude and great air resistance facing the athletes.

Chapman and his co-authors noted in their paper that the world record for men and women in all long-track speed skating events from the 500 m to 10,000 m races were set in Olympics held in either Calgary 1988 at an altitude of 3,400 feet or Salt Lake City 2002 at an altitude of 4,300 feet. No athlete broke any record in Turin 2006 at an altitude of 784 feet.

"The general thought is that altitude slows you down because you have less oxygen going to your muscles," Chapman said. "But at altitude, just as it is easier to hit a home run in the thin air of Denver, speed skaters in Calgary and Salt Lake City could skate faster, move through the air faster, because there was less drag." "Eight years after Salt Lake City, we have natural improvements that you'd expect to see involving training, coaching, and technology, but we won't see many records in Vancouver. It doesn't mean the athletes are worse, if anything they're probably better. It's the effects of altitude on athletes' times."

According to Chapman, Air density particularly acts up on ski jumping, requiring athletes to change the angle of their lean in accordance with the altitude.

Chapman and his co-authors listed the following recommendations concerning training and performing at altitude:

Allow extra time and practice for athletes to adjust to changes in projectile motion. Athletes in sports such

as hockey, shooting, figure skating, and ski jumping may be particularly affected.

Allow time for acclimatization for endurance sports: Three to five days if possible, especially for low altitude (1,640–6,562 feet); one to two weeks for moderate altitude (6,562–9,843 feet); and at least two weeks if possible for high altitude (more than 9,843 feet). Chapman said altitude affects breathing, too, with breathing initially being harder at higher altitudes.

Increase exercise-recovery ratios as much as possible, with a 1:3 ratio probably optimal, and consider more frequent substitutions for sports where this is allowed, such as ice hockey. Recovery refers to the amount of time an athlete eases up during practice between harder bouts. If an athlete runs hard for one minute, following this with three minutes of slower running would be optimal before the next sprint. The recovery period gives athletes more time to clear lactic acid buildup from their muscles.

Consider the use of supplemental oxygen on the sidelines in ice hockey or in between heats in skating and Alpine skiing to help with recovery. Chapman said this helps calm breathing, which can be more difficult at altitude.

Living at high altitudes while training at low altitudes can help athletes in endurance sports improve performance at lower altitudes.

To read the research paper, please see <http://www3.interscience.wiley.com/cgi-bin/fulltext/123195950/HTMLSTART?CRETRY=1&SRETRY=0>

Science fiction comes true

Whole genome sequencing of tumor cells achieved, implications in monitoring cancer

By STEPHANIE LAM
Epoch Times Staff

The Feb. 24 issue of the journal Science Translational Medicine, published by the American Association for the Advancement of Science (AAAS), will include the discovery of a new technique in genome sequencing that led scientists to develop a way to trace cancer by identifying biomarkers present at specific kinds of tumors in different patients.

This technique, dubbed Personalized Analysis of Rearranged Ends (PARE), involves sequencing whole genomes of a patient's tumor, developing biomarkers that are only found in the patient's tumor, and using the biomarker to monitor residual and recurrent tumors, which is essential to evaluating the effectiveness of treatments such as radiation, chemotherapy, and surgery.

"Whole genome sequencing refers to a group of technologies whose goal is to identify the precise sequence of all of the genes in a cell," Dr. Bert Vogelstein of the Johns Hopkins Kimmel Cancer Center said in a video provided by the center.

For 20 years, scientists have known

that tumors are caused by genetic alterations, but many alterations were not identified because "each cancer in each patient is different from any other cancer in any other patient," said Vogelstein.

"This kind of technology might seem familiar to people who watch crime shows on TV, because on those shows, you put someone's DNA into a machine, and you get their sequenced cell. But that really was science fiction up until a couple years ago, and in the last few years there have been more than a hundred cancers in which all of the genes have been sequenced."

It was found that tumor cells often have genomes in which sections of the DNA are rearranged.

"In sequencing individuals' genomes in the past, we focused on single-letter changes, but in this study, we looked for the swapping of entire sections of the tumor genome," said Vogelstein in a press release. "These alterations, like the reordering of chapters of a book, are easier to identify and detect in the blood than single-letter changes."

Since these rearrangements are known to occur only in cancer cells, they are ideal biomarkers for detect-

ing cancer. DNA sheds from tumors into the bloodstream. Therefore, by taking blood samples from patients after a surgery, amplifying the DNA in the samples, and detecting the biomarkers, doctors can determine if a patient's cancer has been cured or if it is recurring.

