

Reading Test 2

Out of Africa: The Tobacco War's New Battleground

***BURNING HOPES:** Anti-tobacco advocacy groups peg Africa as a region of high concern due to its residents' growing habit.*

PART 1

A. Africa is already beleaguered by infectious diseases, such as AIDS and malaria, but now the continent's residents face growing health threats from preventable illnesses brought on by lifestyle changes, such as from poor diets and smoking. In an effort to stave off these maladies, advocates have turned their sights on tobacco use, which is on the rise throughout Africa and projected to double by 2021. Of the approximately one billion people across the world who use tobacco, 60 million to 80 million live in Africa.

B. Along with lobbying for higher tobacco taxes and broader public health messages, advocates are hoping to eliminate smoking in public places in an effort to protect people from both first- and second-hand smoke. About a billion people worldwide live in municipalities where smoking is outlawed in public places, according to a report published Tuesday by Global Smoke free Partnership (a joint initiative backed by the American Cancer Society, Johns Hopkins Bloomberg School of Public Health, Johnson & Johnson, Pfizer and 14 other entities) and announced in time for the African Organization for Research and Training in Cancer's (AORTIC) "Cancer in Africa" conference taking place this week in Dar es Salaam, Tanzania. Reducing secondhand smoke exposure can reduce the rates of lung cancer, heart attacks and breathing trouble in populations.

C. "It's one of the most frustrating things," Thomas Glynn, director of International Cancer Control for the American Cancer Society (ACS) and acting head of the Global Smoke free Partnership says, about knowing that many nicotine-related illnesses can be prevented- especially among those who do not smoke-with the right laws and education. A few countries

in Africa have taken a firm stance on public smoking. The Indian Ocean nation, Mauritius, and South Africa have passed strong national smokefree laws, and Nigeria's capital, Abuja, has a local ordinance in effect. But in many areas throughout the continent, politically connected and economically strong tobacco companies- and their addictive products- are shaping up to be a substantial opponent (British American Tobacco, a member of the industry group the Tobacco Institute of Southern Africa, did not respond to request for comment).

D. Tobacco causes about 5.4 million deaths worldwide each year, according to the World Health Organization (WHO), a number that is set to rise in the coming decades even as use decreases in many developed countries. But it is not just the smokers who suffer from the ill effects of their habits. Since 1986 second hand smoke has been recognized internationally as a contributor to lung cancer and, in 2006, the U.S. Surgeon General went so far as to say "there is no safe level of exposure to secondhand smoke." These findings, however, have not widely been put into regulatory action, leaving some 90 percent of Africans without local or national smoke-free laws, the new report notes. For example, in Tunisia, where tobacco use is especially high, even teachers and doctors smoke at work, according to a report issued earlier this year by the Economist Intelligence Unit, a London-based firm that provides business and market research, and backed by Pfizer.

E. Aside from the millions of tobacco-related deaths annually, the range of long-term disability that tobacco smoke exposure can induce also takes a toll on health and productivity. "We focus on lung cancer deaths, but more people are disabled by emphysema and heart disease and can't provide for their families," Glynn says:

F. In developed countries, heart attacks in areas with smoke-free laws dropped by 36 percent three years after laws went into effect, according to a report released in September by the American Heart Association. California, one of the first states in the U.S. to institute substantial local laws banning public smoking, has seen a reduction in lung cancer, Glynn notes. "From a biological plausibility standpoint, there's no reason we wouldn't see a similar decrease in African countries," he says.

G. "The science is established," Glynn says. "It's now the legal and regulatory issues that are being dealt with." But in cities such as Abuja, where more than half of school students do not know that second-hand smoke can be hazardous, creating public support for laws and enforcement can be challenging. And in countries that grow tobacco, such as Tanzania, where about 6 percent of the country's income is tied to the crop, limiting the product's range can be met with formidable financial resistance.

PART 2

Why has Africa become the new international target for stemming the tobacco tide? "You have to look at it from the perspective of the tobacco industry," Glynn says. Africa is home to about 12 percent of the world's population but only 4 percent of the world's tobacco users. "That makes it a battleground, but that also makes it a golden opportunity for prevention," he says.

"No one has ever accused the tobacco industry of being stupid," Glynn says, noting that they have an obligation to look out for their shareholders just like any enterprise. But, he notes, their tactics can be strident. Aside from lobbying politicians to weaken smoke-free legislation, such as by keeping some smoking areas in public places or mandating ventilation rather than complete bans, the companies have targeted their advertising to women and even children. "I have seen children wearing child-sized Marlboro T-shirts," Glynn says.

"Smoking is not as prevalent among women in Africa, which is not uncommon in developing regions," says Fred Pampel, associate vice chancellor for research at the University of Colorado at Boulder, who has studied the demographics of tobacco use in Africa. But that is not necessarily for the better. "Often adoption of smoking by females lags behind males by about 10 years," he says, "so things could change quickly for the worse."

The sheer number of young people also presents both promise and potential trouble for nicotine-related health issues in Africa. As King notes: "What the tobacco industry is banking on is the reservoir of non-smokers among the youth population."

