Study reveals major decline in bumble bees in the U.S.

By Diana Yates
Life Sciences Editor

The first in-depth national study of wild bees in the U.S. has uncovered major losses in the relative abundance of several bumble bee species and declines in their geographic range since record-keeping began in the late 1800s.

The researchers report that declining bumble bee populations have lower genetic diversity, a characteristic the bee species with healthy populations and are more likely to be infected with Nosema bombi, an intracellular parasite known to afflict some species of bumble bees in Europe.

The new study appeared earlier this month in the Proceedings of the National Academy of Sciences.

“We have 50 species of bumble bees in North America. We’ve studied eight of them and four of these are significantly in trouble,” said UI entomology professor Sydney Cameron, who led the study. “They could possibly recover; some of them might. But we only studied eight. This could be the tip of the iceberg,” she said.

The three-year study analyzed the geographic distribution and genetic diversity of eight species of bumble bees in the U.S., relying on historical records and repeated surveys of about 400 sites. The researchers compiled a database of more than 73,000 museum records and compared them with current sampling based on intensive national surveys of more than 16,000 specimens.

The national analysis found that the relative abundances of four of the eight species analyzed have declined by as much as 96 percent and that their surveyed geographic ranges have shrunk by 23 to 87 percent. Some of these contractions have occurred in the last two decades.

Researchers have many hypotheses about what is causing the declines, but none have been proven, Cameron said. Climate change was discounted as a major factor in the declines because the loss of some specialist species, she said. Low genetic diversity and high infection rates with the parasite pathogen are also prime suspects.

“Whether it’s one of these or all of the above, we need to be aware of these declines,” Cameron said. “It may be that the role that these four species play in pollinating plants could be taken up by other species of bees. But if additional species begin to fall out due to things we’re not aware of, we could be in trouble.”

Outsourcing hurts consumers by softening competition

By Phil Ciciora
News Editor

Firms that outsource aspects of their business to a foreign country may profit by saving money, but the practice tends to soften competition among industry rivals, exacting a hidden cost on consumers, says new research co-written by a UI business administration professor.

Yunchuan “Frank” Liu says outsourcing hurts society in two ways — it results in lost jobs for workers, and in consumers paying higher prices than they should for goods.

“Outsourcing is a topic that affects just about everyone, and the general consensus is that it’s bad because American workers will lose jobs because of it,” he said.

“Most people only focus on the job-displacement angle, but very few people have questioned how it affects consumers and competition in the marketplace.”

The study, which will appear in the journal Management Science, is the first to examine the effects of outsourcing on competition as well as consumers and society, said Liu, who co-wrote the study with Rajveer Tyagi, an economist at the University of California at Irvine.

Liu says that if firms are unwilling to pass along the savings they’ve reaped from outsourcing production and labor to a cheaper country, all consumers suffer because of softer competition.

“If a firm outsources production to a low-cost country, there’s a cost-saving effect, but there’s also a weakening among the competition,” Liu said.

“If the competition is softened and the production costs become lower, businesses don’t have an incentive to pass those savings along to consumers,” Liu said.

In some cases, consumers pay higher prices.

Before outsourcing became a popular strategy for businesses looking to cut costs, competition among firms was more intense.

“Before firms started outsourcing, firms competed head-to-head, and the result of this competition is that businesses were more consumer-centric,” Liu said.

But when firms outsource aspects of their business, they cease competing head-to-head, as the actual competition grows to include more players, Liu said.

“Once more businesses are involved, even if firms become more customer-focused, if their suppliers don’t cooperate, they can’t lower prices,” he said. “So firms lose the incentive to become consumer-centric and competitive.

And the reason why that happens is that outsourcing softens the competition among rival firms.”

Liu says that businesses aren’t simply pocketing the money they’re saving from outsourcing; in some cases, the cost saving from outsourcing is not that significant.

“Some U.S. businesses may outsource to Canada, where the cost-savings are insignificant. Why do firms want to do that? One potential reason is to soften the competition.”

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A newly engineered yeast strain can simultaneously consume two types of sugars from lignocellulose to make ethanol, researchers report. The sugars are a six-carrot sugar that is relatively easy to ferment; and xylose, a five-carbon sugar that is much more difficult to utilize in ethanol production. The new strain, made by combing, optimizing, and tweaking a few natural ingredients, reduces or eliminates several major inefficiencies associated with current biofuel production methods.

The findings, from a collaborative led by researchers from Illinois, the Lawrence Berkeley National Laboratory, the University of California at Berkeley, and the University of Utah, are another step toward producing ethanol from lignocellulosic biomass, a key ingredient in our food, said Yong-Su Jin, a professor of food science and human nutrition at Illinois. He also is an affiliate of the UI Institute for Genomics and Complex Disease and a principal investigator on the study. “Most yeast cannot ferment xylose.”

A big part of the problems with yeasts al- tered to take up xylose is that they will suck up all the glucose in a mixture before they will touch the xylose, Jin said. A glucose transporter on the surface of the yeast pre- fers to bind to glucose.

