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We are delighted to provide you with Old Dominion University’s inaugural issue of its research magazine, Quest. It is our hope that you will find the articles included in this issue interesting and thought-provoking. Our editorial goal is to produce a magazine that provides you with information crossing a variety of disciplines at a level which is both readable and useful.

As one of Virginia’s six public doctoral universities, Old Dominion University is able to build on the unique attributes of its geographic location and the dynamic interests of its faculty to produce research which may inform public policy, as well as the academy. For this reason, we have identified Old Dominion University as one of the nation’s leading cyber universities, but their recognition does not even consider our role as an Internet2 university or the fact that our researchers consume more than $50 million per year in high performance computer time, while performing research on topics ranging from sub-atomic physics through modeling and simulating future traffic flow through the ports of Hampton Roads. You will find an article in this issue describing research in our full-scale wind tunnel, which is the world’s largest university-run wind tunnel. We have included a series of articles on the environment with special attention to the Chesapeake Bay because of its significance to the nation’s seafood industry. While the Chesapeake Bay is a unique geographical attribute of Hampton Roads, other stories in this issue on the nomadic groups in the Kalahari Desert and on taxes represent the work of scholars whose research extends far beyond this region. Hence, we would like you to learn more about this University of the 21st Century through the projects and ideas that excite and intrigue our faculty.

Jo Ann M. Gora
Provost

We sit, in front of electrified glass tubes as colored images swirl before us, thanks to silent satellites that orbit many hundreds of miles over our earthbound heads. We listen to music played with the help of lasers, daily discover the hidden secrets of our DNA blueprint, eat genetically engineered food, dream of living and working in space, try to stay healthy with exercise, and labor to consume less and recycle more. And still we are uneasy. We fret about our increasing technological savvy. Are we good enough, wise enough, to manage our own intelligence?

Quest, Old Dominion University’s new magazine of research, innovations and breakthroughs may not always address head-on the philosophical issues that trouble us in this age of scientific achievement. But what Quest will do is intrigue, excite and engage your mind. As Provost Gora points out in her letter, the stories that will appear here in the months to come arise from world-class research being conducted at the university. Some of the work is so new that you may have heard little or nothing about it. All the more reason to stay tuned. If we do our job properly, then you will know — and will want to know — a great deal more with the turning of every page.

I owe a debt of gratitude to Old Dominion University’s Vice President for Institutional Advancement, John R. Broderick, who has provided an invaluable opportunity to pursue in depth the kind of stories that have long fascinated and compelled me. Even though the ink is barely dry on this issue, I’m already looking forward to the next one. A good deal of my enthusiasm is due to the tireless, cheerful efforts of my Quest co-conspirators, whose names appear on the masthead and whose work I have gotten done.

Despite my interest in and support of scientific endeavor, and my appreciation of all the useful devices at our disposal, I remain one of those who is grateful that marvellous machines have yet to replace human nature. People remain inspired, cranky, generous, anxious, sometimes brilliant and always creative. It is people who do the real work of science. And ultimately it is people who make possible any Quest.

James Schultz
Editor

ON THE COVER
Glaciers meet the ocean in South Cape Fjord on the southern end of Ellsmere Island in the Canadian Arctic Archipelago.

Photo courtesy of Glenn Cota.
It is in our nature to make assumptions. Our distant ancestors lived by rules of thumb; quick reactions to threatening situations usually meant the difference between life and death. Today we live in a far different world, one in which the general, useful suppositions of the past are often misleading or wrong, perhaps even dangerous or damaging. Western girls, for example, are cautioned not to eat too much because of their figures. Their brothers suffer no such prohibition. It is accepted that growing boys need more food than girls. Western eating disorders such as anorexia are not found in Africa and other parts of the world. Science teaches us to be suspicious of our assumptions, to test and retest them in order to find some approximation of the truth — or a version of the truth that, to the best of available knowledge, can hold up to the harshest scrutiny.