As propagating health messages to many African citizens-and healthcare workers about tobacco's hazards has proved difficult, so has gathering data about its use. Even figures about tobacco consumption used in the ACS's report are far from definitive. "They're educated estimates," Glynn says. Knowing the data about who smokes-and why-would help health officials better spread awareness.

Better numbers require better surveillance and more cancer registries. Funding data-gathering work, however, can present a challenge when many advocates point to cancer patients who need immediate treatment.

Nicotine-related diseases are only some of the noncommunicable sicknesses killing people in Africa, but Glynn proposes that with the spread of the vaccine for cervical cancer and improved breast and prostate cancer screening, those forms of malignancy will decrease, whereas tobacco-related lung cancer will rise.

"It's very sad in that this is very predictable," Glynn says about "the march of the Western lifestyle" that brings along with it tobacco use, unhealthy diets, less physical activity-and more preventable diseases. But he does not believe extinguishing these threats are insurmountable challenges, agreeing with other experts that it will take a combination of education, political will, grassroots efforts and global awareness.

Quantum Entanglement

A. Wouldn't it be nice to be an electron? Then you, too, could take advantage of the marvels of quantum mechanics, such as being in two places at once—very handy for juggling the competing demands of modern life. Also, physicists have long spoiled the fantasy by saying that quantum mechanics applies only to microscopic things.

B. Yet that is a myth. In the modern view that has gained traction in the past decade, you don't see quantum effects in everyday life not because you are big, but because those effects are camouflaged by their own sheer complexity. They are there if you know how to look, and physicists have been realizing that they show up in the macroscopic world more than they thought. "The standard arguments may be too pessimistic as to the survival of quantum effects," says Nobel laureate physicist Anthony Leggett of the University of Illinois.

C. In the most distinctive such effect, called entanglement, two electrons establish a kind of telepathic link that transcends space and time. And not just electrons: you, too, retain a quantum bond with your loved ones that endures no matter how far apart you may be. If that sounds hopelessly romantic, the flip side is that particles are incurably promiscuous, hooking up with every other particle they meet. So you also retain a quantum bond with every loser who ever bumped into you on the street and every air molecule that ever brushed your skin. The bonds you want are overwhelmed by those you don't. Entanglement thus foils entanglement, a process known as de-coherence.

D. To preserve entanglement for use in, say, quantum computers, physicists use all the tactics of a parent trying to control a teenager's love life, such as isolating the particle from its environment or chaperoning the particle and undoing any undesired entanglements. And they typically have about as much success. But if you can't beat the environment, why not

use it? "The environment can act more positively," says physicist Vlatko Vedral of the National University of Singapore and the University of Oxford.

E. One approach has been suggested by Jianming Cai and Hans J. Briegel of the Institute for Quantum Optics and Quantum Information in Innsbruck, Austria, and Sandu Popescu of the University of Bristol in England. Suppose you have a V-shaped molecule you can open and close like a pair of tweezers. When the molecule closes, two electrons on the tips become entangled. If you just keep them there, the electrons will eventually decohere as particles from the environment bombard them, and you will have no way to re-establish entanglement.

F. The **answer** is to open up the molecule and, counterintuitively, leave the electrons even more exposed to the environment. In this position, decoherence resets the electrons back to a default, lowest-energy state. Then you can close the molecule again and re-establish entanglement afresh. If you open and close fast enough, it is as though the entanglement was never broken. The team calls this "dynamic entanglement," as opposed to the static kind that endures as long as you can isolate the system from bombardment. The oscillation notwithstanding, the researchers say dynamic entanglement can do everything the static sort can.

G. A different approach uses a group of particles that act collectively as one. Because of the group's internal dynamics, it can have multiple default, or equilibrium, states, corresponding to different but comparably energetic arrangements. A quantum computer can store data in these equilibrium states rather than in individual particles. This approach, first proposed a decade ago by Alexei Kitaev, then at the Landau Institute for Theoretical Physics in Russia, is known as passive error correction, because it does not require physicists to supervise the particles actively. If the group deviates from equilibrium, the environment does the work of pushing it back. Only when the temperature is high enough does the environment disrupt rather than stabilize the group. "The environment both adds errors as well as removes them," says Michal Horodecki of the University of Gdansk in Poland.

H. The trick is to make sure it removes faster than it adds. Horodecki, Hector Bombin of the Massachusetts Institute of Technology and their colleagues recently devised such a setup, but for geometric reasons it would require higher spatial dimensions. Several other recent papers make do with ordinary space; instead of relying on higher geometry, they thread the system with force fields to tilt the balance toward error removal. But these systems may not be able to perform general computation.

I. This work suggests that, contrary to conventional wisdom, entanglement can persist in large, warm systems—including living organisms. "This opens the door to the possibility that entanglement could play a role in, or be a resource for, biological systems," says Mohan Sarovar of the University of California, Berkeley, who recently found that entanglement may aid photosynthesis (see "Chlorophyll Power," by Michael Moyer; *Scientific American*, September 2009). In the magnetism-sensitive molecule that birds may use as compasses, Vedral, Elisabeth Rieper, also at Singapore, and their colleagues discovered that electrons manage to remain entangled 10 to 100 times longer than the standard formulas predict. So although we may not be electrons, living things can still take advantage of their wonderful quantumness.