The yeast’s extremely slow metabolism of xylose also adds significantly to the cost of ethanol. Jin and his colleagues wanted to tackle the yeast to quickly and efficiently consume glucose, the healthier sugar, and its converted it to one that will consume both types of sugar faster and more efficiently than any strain currently in use in the biofuels industry. In fact, the new yeast strain simultaneously converts cellulose (a precur- sor of glucose) and xylose to ethanol just as quickly as it can ferment either sugar alone.

“If you do the fermentation by using only cellulose or xylose, it takes 48 hours,” said postdoctoral researcher and lead author Jin Suk-Jin Ha. “But if you do the co-fermentation with the cellulose and xylose, double the amount of sugar is converted to ethanol.”

The new yeast strain is at least 20 per- cent more efficient at converting xylose to ethanol than other strains, making it “the most cost-efficient yeast” strain reported in any study, Jin said. The team achieved these outcomes by making several critical changes to the or- ganism. First, they gave the yeast a cel- lulo-biose transporter. Cellobiose, a plant cell wall, consists of two glucose sugars linked together. Cellobiose is traditionally seen as a dead-end fuel.

For more information, call or e-mail Yong-Su Jin at 217-333-7090 or jin@uiuc.edu.

Yong-Su Jin, a professor of food science and human nutrition at the University of Illinois, is a co-author of a study that described a newly engineered yeast strain that can simultaneously consume two types of sugars from lignocellulosic biomass.
On the Job  Sue Sanders

Sue Sanders leads a team of building service workers responsible for the cleanliness of the Champaign residence halls.

What do you do at the UI?
I am a building service worker supervisor. I oversee the cleaning of all Champaign residence halls (Barton, Forbes, Garner, Hopkins, Lundgren, Nugent, Scott, Snyder, Taft, Van Doren and Weston halls) and the Student Dining and Residential Programs building in Ikenberry Commons. I make sure the building service workers are maintaining a clean, safe, sanitized environment for students. We also set up bunk beds in the residence hall rooms. We do all the cleaning throughout the building, which includes restrooms, halls and lounges. We also clean all dorm rooms throughout the summer.

Does your department do maintenance work on the buildings?
No, that's another department.

How many employees do you oversee? What are your management duties?
In this zone, I oversee 62 employees and I currently have four foremen. Basically we make sure all our daily cleaning rounds are covered. They collect trash and recyclable items. Any area that is open to all students is our responsibility. If a foreman is having trouble covering something because of a lack of manpower, I help figure out how to handle that or get someone from across campus to help.

I check the building to make sure everything is in order. If an employee isn't working up to par, we work with them to make sure they get up to our expectations. I also train new employees.

We get work orders, called TMAs, for tasks that include bunking or de-bunking residence hall room beds. If there's a mess to clean up in the hallway or stairwell, we take care of it through a work order.

What is the most challenging part of your job?
To me, handling employee disciplinary matters is the most challenging. We do have to discipline workers on occasion. I truly believe in the discipline process we have, which is called the Performance Partnership Program, which helps employees understand the expectations we have for them. Often, just talking with the employee helps them to understand what they should be doing. Other times, they don't change, and that's a harder situation to deal with. I know there's a need for it. I won't back down from my responsibility as a manager to discipline employees, but I also try not to jump to conclusions. I understand there could be other circumstances outside work that could cause difficulties on the job. The PPP helps us work with them, and it allows us to give them complimentary letters to thank them for their hard work.

When did you start at the UI? How did you work your way up to your current position?
I started at the Mailing Center in 1989. I worked there for six years and then came over to Housing in '95. I was a building service worker for six years. I moved to a foreman position at the Illini Union for five years. I've been in this position since 2000.

What did you do before you came to campus?
I was a licensed hairdresser from 1977 to 1989, but I needed a job with insurance, so I moved to a foreman position at the Illini Union for five years. I've been in this position since 2000.

What do you do after work?
I still consider myself a building service worker. I am still a building service worker. I take pride in making students feel at home. For most of them it's the first time away from home. They need to have some kind of regular contact with someone because their parents aren't here. I think that's part of what makes us special. I'm also proud of my team. Without the building service workers, I would not be able to do my job. I feel that we are very much a family. I'd do anything for them and I'd say they'd do anything for me. They make my job 99 percent easier than it could be. I am very grateful for the people who work for me.

Do you work with any students or still stay in touch with former ones?
As a BSW, I had several students I was extremely close to. I've been invited to weddings and baby showers. Many stay in contact. I feel privileged they took time out of their day to check on me and vice versa.

UI mathematician elected fellow of AAAS

By Liz Ahlberg

UI mathematician has been elected 2011 fellow of the American Association for the Advancement of Science.

Donald Burkholder, an emeritus professor of mathematics, will be among 503 new fellows honored by their peers at the AAAS annual meeting in February. Burkholder was cited for “distinguished contributions to probability theory, particularly the theory of martingales, and his work in stochastic processes, functional analysis, and Fourier analysis.”

“We are proud of all that professor Burkholder has accomplished in his illustrious career at Illinois,” said Bob Easter, interim chancellor of the Urbana campus. “Such scholarship is what marks Illinois as a leader in mathematics, science and engineering.”

Burkholder has served on the Council of the American Mathematical Society and on the board of trustees of the Mathematical Sciences Research Institute. He is a fellow of the Society for Industrial and Applied Mathematics and a member of the American Academy of Arts and Sciences, and the National Academy of Sciences.