By Susan Kent with James Schultz

Gender Lessons

Of all my years of field research among the Basarwa, or “Bushmen” peoples of southern Africa, a casual conversation is among my most vivid recollections. Offhand, during lunch, I offered additional food to my native-born field assistant. I told him that he could finish my meal because men need more food than women. My assistant looked at me as though I were crazy. Why would he need extra food from me? He said he could not imagine why either sex would need more or less nourishment than the other. Subsequently, every one of the Basarwa I interviewed on this subject, without exception and regardless of sex, said boys, girls and all adults need the same amount of food. Why would anyone think otherwise?
My years of studying the formerly nomadic peoples of the Kalahari Desert in southern Africa have persuaded me that certain of our Western assumptions about the “natural” roles of men and women in society are just that: cultural constructs that have little to do with biology. However different that biology may superficially appear: There is no innate program, no biological imperative that dictates gender interactions and drives behavior. We are as free, or as imprisoned, by culturally imposed gender assumptions as we allow ourselves to be.

A DIFFERENT LIFE IN THE BUSH

Since 1987 I’ve spent considerable time in rural Botswana, a country bordered by Zimbabwe on the north, South Africa to the south and east, and Namibia to the west. The Basarwa people with whom I have lived occupy the central portion of the Kalahari Desert, near the Central Kalahari Game Reserve. Since 1995 Botswana government policies have encouraged the formerly nomadic hunter-gatherer Basarwa into settlement and limited pastoralism. Although their lives may be judged bleak by affluent Western society, I find them a warm, engaging people from whom all of us have something to learn.

Material culture among Basarwa is not linked to gender, as it tends to be in highly developed Western societies. There is an absence of gender-specific objects, and gender differences are not emphasized. For example, men and women do not keep their belongings in separate containers. Nor are tools tied to gender. A digging stick is no more a female tool than it is a male tool. Both sexes use it in a variety of ways: as a walking stick, hunting club, pestle or digging stick. Spears are technologically associated with hunting and make, but are multipurpose in function and non-sex-specific in use. Women commonly use their husbands’ spears for a wide range of tasks, from stirring porridge, to cutting a piece of hide, to trimming toenails.

A few activities are considered more in the male or the female domain. There is, however, great flexibility within these categories, and there is no stigma when boundaries are crossed. For instance, even though the gathering of plants is a task often associated with women, a male hunter rarely returns, successful or not, without at least one wild plant of some kind. In fact, men collect about 40 percent of all wild plants. And while women do not generally hunt with bows and arrows, hunting is not exclusively a male activity. While hunting, women kill small animals with spears, or use digging sticks as clubs.

HEAVEN ON EARTH?

Have the Basarwa created a kind of paradise, albeit sparse and impoverished? Certainly not. There are problems, just as in any human society. One of the chief difficulties is absence of established authority to settle disputes (official government visits to the bush are infrequent). In the past, disgruntled individuals simply moved away, as nomads, they were going to move in any case. Now they travel in different directions to stay with different groups. Today, because the Basarwa are more settled and move less often, unsolved problems between people commonly escalate into verbal or physical violence.

Males in Western society hit females to intimidate and dominate, which ultimately translates into social, political and economic ascendancy. My observation is that Basarwa men hit Basarwa women for the same reasons they fight with men: for revenge, to settle simmering disputes and during drinking bouts. Relations between Basarwa women are almost as frequent and occur for the same reasons. Women also start fights and hit men and other women as often as men do. After fighting with men, Basarwa women do not necessarily acquiesce to their will or vice versa.

In 1993, I polled 65 students at Old Dominion and 31 of the Basarwa to determine infant gender preferences. Only 31 percent of the American students said they had no gender preference, whereas 87 percent of the Basarwa said the sex of their child didn’t matter. The preferred sex of the child was significantly different between male and female students but wasn’t different at all between male and female Basarwa.

Gender preference and gender bias pervade our culture. There is no ideal culture, of course, but some are more inherently equal than others. As we in the West move toward more diversity in our schools, our work, and even in our families, we will be forced to confront the realities of other cultures and the problems of our own. If gender equality is a goal that Westerners desire, then we can work to achieve it. There is nothing to stop us.

Susan Kent is an Old Dominion professor of anthropology.

Using a pestle, a Basarwa woman chops up meat. Photo courtesy of Susan Kent.

