

Q & A Micro Go Round



VICTORIA ROBERTS

Q. Why does my microwave's turntable switch directions when I stop it and start it again? Does it affect how the food heats?

A. "The direction of rotation should have no effect on the rate of heating or uniformity of heating for any conceivable food-heating situation," said Ashim K. Datta, professor of biological engineering at Cornell University.

Rather, the reversal has to do with the relatively inexpensive turntable motors designed for use in

most microwaves, said Robert J. Thomas, professor of electrical and computer engineering at Cornell. By design, they reverse their direction of rotation if a load greater than their output torque, or twisting force, is present, he said.

"All motors require a starting torque in order to start themselves from zero rotation speed to design speed, with or without a load attached," Dr. Thomas said. It takes very little torque to rotate the turntable once it is turning, he said, but it can take several times the running torque to start it.

After a full stop, the drive mechanism is usually pressed against the load in the direction of the last rotation. When the motor encounters the load, it reverses itself and gets a small running start (with no load for a small fraction of time) to pick up speed before engaging the load again.

The mechanical linkage needed to perform this is much cheaper than the additional windings of copper wire that a stronger motor would require, Dr. Thomas said. C. CLAIBORNE RAY

Observatory

CLIMATE CHANGE

Flights May Get Rougher as CO₂ Builds Up

As the earth gets warmer, that flight to Europe may get bumpier.

Rising levels of carbon dioxide in the atmosphere could increase the frequency of turbulence over the North Atlantic by 170 percent and its intensity by 40 percent by the middle of the century, according to British climate researchers writing in the journal *Nature Climate Change*.

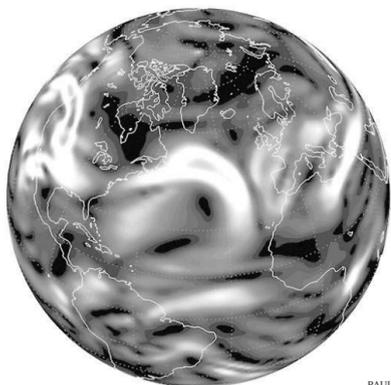
In addition to rattled fliers, the rise in turbulence could mean higher costs for airlines, because pilots typically fly around turbulence rather than through it. "Our study shows that the amount of air space containing significant turbulence is most likely to double," said the study's lead author, Paul D. Williams, an atmospheric scientist at the University of Reading (projected patches of turbulence are in lighter tones in the figure below). "Therefore, if they

want to avoid it, pilots won't be able to fly in a straight line, but they will have to take on a wiggly, more circuitous flight path." That could lead to longer flights, more delays and a greater expenditure of fuel (which would add more carbon dioxide to the atmosphere).

While the study focused only on the airspace over the North Atlantic, Dr. Williams said, other parts of the atmosphere will probably be similarly affected.

"What's causing the turbulence increase is the jet stream becoming stronger, and of course the jet stream is not just confined to the Atlantic Ocean," he said.

"It would be reasonable to expect that similar kinds of increases would be found on other flight routes that come near the jet stream, like those over the Pacific Ocean." DOUGLAS QUENQUA



PAUL WILLIAMS

LETTERS

Building on the Shore

TO THE EDITOR:

Re "Rebuilding the Shores, Increasing the Risks" (By Degrees, April 9): My wife and I lived in Sea Bright, N.J., for about eight years, right next to the sea wall in a garden apartment. We were flooded out several times, and once our unit was totally destroyed. There was some governmental assistance in getting things up and running. Then came a hugely expensive program of beach replenishment, followed by individuals planting dune grass.

Beach replenishment should be the least of our concerns. Money is needed elsewhere. Last night on the local news, there was a story about a care center for disabled people being closed.

THOMAS FRANZON
BREVARD, N.C.

support their conclusion of increased heart risk due to calcium supplements. The Fred Hutchinson Center, the official data manager for W.H.I., concluded there is no such risk. Dr. Bolland had suggested that calcification of coronary arteries was due to a "bolus of calcium" entering the blood from a supplement. Numerous studies show there is no such bolus; at most, serum calcium rises by 2 to 4 percent — about the same as after drinking a glass of milk. And elevated blood calcium is not the cause of calcification in kidney disease, which is caused by very high serum phosphorus concentrations.