The American Association for the Advancement of Science, the world’s largest general scientific society, was founded in 1848. Fellows are chosen by their peers for their outstanding contributions to the field, a tradition since 1874.
Tax Reform

A Minute With …™ tax-policy expert Richard L. Kaplan

Editor’s note: With President Obama signaling interest in pushing a massive overhaul of the income tax code as a first step toward curbing the long-term growth of the national debt, law professor Richard L. Kaplan, an expert on U.S. tax policy, discusses with News Bureau reporter Phil Ciciora what such an overhaul would look like.

Why is there so much antipathy toward taxes in America right now, and how much of a groundswell is there for tax reform?

Most people despise the complexity of the tax system. Why? Well, it’s a monstrosity. Prior presidents have described it as a disgrace against the human race. Everyone thinks someone else is using that complexity to get out of paying his or her fair share, while average Americans think they’re getting the short end of the proverbial stick. So while Americans may support tax simplification as a general goal, what they really want is to pay less tax.

Who’s responsible for the runaway nature of the tax code?

The tax code gets bigger every year, but it’s not organic growth — that is, it doesn’t grow by itself. Congress enacts every change. Every single word in the Internal Revenue Code was enacted by some Congress, and most of the time at no point did anyone ever say: “Stop! This has gotten too unwieldy and complex.” No one does that.

In this year alone, the health care reform legislation spawned close to 200 separate income tax changes; the Small Business Jobs Act changed another 30 tax provisions. Last year’s stimulus bill made many additions to the tax code and yet it pales in significance to what was enacted in 2008 under President Bush.

Politicians try to distance themselves from the tax code’s complexity, but they voted for every addition.

How does President Obama sell the idea of tax reform to the average American?

For tax reform to have any forward momentum, the majority of people must believe that their taxes will be lower. Not just simpler, but lower. When the dust settles and people recalculate, they want to see that they’ll pay less. But your typical wage earner with a few investments, so their tax return is fairly simple. It could even be on one sheet of paper. If that means the tax code gets thicker, so be it, because the majority of people are able to file their tax returns without dealing with most parts of the Internal Revenue Code. People who have small businesses, on the other hand, have a lot more difficulty. But your typical wage earner with a few investments has a relatively simple pathway through the tax code. In fact, 67 percent of taxpayers do not even itemize their deductions, so their tax return is fairly simple. It could even be on one sheet of paper.

Where it does get very complicated, however, is in tax planning — planning to fund a college education for a child, planning for retirement, planning for health care expenses, planning for investments. Those efforts are enormously complex and they affect just about everyone. But the applicable tax provisions were all deliberate policy initiatives.

So we can talk about getting rid of the home mortgage interest deduction, putting caps on pension contributions, eliminating how much you can exclude for health insurance. But the question is always going to come down to: “How will this affect me? Will I be paying more or less tax?”

When was the last time tax simplification was attempted, and what hurdles would it face in today’s political environment?

The last time we went through a major tax simplification effort was the Tax Reform Act of 1986, when more than 400 tax provisions were eliminated. And that did lower tax rates for everyone — the top bracket went down from 50 percent to 28. We went from 14 separate tax brackets to two. People say that it can’t be done, that it’s too politically sensitive, that there are too many interest groups — the fact is, we have done it, and in relatively recent times. Moreover, we did it with divided government — the president was a Republican, and the House was controlled by Democrats. So it can be done. I’m not going to say it was easy, or that it will be easy this time, because there are definitely some impediments to doing it as it was done then. First, the president has to be genuinely committed to this objective. President Reagan was extremely interested in tax simplification; one might say that he was obsessed with it. President Obama’s interest does not seem nearly so visceral. He may want to balance the budget, but that’s secondary to expanding health care and doing many other things.

Second, tax simplification is not a winner politically unless it lowers most people’s personal tax burden. President Obama’s deficit reduction commission proposed simplifying the tax system as a way of raising revenues by $1.3 trillion. That is a very different context and may prove to be too heavy a lift in the current political environment.
New way to make tiny catalysts holds promise for air quality

By Liz Ahlberg

Physical Sciences Editor

F ortified with iron, it’s not just for breakfast cereal anymore. UI researchers have demonstrated a simpler method of adding iron to tiny carbon spheres to create catalytic materials that have the potential to remove contaminants from gas or liquid.

Civil and environmental engineering professor Mark Rood, graduate student John Atkinson and their team described their technique in the journal Carbon.

Carbon structures can be a support base for catalysts, such as iron and other metals. Iron is a readily available, low-cost catalyst with possible catalytic applications for fuel cells and environmental applications for adsorbing harmful chemicals, such as arsenic or carbon monoxide. Researchers produce a carbon matrix that has many pores or tunnels, like a sponge. The large surface area created by the pores provides sites to disperse tiny iron particles throughout the matrix.

A common source of carbon is coal. Typically, scientists modify coal-based materials into highly porous activated carbon and then add a catalyst. The multi-step process takes time and enormous amounts of energy. In addition, materials made with coal are plagued by ash, which can contain traces of other metals that interfere with the reactivity of the carbon-based catalyst.