(Untitled) After the hunt, a Basarwa woman extracts bone marrow from the country. (Right) A Basarwa woman pounds cucumbers while her daughter sits nearby. Photos courtesy of Susan Kent.

... NO BIOLOGICAL IMPERATIVE DICTATES GENDER INTERACTIONS AND DRIVES BEHAVIOR.
Planes came. So did helicopters, the Mercury space capsule, parachutes and parafoils, the occasional dirigible and, once, the fastest submarine in the world. For almost 65 years, NASA Langley’s Full-Scale Wind Tunnel in Hampton was among the biggest and best on the planet, a place where aerodynamic researchers gained a comprehensive understanding of the effects of air flow and air resistance on a variety of large objects. Generations of aircraft passed through the Full-Scale Tunnel; all emerged more airworthy than when they entered.

NASA closed the tunnel in October 1995. But now Old Dominion University has given the facility a new lease on life by signing a permanent operating agreement with NASA. The university’s long-term plan is to equip the tunnel for testing cars, trucks and trains — an investment that is drawing the keen interest of major manufacturers as well as racing teams for whom wind tunnel time is a valuable and scarce commodity. Preliminary testing of two NASCAR-class cars in the tunnel has already been completed.

Despite major advances in computer modeling, there is no substitute for testing of a full-scale vehicle under conditions that closely mimic those in the real world. For those businesses that rely on streamlining improvements to increase operating efficiency (sleeker cars that cut air resistance can significantly boost mileage), the Full-Scale Tunnel is an ideal resource to aid in economic competitiveness.
For Old Dominion students, the ability to participate in model development, testing and tunnel operations is an invaluable hands-on training opportunity. The Long History and Results.

Construction of the Full-Scale Tunnel began in February 1930 in a swampy corner of Langley Field. The entire complex cost almost $1 million and was completed within 16 months, formally opening in late May 1931.

The facility's dimensions remain impressive. The tunnel is still the second largest in the United States in terms of test section size, and is one of the four largest in the world. The test section is 30 feet high, 60 feet wide and 56 feet long. The tunnel's cross section design allows for continuous airflow at speeds ranging from 25 to 120 mph. The building enclosing the test section, supporting equipment, laboratory space, fabrication areas and offices is 434 feet long and 222 feet wide, reaching a maximum height of 97 feet, and places nearly 2.5 acres under roof, ending being roughly 8 million cubic feet.

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The University Steps In.

By the mid-1990s, declining federal budgets led NASA decision makers to draft plans to close some older tunnels. NASA Langley officially shut the doors to the Full-Scale Tunnel on Oct. 22, 1995. Faculty and administrators in Old Dominion's College of Engineering had been observing NASA's cutbacks with distinctly mixed feelings, but believed the tunnel could offer new opportunities. Thus was born the notion of university operation of the facility. Negotiations were lengthy and difficult, but an interim operating agreement was signed on Aug. 1, 1996 and a permanent agreement concluded a year later, on Aug. 18, 1997.

Serious recommissioning work did not start until well into autumn 1996. Air was circulating soon thereafter. Preliminary flow surveys and calibration checks were carried out, and validation experiments conducted to ensure the accuracy of data. Studies were done on a small commuter jet and an experimental aircraft, which had been previously tested in the same facility by NASA.

The first revenue-generating test was carried out in spring 1997 for McDonnell Douglas Corporation, under contract from the U.S. Air Force. The test was designed to investigate the causes and effects of asymmetric flow on the forward fuselage of an F-15 aircraft, suspected as a cause of occasional loss of control in low-speed, high-angle-of-attack maneuvering. Researchers traced the cause to irregularities in a small protective nose cap about half the size of an egg cup.

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Darby has identified a little understood ocean current, with origins in the Greenland Sea, christening it the North Atlantic Deep Water, or NADW. NADW may play a major role in the climates of North America and Europe, moderating cold weather and preventing an abrupt return to a more frigid climate.

To determine how the Arctic may help set the global thermostat, Darby invented a new way of tracing ice-borne sediments. His method involves a kind of fingerprinting of individual sand grains by means of an electron microprobe, which determines the chemical composition of different varieties of mineralized iron oxides. With the help of Old Dominion colleagues and Blashford, who has compiled data on the mineral composition of coarse sediments, Darby has managed to track ice-rafted debris back to precise points of origin throughout Arctic coastal regions. Since 1992, Darby and Blashford have determined the pedigree of nearly 50,000 sand grains and hundreds of the coarser samples.

