2020 VISION

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OSU Frontiers

A Bold Future

The internet has become the technological backbone of commerce, allowing mass customization of information to individual and corporate consumers, letting them purchase everything from airline tickets to books to medicine. What is still lacking is a methodology by which consumers "electronically sign" a transaction, very much the way they sign a credit card voucher at a store.

OSU is at forefront of the race to develop and launch the best digital signature technology -- one that is secure for long-term deployment, requires less circuitry and energy, and is easy to store and use. This OSU technology is being adapted by a consortium of companies that will create more than 200 million "smart credit cards" to be shipped to U.S. consumers during the next year.

It is exciting to know that the people who created the technology that will truly revolutionize Internet commerce transactions are graduate students and faculty from OSU.

University scientists look to reshape the world and beyond

> Were on the cusp of something wonderful. Today, you can stand at the center of campus and look in any direction and find research that impacts everyone in this state. —**Toby Hayes, OSU's new vice provost for research**

When Toby Hayes arrived on the campus of Oregon State University as the new vice provost for research, he was amazed at the breadth of high quality research that was taking place.

It's hard to put a handle on the scope -- and value -- of Oregon State research. During the past year, OSU faculty generated more than $117 million in external grants to conduct studies that take researchers from the wheat fields of eastern Oregon, to the White House, to seafood markets in Asia, and beyond. Per capita, that puts OSU faculty eighth in the nation among similar universities.

But efforts to quantify science often overlook the pure excitement of discovery. Look at the ways these OSU researchers are pushing the boundaries of our world of knowledge.

Steve Giovannoni (on right) and his colleagues have discovered simple life forms in the antarctic desert -- evidence that suggests the possibility of similar life forms on Mars.

Searching for Life in Antarctica

Steve Giovannoni looks for life in some of the most inhospitable places on Earth -- and he usually finds it. A microbiologist, Giovannoni and his colleagues have discovered colonies of bacteria thriving beneath one of the coldest, driest deserts on Earth -- the McMurdo Dry Valleys of Antarctica, where the average temperature is about 68 degrees below zero. Within that frigid environment are warmer pockets, where a combination of minerals, water and solar radiation supports a surprisingly vigorous population of bacteria.

Giovannoni and OSU oceanographer Martin Fisk also have discovered evidence of

Cetin Koc
associate professor of electrical and computer engineering

rock-eating microbes living nearly a full mile beneath the ocean floor in the Pacific, Atlantic and Indian oceans.

What these two discoveries have in common are the primitive processes that were undertaken to create simple, basic life. Those processes may have taken place hundreds of millions of years ago on Earth and, Giovannoni says, may be taking place on Mars or the moons of Jupiter right now.

"It's been suggested that Mars is too dry and cold for life to exist," he said. "But it's also known that both Mars and Europa have frozen water on or near their surfaces. It would be a distinct possibility that similar life forms could exist there."

Mission to Mars

The planet Mars is also on the minds of two other Oregon State researchers.

Atmospheric scientist Jeff Barnes, a member of the Mars Climate Orbiter scientific team, explores the Martial atmosphere by studying the Red Planet's clouds, water vapor, temperature, and dust.

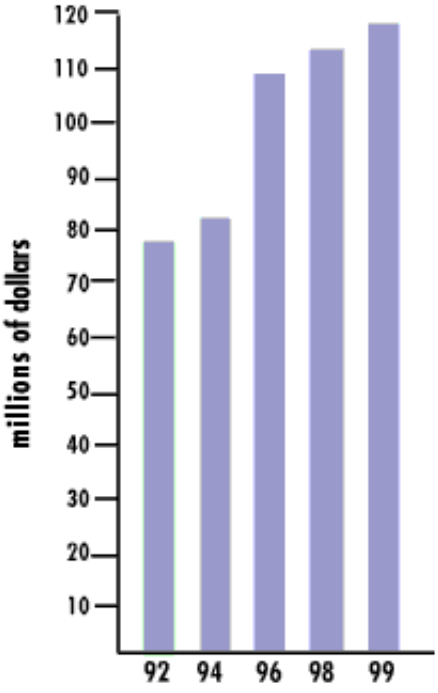
This past year, atmospheric scientist Jeff Barnes journeyed to Cape Canaveral, Florida, to watch the launch of the Mars Climate Orbiter. A member of the space-craft's scientific team, Barnes used an instrument called a "pressure modulator infrared radiometer" to scan the atmosphere of the Martian surface and measure clouds, water vapor, temperature and dust.

On a good day, Barnes says, Mars may get downright balmy, warming to 60 degrees, with gentle breezes blowing off the hillsides. Much more often, he adds, it1s extremely cold, with temperatures reaching nearly 200 degrees below zero and surface winds of 100 knots blowing thick, reddish dust through the air.

His work is helping NASA prepare for the day when humans first set foot on "the red planet." And so is the work of Gene Korienek and his team of student researchers at OSU.

A researcher in the College of Health and Human Performance, Korienek says NASA is looking at a manned space flight there as early as the year 2011. Using seed money from the space agency, Korienek and his assistants developed a prototype set of "Mars pants," to help astronauts train for the planet1s low gravity. A person who weighs 200 pounds on Earth would weigh only 76 pounds on Mars, making movement problematic.

"A manned mission to Mars would be a research mission, where five or six people would stay 500 days, conducting a variety of experiments. The ability to move effectively," Korienek emphasized, "therefore becomes critical."