The Illinois team’s ash-free, inexpensive process takes its carbon from sugar rather than coal.

In one continuous process, it produces tiny, micrometer-sized spheres of porous, spongy carbon embedded with iron nanoparticles — all in the span of a few seconds.

“That’s what really sets this apart from other techniques. Some people have carbonized and impregnated with iron, but they have no surface area. Other people have surface area but weren’t able to load it with iron,” Atkinson said. “Our technique provides both the carbon surface and the iron nanoparticles.”

The researchers built upon a technique called ultrasonic spray pyrolysis (USP), developed in UI chemistry professor Kenneth Suslick’s lab in 2005. Suslick used a house-hold humidifier to make fine mist from a carbon-rich solution, then directed the mist through an extremely hot furnace, which evaporated the water from each droplet and left tiny, highly porous carbon spheres.

Atkinson used USP to make his carbon spheres, but added an iron-containing salt to a carbon-rich sugar solution. When the mist is piped into the furnace, the heat stimulates a chemical reaction between the solution ingredients that creates carbon spheres with iron particles dispersed throughout.

“We were able to take advantage of Dr. Suslick’s USP technique, and we are building upon it by simultaneously impregnating the porous carbons with metal nanoparticles,” Atkinson said. “It’s simple because it’s continuous. We can isolate the carbon, add pores, and impregnate iron into the carbon spheres in a single step.”

Another advantage of the USP technique is the ability to create materials to address particular needs. By fabricating the material from scratch, rather than trying to modify off-the-shelf products, scientists and engineers can develop materials for specific problem-solving scenarios.

“Right now, you take coal out of the ground and modify it. It’s difficult to tailor it to solve a particular air quality problem,” Rood said. “We can readily change this new material by how it’s activated to tailor its surface area and the amount of impregnated iron. This method is simple, flexible and tailorable.”

Next, the researchers will explore applications for the material. Rood and Atkinson have received two grants from the National Science Foundation to develop the carbon-iron spheres to remove nitrogen oxide, mercury, and dioxin from gas streams — bioaccumulating pollutants that have caused concern as emissions from combustion sources.

Currently, the three pollutants can be dealt with separately by carbon-based adsorbents and catalysts, but the Illinois team and collaborators in Taiwan hope to harness carbon’s adsorption properties and iron’s reactivity to remove all three pollutants from gas streams simultaneously.

“We’re looking at taking advantage of their porosity and, ideally, their catalytic applications as well,” Atkinson said. “Carbon is a very versatile material. What’s in my mind is a multi-pollutant control where you can use the porosity and the catalyst to tackle two problems at once.”

EPRI, the National Science Foundation, the U.S. Department of Energy, the Air and Waste Management Association, and the UI supported this work. Co-authors included Suslick, graduate student Maria Fortuna, and researchers from the Illinois State Geological Survey.

Unique technique Civil and environmental engineering professor Mark Rood (left) and graduate student John Atkinson developed a novel method of producing porous carbon spheres with iron dispersed throughout them for catalytic and air-quality applications.

By L. Brian Stauffer
Food insecurity has a negative impact on American household income families, the identification of food insecurity for directed interventions, policy innovations to improve the effectiveness of food assistance programs in reducing episodic and persistent hunger, implications for how complementary safety-net programs can be improved to eliminate hunger, and a detailed analysis of what we know and what we need to know in order to eliminate childhood hunger in the United States," Gundersen said.

According to the USDA, in 2008 about one in five children lived in families without the financial means to access enough food to sustain active, healthy living. In 2009, the USDA devoted more than $60 billion to address the problem.

"The problem of food insecurity has become particularly acute in recent years, including an unprecedented increase of over 30 percent from 2007 to 2008," Gundersen said. "One key reason that rate remains stubbornly high is limitations in our understanding of the causes and the effectiveness of programs currently in place to alleviate food insecurity. This program will use integrated, cutting-edge research to explore the causes, consequences and policy solutions to childhood hunger in the United States."

UI study: taking an active role in learning enhances memory

Good news for control freaks! New research confirms that having some control over what you are learning not only helps you retain information better, but also active memory consolidation. The study was led by psychology professor Neal Cohen, right, and postdoctoral researcher Joel Voss. "Lo and behold," Cohen said, "Our friend the hippocampus makes a very conspicuous appearance in active learning."

The new findings challenge previous ideas about the role of the hippocampus in learning. Cohen said, "It is a surprise, he said, that other brain regions that are known to be involved in planning and strategizing, for instance, "can't do very much unless they can interact with the hippocampus."

Rather than being a passive player in learning, the hippocampus "is more like an integral part of an airplane guidance system," Voss said. "You have all this velocity information, you have a destination target and every millisecond it's taking in information about where you're headed, comparing it to where you need to go, and correcting and updating it."
How one gene becomes two (with different functions)

By Diana Yates

Life Sciences Editor

Researchers report that they are the first to show how one gene evolved two competing functions that eventually split up—through gene duplication— to pursue their separate destinies. The study, in the Proceedings of the National Academy of Sciences, validates a decades-old hypothesis about a key mechanism of evolution. The study also confirms the ancestry of a family of “antifreeze proteins” that helps the Antarctic eelpout survive in the frigid waters of the Southern Ocean.