"One of the biggest obstacles for physicians to treat cancer is how to monitor our patients," said Dr. Luis Diaz, professor at Johns Hopkins University, at a press conference.

"Eventually, we believe this type of approach could be used to detect recurrent cancers before they are found by conventional imaging methods, like CT scans," Diaz said in a press release.

Currently, a genome scan costs about \$5,000, and a CT scan costs about \$1,500. However, CT scans are not able to detect cancer on small scales like PARE can, and the researchers believe the cost for PARE will become affordable.

"There's still a lot of work to be done to translate this approach and make it widely accessible to patients. However, we are optimistic that this will happen within the next two years," said Diaz.

Crystals could offer high-tech data storage solutions

By KAT PIPER
Epoch Times Staff

An unusual family of minerals could be used in the computer chips of the future to hold more data and encrypt it more securely, says a team of scientists collaborating in the U.S. and U.K.

Using laboratory experiments and computer analysis, the researchers found that four of the porous crystalline minerals known as "metal-organic frameworks" (MOFs) possessed rare dual properties when cooled to a specific temperature—that is, they were "multiferroic."

This means that the crystals have magnetic poles (ferromagnetic) and at the same time a positive and negative electrical charge that can be reversed when an external electrical field is applied (ferroelectric).

"Normally, these two properties are mutually exclusive," said Dr. Naresh Dalal, professor at Florida State University and researcher at the National High Magnetic Field Laboratory, in a press release.

The researchers found that the

multiferroic properties were the result of hydrogen bonds forming between the components of the MOFs—a new concept in the field of multiferroics.

"Finding four multiferroic materials at one time is quite scientifically significant and opens numerous doors in terms of potential applications."

These applications could include the boosting of the data storage capacity of computer memory and other data storage devices, according to the researchers.

"Theoretically, it might be possible to design devices that are much smaller and faster than the ones we use today to store and transmit data," said Dr. Harold Kroto, professor at Florida State University. "And with data split over two mediums, information could be encrypted in a way that makes it far more secure than is currently possible. This could have wide-ranging applications in areas as diverse as the aeronautics industry, the military, the workplace, and even the average consumer's home."

Another advantage of using the crystals in high-tech devices is the environmental and health benefits,

said Dalal.

"The four new multiferroic crystals that we have identified all substitute other, less toxic metals for lead, which is a potent neurotoxin," he said. "By reducing the amount of lead that enters landfills, we also reduce the amount that enters our water supply—and our bodies."

But before any of this can happen, scientists would have to figure out how to significantly raise the temperature at which the multiferroic properties emerge to around room temperature, commented Dr. Ramamoorthy Ramesh of the University of California, Berkeley, in the journal Nature.

The research is published in the *Journal of the American Chemical Society*. It is an extension of three decades of work by Dr. Dalal and was instigated by Dr. Kroto, who received the 1996 Nobel Prize for Chemistry and Biochemistry for co-discovering pure carbon "footballs," or buckminsterfullerene.

To read the research paper, please visit <http://pubs.acs.org/doi/full/10.1021/ja904156s>

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Dr. David Suzuki is a scientist, broadcaster, author, and chair of the David Suzuki Foundation and Dr. Faisal Moola is the Director of Science at the David Suzuki Foundation.

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Caring for ourselves goes hand in hand with caring for the planet

By DAVID SUZUKI with FAISAL MOOLA

Ecosystems come in all shapes and sizes, often without distinct boundaries. And what happens in one ecosystem affects other ecosystems.

We can even consider the human body as an ecosystem, or perhaps more correctly as a number of interrelated ecosystems. According to a recent article in the scientific journal Nature, "The human body is one of the most important ecological study sites of the coming decade."

The article's author, David A. Relman, chief of infectious diseases at Veterans Affairs Palo Alto Health Care System in California, writes: "Humans depend on the microbial communities that colonize them for a surprising suite of benefits. These include: extracting energy from food, educating the immune system and protection from pathogens. Yet, despite the recent attention to this indigenous microbiota, we are relatively ignorant of what our 'extended self' comprises or how it works."

If we didn't have microbes, which are mainly bacteria, living in and on us, we wouldn't be able to digest our food or breathe properly, and we'd be more vulnerable to numerous types of disease and infection. Scientists estimate that our bodies contain 10 times as many bacteria as human cells, numbering around 100 trillion, and that the human gut alone contains 500 to 1,000 species of bacteria.