ROBERT P. HEANEY, M.D.
OMAHA

The writer is a professor of medicine at Creighton University.

Emergency Contraception

TO THE EDITOR:

Re "Contraception and the Courts" (News Analysis, April 9): One of the ironies of making emergency contraception available over the counter is that it will not affect the out-of-pocket cost. Like other OTC drugs, Plan B is not covered by health insurance. The Affordable Care Act won't change this. According to federal guidelines, "Contraceptive methods that are generally available OTC are only included if the method is both F.D.A.-approved and prescribed for a woman by her health care provider." Given the pending lawsuits against these guidelines, it's not clear if even prescription contraceptives will be covered. Removing the age restriction on Plan B may make it easier to find, but it won't make it more affordable.

HEATHER MUNRO PRESCOTT
NEW BRITAIN, CONN.

Risks of Calcium Supplements

TO THE EDITOR:

Re "Getting Enough Calcium" (Personal Health, April 9): An otherwise excellent article missed a few key points concerning coronary disease risk. Dr. Mark J. Bolland and his colleagues used a highly selective subset of the Women's Health Initiative data to

Relief for a Parched Delta



PHOTOGRAPHS BY FRED R. CONRAD/THE NEW YORK TIMES

The Morelos Dam on the Colorado River a mile below the California-Mexico border diverts water into a huge irrigation canal to supply farms in the river valley. There is rarely any left to flow into the remaining river channel, but an amendment to an old treaty will send more water downstream.

CONTINUED FROM PAGE D1

over the state of the delta, there is reason for some optimism. An amendment to a seven-decades-old treaty between the United States and Mexico, called Minute 319, will send water down the river once again and support efforts to restore native habitat and attract local and migratory wildlife.

Water for the environment is only one part of Minute 319, which also calls for more water-sharing between the two countries, and the amounts for the delta are a trickle compared with the huge volumes siphoned off for cities, farms and industries. But a regular base flow of even a small amount of water should breathe new life into the riparian corridor, the river's main channel.

The amendment, which is in effect for five years, also calls for a larger one-time release of water that will mimic the once-common floods that rejuvenated the delta every spring, scouring out sediment and old vegetation and opening up areas for new vegetation to thrive. During this pulse flow, the Colorado should once again reach the sea.

"The new agreement will definitely help to restore the Colorado," said Efraín Nieblas, director of the environmental protection agency for the state of Baja California. In the tidal estuary at the northern end of the gulf, the influx of fresher water will reduce salinity, aiding members of the indigenous Cucupá community and others who fish for gulf corvina and shrimp. "It's really important to connect the river with the ocean," Mr. Nieblas said.

The delta will never be like it was before the dams — for one thing, much of the riparian corridor is now hemmed in by irrigated farmland — and Mr. Muñoz surely will not see dolphins frolicking past his door again. The amounts of water are less than American and Mexican conservation groups, which have been studying the delta ecosystems and undertaking small restoration projects for years, recommended in a report nearly a decade ago. But the groups say the agreement is a good first step — a pilot project that they hope will become permanent.

"We'd been working hard for many years to have something like this," said Francisco Zamora, director of delta projects at the Sonoran Institute, which is based in Tucson. "We know it works. You add a little bit of water, and the trees will grow."

Nowhere is this more evident than at Laguna Grande, a stretch of the main river channel about 20 miles south of the border. Over the past two years, staff members and volunteers with the Sonoran Institute and other groups, including Pronatura Noroeste, which is based in Ensenada, Mexico, have been removing acres of salt cedar, an invasive shrub that makes for poor habitat for birds, and planting native willows and cottonwoods, irrigating them with water bought from farmers. The trees are thriving, and both total bird counts and the number of species — towhees, cuckoos and flycatchers among them — are increasing.

"The problem in the riparian corridor is that the lack of water created the perfect conditions for salt cedar, not the native vegetation," Dr. Zamora said. "Now in this area we have more trees than in the entire corridor."

The groups have restored about 50 acres and are working on 35 more, where earlier this year crews went in and ripped out the stubborn salt cedar, leaving it in large heaps to be burned or chipped. Then thousands of small willows and cottonwoods will be planted, grown from cuttings in small greenhouses in a nearby village.