“I’m always asking the question of where these antifreeze proteins come from,” said animal biology professor Christina Cheng, who has spent three decades studying the genetic adaptations that enable Antarctic fish to survive in one of the coldest zones on the planet. “The cell usually does not create new proteins from scratch.”

Scientists have known since 2001 that the sequence of genes coding for family of antifreeze proteins (known as AFP IIB) was very similar to a sequence of a gene that codes for a cellular enzyme in humans. Since Antarctic fish also produce this enzyme, sialic acid synthase (SAS), it was thought that the genes for these antifreeze proteins had somehow evolved from a duplicate copy of the SAS gene. But no study with experimental data had shown how this happened.

Cheng and her colleagues at the Chinese Academy of Sciences began by comparing the sequences of the SAS and AFP IIB genes. There are two SAS genes in fish—SAS-A and SAS-B. The researchers confirmed that the AFP IIB genes contain sequences that are similar to those in a region of SAS-B. They also found a sequence in the SAS-B gene that, when translated into a new protein, could—with a few modifications—direct the cell to secrete the protein. This slightly modified signal sequence also appears in the AFP IIB genes. Unlike the SAS enzymes, which remain inside the cell, the AFP IIB proteins are secreted into the blood or extracellular fluid, where they can more easily disrupt the growth of invading ice crystals.

“This basically demonstrates how something that ‘lives’ inside the cell can acquire this new functionality and get moved out into the bloodstream to do something else,” Cheng said.

Further analysis revealed that the SAS proteins function as enzymes but also have modest ice-binding capabilities. This finding supports a decades-old hypothesis that states that when a single gene begins to develop more than one function, duplication of that gene could result in the divergent evolution of the original gene and its duplicate.

The new finding also supports the proposed mechanism, called “escape from adaptive conflict,” by which this can occur. According to this idea, if a gene has more than one function, mutations or other changes to the gene through natural selection that enhance one function may undermine its other function. Cheng said when the SAS-B gene became duplicated as a result of a copying error or some other random event in the cell, she said, then each of the duplicate genes was freed from this conflict and “could go on its own evolutionary path.”

This is the first clear demonstration—with strong supporting molecular and functional evidence—of how genes can escape from adaptive conflict as the underlying process of gene duplication and the creation of a completely new function in one of the daughter copies.

“This has not been documented before in the field of molecular evolution.”

Cheng said that even before the gene for the secreted antifreeze protein was formed, the original SAS protein appears to have had both the enzymatic and ice-binding functions. This suggests that somehow the SAS protein (which is not secreted) acted within the cell to disrupt the growth of ice.

This basically demonstrates how something that ‘lives’ inside the cell can acquire this new functionality and get moved out into the bloodstream to do something else,” Cheng said. When the SAS-B gene was freed from the conflict and “could go on its own evolutionary path.”

“This is the first clear demonstration—with strong supporting molecular and functional evidence—of escape from adaptive conflict as the underlying process of gene duplication and the creation of a completely new function in one of the daughter copies.”

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Seven-year moratorium on Gulf oil drilling an unwise decision

By Phil Ciciora

Business & Law Editor

The Obama administration’s decision to maintain a seven-year ban on oil drilling in the eastern Gulf of Mexico and off the Atlantic and Pacific coasts is a mistake, according to a University of Illinois professor who wrote a six-volume book series on marine pollution.

“It’s a ridiculous decision on the part of the Interior Department,” said John W. Kindt, a professor of business and legal policy at Illinois. “The previous 180-day moratorium really hurt a lot of businesses. Well, a seven-year ban is going to sting even more.”

Kindt says giving the oil companies a public spanking through a seven-year ban isn’t going to solve our energy problems, and that unreasonable opposing offshore drilling will not only exacerbate the region’s economic woes, it also will strengthen U.S. dependence on foreign oil.

“Our motto should be ‘Drill, Baby, Drill’ but ‘Safely, Baby, Safely,”’ he said. “We have two wars in the Middle East, and while we do need alternate sources of energy, in the interim we still need to safely develop our off-shore resources. That means we need to open up both the East Coast and California for drilling, although California is not going to like that. But we’ve got to be able to walk and chew gum at the same time.”

According to Kindt, the author of “Marine Pollution and the Law of the Sea,” a six-volume series that examines protecting the world’s oceans while encouraging development of essential resources, the real villain in the new contrempts is not BP (formerly British Petroleum), but the Department of the Interior, with the recently announced seven-year moratorium serving as yet another example of what he says is the department’s shortsightedness and incompetence.

“BP is not the problem,” Kindt said. “The real issue is the Interior Department, which is the most scandal-ridden agency in American history.”

“Along with an inability to regulate, the entire department is rife with conflicts of interest, which came to light during the BP fiasco when Interior Secretary (Ken) Salazar was making statements to the effect of, ‘We’ve got our heel on the throat of BP.’ Statements like that were just a way to divert attention away from their own inadequacy.”

Kindt argues that the Interior Department is just as culpable as BP for the disaster in the Gulf yet has somehow avoided any real scrutiny in the court of public opinion.