The picture that emerges is one in which the normal NADW conveyor belt can grind to a literal halt when excess sea ice or icebergs exit the Arctic Ocean into the Greenland Sea. As the ice begins to melt, fresh water diffuses through the upper layers of the sea, diluting its salt content. Because fresh water is not as dense as saline water, it doesn’t mix with NADW and sinks out of the way, bringing coldness to the Arctic by preventing the formation of warm ocean currents that begin to move southward, further lowering temperatures and spurring the aggregation of additional ice.

"Once ice starts building up..." Darby pauses before finishing. "I don’t know how to stop an ice sheet that covers thousands of square miles.

COLD TIMES, HOT PLANET

Ice ages dominate Earth’s climatic history within the last million years. At the height of the last major glaciation some 18,000 years ago, sea levels dropped, exposing North America’s east coast an additional 200 miles toward Europe and Africa. Warm “interglacial” such as the one in which most scientists believe the planet currently basks, occur briefly every 100,000 years. Ironically, Darby says, humans-induced global warming — popularly known as the greenhouse effect — could trigger the next cold snap.

In recent years, a number of Northern Hemisphere mountain glaciers have retreated to higher, colder altitudes. Portions of others near coastal areas have melted outright. Darby has speculated that a failure of the West Antarctic ice sheet could lower sea levels by as much as 20 feet. Should this meltwater pour into the ocean, it would increase the salinity of the world’s oceans and sharply lower temperatures. This could alter typical ocean circulation patterns, precipitating widespread alterations in global climate.

As befits the subject matter, Darby says his research has been global in scope. Teams of investigators in the United States, Canada, Europe and Russia have contributed sediment samples and expertise to help Darby piece out the Arctic’s past and future roles in climate change. In turn, Darby has passed on what he calls “ground truth,” or findings based on observations and analyses, to climate modelers in order to improve the precision of computerized forecasts.

"The more I get into climate change, the more I realize what a difficult and complex thing it is to tackle," Darby confesses. "It’s the most difficult thing I’ve done in my 28 years as a scientist. There’s a lot we just don’t understand. What excites me is finding out more about the whole story.”
BAY SAVING

BY JAMES SCHULTZ

CONTINUING THE CLEANUP

A

seeking human-induced damage to Bay flora and fauna is a complex, time-consuming process. And what has taken decades, or centuries, to degrade may take at least that long to repair. Dauer does believe, however, that modest progress is being made to restore the Bay to some portion of its historical vitality.

“There have been improvements in the Bay,” he contends. “In some areas, we’re seeing some increase in sea grass, hopeful, but not spectacular. Striped bass — rockfish — have come back from near disaster to abundance. But we’re nowhere near creating the original fecundity.”

The chief problem involves human activity on the land and near the coast. Homeowners and farmers use fertilizers, herbicides and pesticides to keep lawns green and croplands productive. Storm runoff cannot naturally drain through areas of asphalt parking lots and roadways, and so it funnels into drains and ultimately into the Bay. Airborne pollutants are taken up in the atmosphere and descend in the form of rain, hail and snow. The problem with the Chesapeake Bay is too much enrichment and too much runoff. Dauer says, “It’s more than Nature can handle. It’s the legacy of civilization. We’re out of balance and we’re trying to move things back.”

MANAGED BAY, CLEAN BAY

Beyond lobbying for legislation that limits the worst effects of coastal development, Dauer points to the Potomac River, which, in the 1960s he says “was green pea soup [and] it smelled bad.” Today the Potomac’s health continues a decades-long rebound. No one, not advocate, scientist, critic or manager, sees the Bay as returning to its pre-European-settlement state. But Dauer says that many people are gradually becoming partners with and not exploiters of natural systems. “People want to see a Bay that’s rich in living resources,” Dauer asserts. “They want to see geese, ducks, spot, croaker, drum and rockfish. And they don’t want to be in water that stains them and smells bad.”