The goal is to restore about 200 acres here and more in similar areas up and downstream, for a total of about 2,300 acres over the five years of the agreement, at a cost of \$8.5 million. That is only a fraction of the 40,000 acres in the corridor, but the plots do not have to be contiguous to be effective habitat, Dr. Zamora said.

For any amount of restoration work to succeed, however, water is a necessity.

Colorado River water is a precious commodity — most years, every drop is



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spoken for. About 90 percent of the river's annual flow of roughly five trillion gallons goes to California, Arizona and the five other Western states in the Colorado basin. Over the years these states have argued over how the water is shared, and they will no doubt fight more as climate change and population growth put pressure on already overtaxed supplies. But Mexico has largely been an onlooker during such squabbles; under the 1944 treaty, it is guaranteed about 500 billion gallons a year.

That water reaches the border at Morelos Dam, the last on the river, where it takes a sharp right turn into canals for delivery to Mexican farms and cities for drinking water. Unless heavy winter snows in the Rockies lead to higher spring flows than the upstream reservoirs and canals can handle — which last happened

A new restoration effort hopes to reconnect a river to the ocean.

to any significant degree 15 years ago — no water goes through the dam and down the riparian corridor.

But that does not mean there is no water to be found. There is Colorado water in parts of the delta; it just gets there in roundabout ways.

To the east of the river channel, for example, La Ciénega de Santa Clara, a 12,000-acre wetland that is a stopover for migrating waterfowl, is fed by water that drains from irrigated cotton fields in Arizona. A smaller wetlands west of the corridor, Las Arenitas, was created by the conservation groups to help treat the outflow from a Mexicali sewage treatment plant — and Mexicali consumes Colorado water. The treated wastewater continues into the Hardy River, the Colorado tributary that slowly flows past Mr. Muñoz's land.

At Laguna Grande, the river channel is filled much of the year with water that seeps in after draining through nearby



La Ciénega de Santa Clara, an important 12,000-acre wetland that attracts migrating waterfowl, still gets some water from the Colorado, in the form of agricultural runoff from farms in Arizona.

ONLINE: DELTA BLUES

▶ A video about the drying of the Colorado delta, and an interview with Henry Fountain. nytimes.com/science

fields of wheat and cotton. That is good for restoration efforts — the water table remains high enough so that after two or three years of irrigation the roots of willows and cottonwoods can reach it — and is a main reason the area was chosen for a project.

But for more areas to be restored, more water is needed, and it must come down the corridor. The river must flow.

As part of the agreement, the conservation groups pledged to provide the water for the base flow, roughly 3.5 billion gallons a year, by buying unused water rights from Mexican farmers. They have already acquired about 40 percent of that amount — although as Dr. Zamora noted, ideally the base flow would be closer to 20 billion gallons a year. The water will be used to irrigate plantings and to raise the water table along the corridor to enable the water-hungry cottonwoods and willows to survive.

The pulse flow — about 35 billion gallons, to be released over one or two months by spring 2016 at the latest — will be provided by Mexico. The idea is not to cut amounts currently being used by farms and cities, said Francisco Bernal, director of the Mexicali office of the International Boundary and Water Commission, the binational organization that administers the 1944 treaty, but to save water through conservation improvements, some of which under Minute 319 will be paid for by water districts in the United States in return for some of Mexico's water. Those improvements include lining canals so less water seeps through.

"We want to conserve enough water to share with the environment," Mr. Bernal said.

Scientists are also trying to better understand hydrologic conditions in the delta so that the pulse flow will be effective. Jorge Ramírez, a hydrologist at the University of Baja California, said that in some areas along the corridor the water table is very low because so much water has been pumped out for agriculture. If the pulse water is released too slowly, much of it may be absorbed in these dry areas and no water may reach the gulf.

"This is the key — how fast we're going to put in the water in order to have the water flowing down the whole river and into the estuary," Dr. Ramírez said. "We need to be very careful."

Dr. Zamora said that he had no doubt that the pulse flow would reach the gulf, and that in addition to environmental benefits there would be social ones.

"One thing that people haven't seen in many years is the river flowing, the river making noise," he said. "People here in Mexicali, sometimes they don't even know there's a river, because they don't see it — they haven't experienced that in their lives. So it's really the process of reconnecting people with the river."