PASSAGE 3 Growing Skyscrapers: The Rise of Vertical Farms

A. Together the world's 6.8 billion people use land equal in size to South America to grow food and raise livestock - an astounding agricultural footprint. And demographers predict the planet will host 9.5 billion people by 2050. Because each of us requires a minimum of 1,500 calories a day, civilization will have to cultivate another Brazil's worth of land - 2.1 billion acres - if farming continues to be practiced as it is today. That much new, arable earth simply does not exist. To quote the great American humourist Mark Twain: "Buy land. They're not making it anymore."

B. Agriculture also uses 70 percent of the world's available freshwater for irrigation, rendering it unusable for drinking as a result of contamination with fertilizers, pesticides, herbicides and silt. If current trends continue, safe drinking water will be impossible to come by in certain densely populated regions. Farming involves huge quantities of fossil fuels, too - 20 percent of all the gasoline and diesel fuel consumed in the U.S. The resulting greenhouse gas emissions are of course a major concern, but so is the price of food as it becomes linked to the price of fuel, a mechanism that roughly doubled the cost of eating in most places worldwide between 2005 and 2008.

C. Some agronomists believe that the solution lies in even more intensive industrial farming, carried out by an ever decreasing number of highly mechanized farming consortia that grow crops having higher yields - a result of genetic modification and more powerful agrochemicals. Even if this solution were to be implemented, it is a short-term remedy at best, because the rapid shift in climate continues to rearrange the agricultural landscape, foiling even the most sophisticated strategies. Shortly after the Obama administration took office, Secretary of Energy Steven Chu warned the public that climate change could wipe out farming in California by the end of the century.

D. What is more, if we continue wholesale deforestation just to generate new farmland, global warming will accelerate at an even more catastrophic rate. And far greater volumes of agricultural runoff could well create enough aquatic "dead zones" to turn most estuaries and even parts of the oceans into barren wastelands.

E. As if all that were not enough to worry about, food borne illnesses account for a significant number of deaths worldwide - salmonella, cholera, Escherichia coli and shigella, to name just a few. Even more of problems are life-threatening parasitic infections, such as malaria and schistosomiasis. Furthermore, the common practice of using human faces as a

fertilizer in most of Southeast Asia, many parts of Africa, and Central and South America (commercial fertilizers are too expensive) facilitates the spread of parasitic worm infections that afflict 2.5 billion people.

F. Clearly, radical change is needed. One strategic shift would do away with almost every ill just note: grow crops indoors, under rigorously controlled conditions, in vertical farm. Plants grown in high-rise buildings erected on now vacant city lots and in large, multi-storey rooftop greenhouses could produce food year-round using significantly less water, producing little waste, with less risk of infectious diseases, and no need for fossil-fuelled machinery or transport from distant rural farms. Vertical farming could revolutionize how we feed ourselves and the rising population to come. Our meals would taste better, too; "locally grown" would become the norm.

G. The working descriptions sound outrageous at first. But engineers, urban planners and agronomists who have scrutinized the necessary technologies are convinced that vertical farming is not only feasible but should be tried.

H. Growing our food on land that used to be intact forests and prairies is killing the planet, setting up the processes of our own extinction. The minimum requirement should be a variation of the physician's credo: "Do no harm." In this case, do no further harm to the earth. Humans have risen to conquer impossible odds before. From Charles Darwin's time in the mid-1800s and forward, with each Malthusian prediction of the end of the world because of a growing population came a series of technological breakthroughs that bailed us out. Farming machines of all kinds, improved fertilizers and pesticides, plants artificially bred for greater productivity and disease resistance, plus vaccines and drugs for common animal diseases all resulted in more food than the rising population needed to stay alive.

I. That is until the 1980s, when it became obvious that in many places farming was stressing the land well beyond its capacity to support viable crops. Agrochemicals had destroyed the natural cycles of nutrient renewal that intact ecosystems use to maintain themselves. We must switch to agricultural technologies that are more ecologically sustainable.

J. As the noted ecologist Howard Odum reportedly observed: "Nature has all the answers, so what is your question?" Mine is: How can we all live well and at the same time allow for ecological repair of the world's ecosystems? Many climate experts - from officials at the United Nations Food and Agriculture Organization to sustainable environmentalist and 2004 Nobel Peace Prize winner Wangari Maathai agree that allowing farmland to revert to its natural grassy or wooded states is the easiest and most direct way to slow climate change. These landscapes naturally absorb carbon dioxide, the most abundant greenhouse. gas, from the ambient air. Leave the land alone and allow it to heal our planet.

K. Examples abound. The demilitarized zone between South and North Korea, created in 1953 after the Korean War, began as a 2.5-mile-wide strip of severely scarred land but today is lush and vibrant, fully recovered. The once bare corridor separating former East and West Germany is now verdant. The American dust bowl of the 1930s, left barren by over farming and drought, is once again a highly productive part of the nation's breadbasket. And all of New England, which was clear-cut at least three times since the 1700s, is home to large tracts of healthy hardwood and boreal forests.