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MODEST PROGRESS IS BEING MADE TO RESTORE THE BAY TO SOME PORTION OF ITS HISTORICAL VITALITY.

For tiny creatures, they pack a painful punch. And that’s if you’re human. Fish aren’t as lucky and can die by the hundreds or thousands. This past summer and fall, fish in several Chesapeake Bay rivers in Maryland and Virginia fell victim to the organism known as Pfiesteria piscicida, while people playing or fishing in infested waters suffered from respiratory irritation, headaches, memory loss and painful skin lesions.

Residents worried while experts flocked to the affected sites to collect samples and study Pfiesteria’s toxic effects. Was this yet another sign of the Bay’s deteriorating health, further proof that coastal overdevelopment and runoff from farms, parking lots and chemically-treated suburban lawns is killing one of the nation’s most vital marine resources?

It’s nothing quite so simple, says Daniel Dauer, associate director of Old Dominion’s Benthic Ecology Laboratory in the university’s Department of Biological Sciences, and a senior scientist in Virginia’s Chesapeake Bay Restoration program. Dauer has also written numerous articles on improving the biological health of the Bay and has received many grants to study these topics.

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“We’ve degraded the natural system for a long time. Can we improve it? Sure. It’s a matter of how much we’re willing to pay or willing to accept.”

Dauer explains that most researchers believe the microscopic, mucous-covered Pfiesteria is an ancient life form with a complicated life cycle that includes 24 discrete stages. Only one of those stages is dangerous to marine and human life. Likewise, species, Pfiesteria is designed by nature to make optimal use of favorable conditions, which can be summarized in one word: food.

Pfiesteria’s toxic manifestation, Dauer points out, has occurred in warm weather in small, poorly flushed rivers located near areas where animal manure is stockpiled. Storm runoff or leaking of the manure into nearby creeks or streams can carry nutrients such as nitrogen and phosphorus into the tributaries. More food translates to a resurgent Pfiesteria population, ready to transform into its deadly stage when it snarls chemicals excreted by abundant schools of nearby fish. With the onset of cold weather, Pfiesteria converts to another, non-malignant stage.

“It’s like Dr. Jekyll and Mr. Hyde,” Dauer says. “During the winter we expect this thing to disappear. [Pfiesteria toxicity] is certainly a cause for concern. But it’s not a cause for panic.”

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One sample comes from land and the other from the sea. But under a microscope, both are eerily similar. Because for trees and fish alike, their ear bones, growth rings tell the tale of birth, maturation, trauma and death.

By looking carefully at fish "otoliths," says Cynthia Jones, associate director of Old Dominion's Applied Marine Research Laboratory, one can glean the details of lives otherwise cloaked by the vastness of bay and open ocean.

"Fish live in a three-dimensional mobile house in an opaque world," Jones says. "They are a mystery; a mystery we can plumb if we do it properly. The only time we can learn about them is when we catch them and bring them to the surface to study."

The lives of fish are etched in their "hard parts"—fin rays, scales and, most clearly, in their inner ear otoliths. As otoliths grow, they add layers of calcium carbonate that accumulate daily during the first year of life and annually thereafter. Different waters through which fish swim contain distinctive trace elements that the fish breathe through gills. In turn, the elements enter the bloodstream and leave their singular chemical marks within the otoliths.

These chemical traces can be read through a newly developed technique pioneered by Jones and colleagues Simon Thorrold and Steven Campana. The process, known as laser-ablation inductively-coupled mass spectrometry, or LA-ICPMS, vaporizes select portions of the otolith. The resultant gases are collected and analyzed by mass spectrometry revealing where the fish was born, where it's been and precisely how old it is.

Jones has used the technique to confirm that a key Bay species, the black drum, can live as long as 60 years, attaining an average age of 26. She determined the creatures' life span by measuring the amount of radioactive carbon released during atmospheric nuclear testing and incorporated into creatures' otoliths. "It's just like taking a census," Jones says. "Only better. We can age fish down to a particular day. We've never had that ability until now."

**Fish Famine**

BY JAMES SCHULTZ

"Fish populations have gone to hell in a handbasket," Jones says. "It's just like taking a census," she says. "If you overfish, you had better have a plan to fix that," Jones says. "You've got to use it wisely."