“The regulators at Interior didn’t just have a cosy relationship with the people they’re supposed to be regulating, they had outright conflicts of interest,” he said. “I fault the regulators at Interior for not doing what they should have been doing.”

But that’s not to say that BP should be given a free pass. Kindt says BP is guilty of managerial arrogance and “not looking out for the public interest.”

“BP’s management needs to be much more focused on emergency action and safety concerns,” he said. “For years we’ve been talking about the Exxon Valdez oil spill, which resulted in billions of dollars of liabilities for Exxon. That’s going to be dwarfed by whatever BP is going to have to pay, when all is said and done. So from a strategic management perspective, safety pays. We’ve been saying for years that the oil companies should have learned from the Valdez debacle after Exxon had allowed the safety mecha-
Self-assembling structures open door to new class of materials

Researchers at the UI and Northwestern University have demonstrated bio-inspired structures that self-assemble from simple building blocks: spheres.

The helical “supermolecules” are made of tiny colloidal balls instead of atoms or molecules. Similar methods could be used to make new materials with the functionality of complex colloidal molecules. The team published its findings in the Jan. 14 issue of the journal Science.

“We can now make a whole new class of smart materials, which opens the door to new functionality that we couldn’t imagine before,” said Steve Granick, Founder Professor of Engineering at Illinois and a professor of materials science and engineering, of chemistry and of physics.

Granick’s team developed tiny latex spheres, dubbed “Janus spheres,” which attract each other in water on one side, but repel each other on the other side. The dual nature is what gives the spheres their ability to form unusual structures, in a similar way to atoms and molecules.

In pure water, the particles disperse completely because their charged sides repel one another. However, when salt is added to the solution, the salt ions soften the repulsion so the spheres can approach sufficiently closely for their hydrophobic ends to attract.

The attraction between those ends draws the spheres together into clusters.

At low salt concentrations, small clusters of only a few particles form. At higher levels, larger clusters form, eventually self-assembling into chains with an intricate helical structure.

“Just like atoms growing into molecules, these particles can grow into supracol-}

loids,” Granick said. “Such building blocks would be very conventional if we were talking about atoms and molecules reacting with each other chemically, but people haven’t realized that particles can behave in this way also.”

The team designed spheres with just the right amount of attraction between their hydrophobic halves so that they would stick to one another but still be dynamic enough to allow for motion, rearrangement, and cluster growth.

“The amount of stickiness really does matter a lot. You can end up with something that’s disorganized, just small clusters, or if the spheres are too sticky, you end up with a globular mess instead of these beautiful structures,” said graduate student Jonathan Whitmer, a co-author of the paper.

One of the advantages of the team’s supermolecules is that they are large enough to observe in real time using a microscope. The researchers were able to watch the Janus spheres come together and the clusters grow – whether one sphere at a time or by merging with other small clusters – and rearrange into different structural configurations the team calls isomers.

“We design these smart materials to fall into useful shapes that nature wouldn’t choose,” Granick said.

Surprisingly, theoretical calculations and computer simulations by Erik Luijten, Northwestern University professor of materials science and engineering and of engineering sciences and applied mathematics, and Whitmer, a student in his group, showed that the most common helical structures are not the most energetically favorable. Rather, the spheres come together in a way that is the most kinetically favorable – that is, the first good fit that they encounter.

Next, the researchers hope to continue to explore the colloidal properties with a view toward engineering more unnatural structures. Janus particles of differing sizes or shapes could open the door to building other supermolecules and to greater control over their formation.

“These particular particles have preferred structures, but now that we realize the general mechanism, we can apply it to other systems – smaller particles, different interactions – and try to engineer clusters that switch in shape,” Granick said.

The team also included UI graduate students Qian Chen and Shan Jiang and research scientist Sung Chul Bae. The U.S. Department of Energy and the National Science Foundation supported this work.
BIOFUEL

converted from page 2

converted to glucose outside the yeast cell before entering the cell through glucose transporters for conversion to ethanol. Hav ing a cellulosic transporter means that the engineered yeast can bring cellulosic di rectly into the cell. Only after the cellulosic is inside the cell is it converted to glucose.

This approach, initially developed by co corresponding author Jamie Cat e at the Lawrence Berkeley National Laboratory and the University of California at Berkeley, eliminates the costly step of adding a cellulosic-degrading enzyme to the lignocellulosic mixture before the yeast consumes it.

It has the added advantage of circumventing the yeast's own preference for glucose. Because the glucose can now "sneak" into the yeast in the form of cellulosic, the glucose transporters can focus on drawing xylose into the cell instead. Cate worked with Jonathan Galazka, of UC Berkeley, to clone the transporter and enzyme used in the new strain.

The team then tackled the problems associated with xylose metabolism. The researchers inserted three genes into S. cere vi ze from a xylose-consuming yeast, P chia stipitis.

Graduate student Soo Run Kim at Illinoi s identified a bottleneck in this metabolic pathway, however. By adjusting the relative production of these enzymes, the research ers eliminated the bottleneck and boosted the speed and efficiency of xylose metabolism in the new strain.