The microbes that help our body function

properly are referred to as "normal flora" or "microbiota". But, like all ecosystems, our body's ecosystems can be disrupted. If we pollute our bodies, either intentionally or unintentionally, the normal flora can become overwhelmed to the point that they don't function as well as they should. Sometimes this may result simply in a case of upset stomach or indigestion, but often, especially if the pollution is ongoing, it can result in serious disease and death.

What we expose our bodies and the microbes within them to can also have unintended consequences. Although antibiotics have offered a lot of benefits to human health, we're now seeing that decades of their use, often as "growth promoters" in feed for chickens, hogs, and cows, is leading to new illnesses and infections as sometimes-harmful bacteria evolve to be resistant to antibiotics and to our own microbial defences.

The more we learn about the microbial communities in our own bodies, the more we see that a balance must be maintained, for our own sake and for the sake of our human communities. According to New York microbiology professor Martin J. Blaser, "evolution has selected for those microbial populations that maintain and increase the fitness of both individual hosts and the group as a whole."

If we want our own bodies to be healthy, we must ensure that we have access to wholesome food, clean water, and good air. And we should avoid exposing ourselves to anything that would

negatively affect the health of our own cells or the microbes that keep those cells healthy.

This is really no different than what happens in all ecosystems. If we put too much garbage and pollution in to the air, water, or ground, we upset the balance created by all the organisms and natural cycles in the environment. Our planet itself has a lot of similarities to the human body. Water circulates around and through the Earth in a complex hydrological cycle, regulating temperature and keeping plants and animals alive, just as blood circulates through our bodies. The natural organisms of the Earth's ecosystems, like the microbes in our bodies, also offer numerous services that we rely on to survive and be healthy.

And for both the human body and the Earth, carbon is an essential element. Carbon is the second most abundant element in the human body, after oxygen, and it also cycles through the Earth, its inhabitants, and its atmosphere. Normally, carbon is absorbed from the atmosphere through photosynthesis and is put back through respiration and decay. But when we upset the balance by cutting down too many of the plants or trees that absorb the carbon and by burning fuels that put too much carbon back into the atmosphere, we put the Earth's health, and thus the health of all of us, at risk.

We must learn to treat the Earth as we would treat ourselves. After all, we are part of nature, and if we don't look after its health, we aren't looking after our own health.



VEIL REMOVED: Research by the ESO has confirmed that small galaxies like the Fornax Dwarf Galaxy contain very old stars. ESO/DIGITIZED SKY SURVEY 2

Primitive stars revealed outside of the Milky Way

By ANDRES CORDOVA
Epoch Times Staff

Scientists at the European Southern Observatory (ESO) have revealed the most primitive stars outside of the Milky Way. These stars had remained hidden for years, but now they have been detected thanks to new observations by the ESO's Very Large Telescope.

It is believed that primitive stars were formed 13.7 billion years ago from matter formed right after the Big Bang. According to the ESO, they are stars that are considered "extremely poor metal stars" since they have less than a thousandth of the amount of metallic elements found in the sun. The term "metal" in astronomy refers to all elements heavier than hydrogen and helium.

What enables the scientific community to detect the elements? Each element that composes a star absorbs light of a particular frequency—color. When astronomers analyze star light through a spectrograph, they obtain the "spectrum" of the star. These measurements allow scientists to know what types of elements are within a star and in what quantities.

"Only subtle differences distinguish the chemical fingerprint of a normal metal-poor star from that of an extremely metal-poor star, explaining

why previous methods did not succeed in making the identification," according to an ESO press release.

With thorough computer analysis of the stars' spectra and the aid of extremely detailed information provided by the new UVES (Ultraviolet-Visual Echelle Spectrograph) on the Very Large Telescope, scientists were able to confirm the existence of these primitive stars, that is, stars that are extremely metal-poor.

"Not only has our work revealed some of the very interesting, first stars in these galaxies, but it also provides a new, powerful technique to uncover more such stars," said lead researcher Dr. Else Starkenburg. These discoveries mean a significant advancement in the field of star analysis, and they have now taken us one step closer toward understanding the universe and how it came to be.

The only problem that this new type of analysis has is the amount of time it takes. "Just a small number of stars can be observed this way because it is very time consuming," said researcher Dr. Vanessa Hill in the press release.

The research is published in the journal *Astronomy & Astrophysics*.

To read the research paper, please visit <http://www.aanda.org/index.php?option=article&access=doi&doi=10.1051/0004-6361/200913759/view=pdf>