Jones has been using her otolith research to determine which fish populations best withstand harvesting pressures. The most robust are those that can grow quickly and mature early. Along with colleagues and graduate students, Jones has recently identified sea trout and black drum as among those fish that have endured despite heavy harvests.

"As a scientist, it is my job to get society and managers the most accurate information I can," she says. "I consider the choices to be very difficult. I certainly don't want to have to make the decisions."

**FUTURE OF THE FISHERIES**

The days of the lone, heroic fisher battling the elements seem long past. Jones says that more aggressive fisheries management appears the only alternative to a gradual drift toward widespread extinctions.

"If you overfish, you had better have a plan to fix that," Jones maintains. "If the situation is dire enough, there will be a legal means presented to shut down the fishery. Under the new laws, it will happen sooner than later."

While fishing and farming have similarities, Jones points out that the ocean cannot be fenced like a fertile field. But fishers, like farmers, must stockpile seed so that next year's, or next decade's, "crops" can once again grow to maturity. Neglect these seed, and the pastures will lie fallow indefinitely.

Jones says, first, prevent overfishing. Then restore marine habitats to impose fishing moratoria on certain species. Otherwise, say the experts, there is the prospect of outright collapse—perhaps even extinction.

"Fish populations have gone to hell in a handbasket," Jones says. "The number of overexploited fish has burgeoned. There's simply much more pressure on the fisheries than there's ever been."

"Fishing is important," she says. "It's a way of life. It's a source of food. The presence of fish creates sovereignty for most nations. Having an active fishery has meant historically that you can convert your fishermen into sailors if you need a navy."

"Fish live in a three-dimensional mobile house in an opaque world," Jones says. "They are a mystery, a mystery we can plumb if we do it properly. The only time we can learn about them is when we catch them and bring them to the surface to study."

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**PRESSURE FROM THE COASTS**

A smore and more people have moved from the nation's interior, coastal populations have ballooned. Some studies estimated that 90 percent of U.S. inhabitants live within a day's drive of the East, West and Gulf coasts.

With population growth has come increasing harvesting pressures on fish species. Appetites for fresh fish have increased. A vital food source for hundreds of millions around the world, fish in this country are prized as a low-fat part of the national diet. In addition to their dietary attraction, Jones points out that fish historically have also served an important geopolitical function.

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**MORE AGGRESSIVE FISHERIES MANAGEMENT APPEARS THE ONLY ALTERNATIVE TO A GRADUAL DRIFT TOWARDS WIDESPREAD EXTINCTIONS.**
**Metal Meals?**

BY JAMES SCHULTZ

Forget peanuts, chips, cheese or the occasional slice of pizza. Snacks of choice should include healthy doses of iron, zinc, manganese, copper, molybdenum, cobalt and nickel. Chemical oceanographer and Old Dominion assistant professor of chemistry and biochemistry John Donat says these metallic treats are essential to the health of the microscopic creatures called phytoplankton that inhabit most natural waters. Though they are individually tiny, collectively phytoplankton are essential, forming the base of the aquatic food chain and exerting influence over Earth's climate.

"Every morning I take a vitamin with metals in it. Maybe you do too," he points out. "Our bodies need trace quantities of these metals for basic biochemistry. So does everything on Earth. The problem comes when organisms get too much of one and too little of the other.

"Will a glass of water hurt you or not? Donat says "You need to know exactly what the concentrations of the various forms of the metals are if you're trying to understand their toxic effects. The toxic forms can represent a very small fraction of the total."

**Doctor of Aquatics**

To identify metallic different biochemical and geochemical behaviors, Donat has studied trace concentrations in the waters of the Chesapeake Bay, the coastal western North Atlantic, the eastern South Atlantic, the North and South Pacific and local Virginia lakes. He compares the effort to medical school studies. To understand human disease, would-be physicians should understand how the body works and how bodily systems interact. The same is true for anyone who studies complex ecosystems.

"My philosophy is, if you want to understand human effects on the environment, you need to understand the natural system in the same way a doctor goes to school to learn about anatomy and physiology," Donat avers. "We need to know natural systems in order to know what's unnatural."