They also engineered an artificial "iso enzyme" that balanced the proportion of two important cofactors so that the accumulation of xylitol, a byproduct in the xylose assimilatory pathway, could be minimized. Finally, the team used "evolutionary engineering" to optimize the new strain's ability to utilize xylose.

The cost benefits of this advance in co fermentation are very significant, Jin said. "We don't have to do two separate fermentations," he said. "We can do it all in one pot. And the yield is even higher than the industry standard. We are pretty sure that this research can be commercialized very soon."

Jin noted that the research was the result of a successful collaboration among principal investigators in the Energy Biosciences Institute and a BP scientist, Xiaomin Yang, who played a key role in developing the co fermentation concept and coordinating the collaboration.

PUBLIC SAFETY

Officer William R. Smoot Jr., a 24-year veteran of the UI Police Department, is the first patrol officer to receive Badge 1, a distinction awarded to the department's most senior patrol officer.

Upon retirement of the Badge 1 officer, the honor will then be passed to the next senior patrol officer. Each time the honor is issued, the department will host a ceremony to honor the new bearer of Badge 1.

Smoot was awarded medals of merit for his quick response to incidents in 1993, 2003 and 2006. He also was selected by his peers as the Police Officer of the Year in 1994 and 2008.

UI PRESS

"Hands on the Freedom Plow: Personal Accounts by Women in SNCC," a book recently published by UI Press, has been nominated for an NAACP Image Award in the category of Outstanding Literary Work--Non-Fiction. This year's event will be broadcast live at 7 p.m. CST on March 4 on Fox.
**bri** **e** **f** **notes**

**Illinois Public Media**

Interview with President Hogan is Feb. 2
WILL’s David Inge, first interviewed UI President Michael Hogan several days after Hogan took office in July 2010. Now that the president has spent seven months on the job, Inge will talk to him again at 9 p.m. Feb. 2. “Focus: A Conversation With President Michael Hogan” will be broadcast on WILL-TV and WILL-AM (580), with live audio and video streaming online at will.illinois.edu.

Weekly movie reviews on WILL-TV
Ebert returns to TV Jan. 21
Roger Ebert, an adjunct professor in the College of Media and host of the annual Roger Ebert’s Film Festival, returns to television with “Ebert Presents At The Movies.” The half-hour program premieres locally on WILL-TV at 8:30 p.m. Jan. 21. The show is repeated Sundays at 9:30 p.m.

The series features reviews of new movies, foreign and independent films and direct-to-TV releases; showcases classics movies and hot issues in cinema; and presents new segments on new media and movie interactivity.

The show will feature Associated Press film critic Chrisy Lemure and Chicago-based film critic Ignatiy Vishnevskiy, with occasional contributions from popular film bloggers Kim Morgan and Omar Moore and appearances by Ebert. Ebert, unable to speak as a result of throat cancer and related surgery, will use a computer voice to appear on every episode.

The series will also feature listener and viewers direct access to the president through phone calls during the show. Questions also may be e-mailed before the show to will-talk@illinois.edu.

**ON THE WEB**

**Asian Educational Media Service**
Spring films announced for AsiaLENS
The spring edition of the AsiaLENS film series will open Feb. 1 with a feature-like documentary highlighting—through a father and son’s portrait of three generations in one migrant family—the social and cultural dislocation resulting from China’s modernization. The film, shot over a two-year period by Chinese director Lixin Fan (director of “Up the Yangtze”), includes seldom-seen footage of the annual (and chaotic) New Year’s trek when some 130 million migrant workers return home.

“Last Train Home,” the first of four films in the monthly series, will be shown at 7 p.m. in the Knight Auditorium at the Spurlock Museum. Nancy Jervis, program director of the Asian Educational Media Service at the UI, will lead the post-screening discussion.

The Jan. 27 screening takes place at 7:30 p.m. in Robeson Rooms A and B at the Champaign Public Library, 200 W. Green St. The event is free and open to the public. The program airs on “Independent Lens” on WILL-TV on Feb. 1. From January through June, Illinois Public Media will join with the Independent Television Service to sponsor screenings of independent documentaries, followed by discussions facilitated by community groups with an interest in the topic. Screenings will each take place the month before the programs will be broadcast on WILL-TV.

Community cinema presentations are being done in more than 90 countries nationwide, said Henry Rackcliffe, who is in charge of the project for Illinois Public Media. “It’s a great opportunity to showcase documentaries and to generate conversations in the community about issues and concerns raised by those documents,” he said.

On Feb. 24, Illinois Public Media will host a screening and discussion of the independent documentary, “Me Facing Life: Cyntoia’s Story,” about a 16-year-old girl charged with murder. The event takes place at 6:30 p.m., also at the Champaign Public Library.

Other films in the series are “Pushing the Elephant,” about forgiveness and coming to terms with the past in the Democratic Republic of Congo; “Welcome to Shelbyville,” a glimpse of a small Tennessee town that graphically illustrates the rapid changing demographics; “Bluerto,” an intimate look at Pakistani leader Benazir Bhutto; and “Two Spirits,” about the murder of a 16-year-old Navajo youth.