Research funding at OSU

externally funded research at OSU has grown from $78 million to more than $117 million in just 7 years

World Whale Watch

Bruce Mate also has a stake in space. He's using satellites that orbit the Earth to help him track threatened and endangered whales all over the world's oceans.

The OSU researcher is considered one of the world's foremost experts in marine mammals, and he pioneered the use of satellites to help him track grays, humpbacks, blue whales, Arctic bowheads and right whales.

Now researchers are poised for a major breakthrough in collecting key information on **whales, building on Mate's success.** The OSU scientist **was able to follow via satellite** humpback whales from Hawaii to Alaska for **five full months using new** tags he helped develop. Older tags lasted only a month or two, yet Mate is confident he can extend that time to a full year -- a critical length of time that encompasses the whole feeding, migrating and breeding **cycle** of whales.

What the research is divulging has startled Mate, who has been studying whales for 23 years.

"We have known that many of the humpbacks that congregate around Hawaii in the winter to calve also spend a lot of time off southeast Alaska in the summer feeding," Mate said. "Many scientists assumed that all of the humpbacks would leave Hawaii and head to Alaska. In the past, our tags never lasted long enough to find out.

"But last year we were able to track them for a longer period of time," he added. "One tagged whale went from Hawaii to the eastern base of the Aleutian Islands, then west over to Kamchatka Peninsula in Siberia. It never went near southeast Alaska. No one ever realized that whales in Russia had ties to Hawaii."

The implications of the new, longer-lasting tags are profound, Mate said.

"We are finding out that many whale species inhabit whole ocean basins, traveling through the waters of many nations annually," Mate said. "It demands that we have coordinated international protection if we are to be successful saving these animals."


Oceanographer Dawn Wright teaching an undergraduate geology class.

From Deep Oceans to Digital Earth

OSU scientist Dawn Wright is an explorer, trying to learn more about one of the most secretive places on Earth -- the deep ocean. Ironically, she says, scientists know far more about the topography of Mars and Venus than they do about the ocean floor.

That may be about to change. New technology is enabling Wright and colleagues from other institutions to move closer to their eventual goal of recreating a "digital Earth," where every aspect of the planet -- including land surfaces, life forms, climate and ocean topography -- fits into a complete, meaningful picture.

Wright's pioneering work in the deep ocean is changing what scientists know about the subsurface world. And it constantly amazes her. When people see maps of the oceans, Wright says, they usually see a big, blank blue space between land forms. In reality, the ocean world is a massive, complex terrain filled with canyons, volcanoes, earthquakes, landslides, unusual marine species, poorly understood currents and complex life processes.

It's an area that is difficult to study. Wright uses cameras towed on a metal sled, sophisticated "multi-beam" bathymetry and personal observations from aboard the Alvin and other deep-sea submersibles to learn more about the deep-sea world. She has studied such exotic locales as the Tonga Trench near Fiji, a fast-moving subduction zone, and the Eastern Pacific Rise near Easter Island, which boasts some of the fastest rates of seafloor spread in the world.


Biologist Andy Blaustein is studying the effects of increased ultraviolet radiation, caused by ozone depletion, on amphibians in the Pacific Northwest.

Listening to Frogs

More than 10 years ago, OSU zoologist Andrew Blaustein was among the first in the world to observe that amphibians, animals that had been on Earth since the time of the dinosaurs, were in decline -- and he was determined to find out why.

"Some of our findings have astounded us", Blaustein said. "At least one cause of some amphibian decline appears to be rising levels of ultraviolet radiation in sunshine, which may be linked to erosion of our protective ozone layer."

That's probably not the only cause, researchers agree -- habitat destruction, invading new species, chemicals, pesticides, pollution, and disease may all be part of the puzzle. But as research continues, Blaustein and other scientists point to the alarming amphibian issue as a "canary in the coal mine" of changes in our global environment, and the ecological havoc these changes may eventually cause.

A Genetically Engineered Forest

Growing slowly in OSU laboratories, small young trees produced through genetic engineering represent one of the next fundamental steps forward for biotechnology -- the application of this revolutionary new science to forestry.

Forestry researcher Steve Strauss is working in the new Richardson labs on pest-resistant poplars for reforestation.

In 1999, OSU received a five-year, $315,000 grant from the National Science Foundation to create the NSF's first research center for genetic engineering of trees, an initiative that will build upon the university's leading programs in this field.

The focus of the program will be on environmental protection -- researchers working closely with their 12 industrial partners to ensure that valuable new products which are being created can be used safely in plantation forests of poplar trees, which will probably be the first large scale application of gene research in forestry.

"Because trees take so long to grow and flower, we're still basically in the Dark Ages with their development, compared to many other agricultural crops," said Steven Strauss, professor of forest science at OSU and director of the new program.

"For instance, it took 10,000 years of genetic manipulations to develop the high yield corn varieties that today help feed much of the world. But we can't afford to wait that long to develop the improved tree species that can provide the pulp and wood products we need."

{ Zoologists Jane Lubchenco and Bruce Menge received a five-year grant of $17.7 million from the Packard Foundation to coordinate a study by OSU, Stanford, UC Santa Cruz and UC Santa Barbara to study the near-shore ocean off Oregon and California. It was the largest gift to a university in the history of the prestigious foundation. }

Pioneering work in forestry will be greatly aided by the opening of Richardson Hall, a sophisticated new $24 million structure that will allow cutting-edge research in many aspects of forestry and wood products.

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