According to Donat's analysis, the Chesapeake Bay itself hasn't troubled by high concentrations of toxic metals. Overall, simplest amounts of copper, cadmium and zinc are present in very low amounts. But Donat cautions that there are some areas in the Bay where the concentrations are high enough to cause concern. And low levels may have yet-unknown effects in a body of water as large and ecologically varied as the Bay.

"I don't know that the health of the Bay is governed by metals," he says. "There may be other pollutants — nutrients and organics, for example — that play a far greater role."

Despite years of investigations, Donat says that he and his colleagues are only beginning to understand how metals play in water. Questions remain. Do seasonal changes affect concentrations of metals? How do geography and location influence distribution? How do metals trace or otherwise synergistically interact with living systems? Can the results of investigations in the Chesapeake Bay be applied to other waterways and waterbodies?

Several studies have indicated that some metals can trigger toxic algae blooms. Last summer, Donat traveled to Brazil, Chile and Uruguay to establish collaborations with biological oceanographers working on damming algal infestations known as "red tides." To see if metals are partly to blame. Thus far, results are inconclusive, although concentrations of copper or iron elsewhere in the Americas have been known to kill beneficial algae, allowing their marine-damming toxic kin to take hold. With colleagues from the State University of New York at Stony Brook and the University of Delaware, Donat is also studying the influence of trace metal concentrations on so-called brown tides in Long Island Sound.

**Waste and Cures**

Many, but not all, ill that plague coastal waters can be traced to the development of modern industrial society. Donat concedes that wealth creates waste, especially the pollution variety, but suggests that environmentally damaging behavior is not limited to humans.

"The Earth has never been a Garden of Eden. When the Earth was first formed it was a pretty nasty place for life as we know it today — poison air, no oxygen," he says. "Natural processes put in metals and harmful organic substances. Even today, natural agents and processes like volcanoes, weathering by rivers, and animals introduce potentially harmful substances into the environment. Humans are not the boogeyman. But we do need to act responsibly and find ways to reduce our wastes and their potential environmental effects."

The key to striking a balance, Donat believes, is to retard human-discharged metals down to natural concentrations. Environmental regulations should also be rewritten when necessary to direct behavior based on the scientific community's latest, best-validated findings. Manufacturers should be included as partners in the process.

"It's impossible for certain companies to keep metals out of their wastewater," Donat contends. "Metals are a natural component of water everywhere. Bottled water has metals. Tap water has metals. The trick is to reduce their concentrations low enough so that no one is harmed."

If there is one rule to dealing with the environment, Donat believes, it comes from the ancient healers' code: First, do no harm. And clean up after yourself. "We all have to drink, sleep and live. Those activities produce waste," Donat says. "We'll never get to the state of producing no waste. The best we can hope for is to get to the stage of recycling most, maybe all, of our waste. And polluting as little as possible, or not at all."

According to Donat's analysis, the Chesapeake Bay itself isn't troubled by high concentrations of toxic metals. Overall, sampled amounts of copper, cadmium and zinc are present in very low amounts. But Donat cautions that there are some areas in the Bay where the concentrations are high enough to cause concern. And low levels may have yet-unknown effects in a body of water as large and ecologically varied as the Bay.

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By James Schultz

One after another, the victims recited a litany of abuse. A retired priest spoke of being hounded for his dead mother’s inheritance, the only money he had managed to put aside after a lifetime of service to parishioners. Another, a divorcee who had remarried a district attorney, described how she was forced to divorce again to escape her first husband’s crushing debt mistakenly attributed to her. A third, a small business owner, reported that he was unjustly accused of bilking more than $2 million from the government and threatened with the loss of his business and his home.

These stories emerged earlier this fall during congressional hearings concerning the one government agency many openly profess to hate: the Internal Revenue Service. The IRS’s systematic harassment of ordinary citizens was spelled out in splashy newspaper headlines and during tearful witness accounts broadcast on television. Commentators wondered if congressional scrutiny heralded the end of what some call the “infernal” tax agency, or the beginning of sweeping reform efforts that would overhaul the current tax code in favor of a far simpler, easier version.

Not so fast, says Ted Englebrecht, a University Eminent Scholar at Old Dominion and director of the university’s new Master of Taxation Program. He acknowledges that abuses exist and cannot be tolerated. But reform carefully, Englebrecht warns, lest change sweep away the very benefits reformers intend. The price of radicalism may be too high.

“Don’t throw out the baby with the bath water,” he urges. “Say you want to throw out the [current] tax law dating from 1913. What if it doesn’t raise the revenue you want? What if it creates more socioeconomic problems than you ever thought possible? We need background empirical research on what taxation changes actually do to the economy. When you come up with alternatives — a flat tax, say — you have to ask if it is equitable. We just can’t be cavalier.”

LEARNING TO LOVE THE TAX
"We have a voluntary compliance system in the United States that tends to work better than any other country’s."

Englebrecht sees the tax code as a series of gradual accommodations. Over time, he says, societies have taxed to pay for services that would otherwise be difficult or impossible to deliver. The trick is to balance delivery of needed services with excessive or unjust taxation — an especially important concern in this country given that anger over taxation led in part to the American Revolution. There is also a latter-day hunger for simplicity, for a reasonable code that is easy to understand and comply with.

“Taxpayers are right when they complain that the current code is so convoluted that even experts like Englebrecht have a difficult time deciphering it. The tax code is incredibly complex. But as are our lives and business dealings,” he contends. “Society has also placed other demands on taxation that are there to attempt to remedy certain perceived abuses or socioeconomic ills. You can’t blame it on an insensitive Congress.”

Englebrecht points out, “It’s very important to our economy. It’s very important to our lives. To me, taxation is the whole ball of wax — I’m not too big on debating the morality of taxes. I am about improving what we have and working within the existing system.”

In one study, Englebrecht tells the story of a man paid by a neighbor to help add a room to the neighbor’s house. The payment is in cash and not deposited into the man’s bank account. The tax law is clear: The income is taxable. But by not reporting it, the man runs little risk of being discovered. He chooses not to report the income on his tax return.

Englebrecht is putting his expertise to work for students in Old Dominion’s Master of Taxation program, which consists of five required tax courses and five tax electives. All students are required to have some rudimentary knowledge of business, including courses in accounting, business law, economics, finance, information systems, management, marketing and statistics.

Englebrecht intends that students who graduate from the program will have a far deeper understanding of a system that, for better or worse, appears headed toward another century.

Englebrecht sees the tax code as a complex system in the United States that tends to work better than any other country’s. "There’s less fraud and corruption. Everybody from billion-dollar minimum-wage workers, his or her salary subject to taxation. Equitable enforcement of these laws, visibilities viability into it."

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In addition to the time-honored home mortgage deduction — a government subsidy to encourage widespread ownership — and charitable deductions, taxation has expanded to accommodate the wide-ranging plans of civic activities and the well-intentioned. There are incentives, Englebrecht points out, for the restoration of historic structures, for efforts to reitalize the environment, to undertake certain kinds of energy production, and to encourage the international marketing of American-based corporations.

The U.S. tax code may be cumbersome, it may raise blood pressures and cause general consternation, but Englebrecht believes it is still among the fairest and most effective in the world. "We have a voluntary compliance system in the United States that tends to work better than any other country’s," Englebrecht asserts. "There’s less fraud and corruption. Everybody from billion-dollar minimum-wage workers, his or her salary subject to taxation. Equitable enforcement of these laws, visibilities viability into it."

Training the Next Generation of Specialists

An in-demand speaker on the ins and outs of taxation and the author and co-author of books on tax code, Englebrecht says he is forever challenged and intrigued by the intricacies of the U.S. tax system. It is the practical that interests him. How should people organize their lives to live within the law and yet take advantage of favorable situations that arise at particular life stages — partnership arrangements, for instance, or retirement trusts?

In studies done to see how and why individual comply with tax laws, Englebrecht says there is no easy and no simple answer. People decide whether or not to pay based on their own experience and their exposure to religion, culture and education.

"Tax is ever changing," Englebrecht points out. "It’s very important to our economy. It’s very important to our lives. To me, taxation is the whole ball of wax — I’m not too big on debating the morality of taxes. I am about improving what we have and working within the existing system."