Reducing electronic waste
E-Waste Design Competition announced
Electronic waste is a growing concern for environmentalists and world leaders, as about 2.5 million tons of obsolete or broken electronic products are discarded each year, according to the U.S. Environmental Protection Agency. Creative and environmentally conscious students will have the opportunity to showcase their ideas for recycling and reducing e-waste during the International E-Waste Design Competition hosted by the School of Art and Design, a unit in the College of Fine and Applied Arts, and the Illinois Sustainability Technology Center at the UI.

This is the third year of the competition, which was expanded from a campus event to an international event in 2010. A total of $20,000 in prize money will be awarded to six winning teams.

Participants will compete in either of two categories: “E-waste Prevention,” which focuses on new products or SEE BRIEFS, PAGE 11
Center for Advanced Study series highlights the role of animals

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nimals are food, but they are also companions. They are beasts of burden but they also inspire跛足(黑天鹅)and the impotent (same duck). They are property and yet they are worthy of societal protection from abuse.

A series of public events sponsored by the Center for Advanced Study explores these animal-related themes and more in a series of events this spring at various locations. “Knowing Animals: Histories, Strategies and Frontiers in Human/Animal Relations” will explore the latest developments in animal law and wildlife protection, celebrate the search for the origin of species, delve into the social life of chimpanzees and survey evolving ideas of “animal personhood.”

“This initiative is part of a whole wider international movement to ask the question in every discipline, not just the obvious ones such as biology or zoology, ‘What if we put animals into the equation?’ ” said UI anthropology professor Jane Desmond, who chairs the multidisciplinary steering committee that planned the events.

The movement, called simply “animal studies” or “critical animal studies,” explores the overlapping disciplines of scientists who study animal physiology and behavior with those who look at the role of animals in history, law, religion, philosophy, language and the visual and performing arts, Desmond said.

“Of course zoologists and biologists have been doing animal studies forever,” she said. “But the questions are different and the conversations are even more interdisciplinary than within the sciences because they cross the humanities and the social sciences and the arts.”

Knowing animals A series of public events sponsored by the Center for Advanced Study, explores the role of animals in human history and culture. The first spring lecture in the series, “Knowing Animals: Histories, Strategies and Frontiers in Human/Animal Relations,” will be Feb. 15. Pictured: London Zoo’s first hippopotamus, 1852.

This series began in the fall of 2010. The spring events will begin Feb. 15, with “The Evolving Nature of Animal Law,” a presentation by Valparaiso University law professor Rebecca Huss, who was the court-appointed guardian/special master of the American pit bull terriers in the Michael Vick dogfighting case. (4 p.m., Knight Auditorium, Spurlock Museum)

Feb. 22, University of Wisconsin molecular biology and genetics professor Sean Carroll will present “Remarkable Creatures: Epic Adventures in the Search for the Origins of Species,” which will chronicle the exploits of scientists and explorers whose work “changed, profoundly and forever, our perception of the living world and our place within it.” (4 p.m., Knight Auditorium, Spurlock Museum)

“Hominid,” a theatrical performance based on the work of primatologist Frans de Waal, will be presented at 8 p.m. Feb. 25 at the Armory Free Theater. Illinois theater students will perform the piece under the direction of visiting director Ariel Fristoe (co-artistic director, Out of Hand Theater) and Illinois theater professor J.W. Morissette.

On March 8, Mark Sturter, a zoo and wildlife veterinarian, Illinois alumnus and director of animal programs and environmental initiatives at Walt Disney World in Florida, will present “Humans Helping Wildlife.” He will discuss efforts to protect wild animals and their habitats, the life of captive animals and educational efforts on behalf of wildlife and wild places. (4 p.m. Knight Auditorium, Spurlock Museum)

On March 15, William and Mary College anthropology professor Barbara King will present “Apes, Elephants, and the Relational Self: Thinking Through Animal Personhood,” an exploration of the implications of the science of “animal nature.” (4 p.m. Knight Auditorium, Spurlock Museum)

On April 19, Andrew Rowan, president and CEO of Humane Society International and CIO of the Humane Society of the United States will speak about international animal welfare. (4 p.m. Knight Auditorium, Spurlock Museum)

April 1.

Details about registration, submitting entries and judging criteria are available online at http://ewaste.illinois.edu Questions can be directed to wbullock@illinois.edu or 217-333-8940. The 20 finalists will be announced April 15 on the competition website. Finalists in the video competition will be screened at the International E-Waste Video Festival on a date to be announced and publicized through the Sustainable Electronics Initiative website, www.sustainelectronics.illinois.edu; the Illinois Sustainable Technology Center website, www.istc.illinois.edu; YouTube and other media.

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Study estimates land available for biofuel crops

By Liz Ahlberg Physical Sciences Editor

Using detailed land analysis, Illinois researchers have found that biofuel crops cultivated on available land could produce up to half of the world’s current fuel consumption — without affecting food crops or pastureland.

Published in the journal Environmental Science and Technology, the study led by civil and environmental engineering professor Ximing Cai identified land around the globe available to produce grass crops for biofuels, with minimal impact on agriculture or the environment.

Many studies on biofuel crop viability focus on biomass yield, or how productive a crop can be regionally. There has been relatively little research on land availability, one of the key constraints of biofuel development. Of special concern is whether the world could even produce enough biofuel to meet demand without compromising food production.

“The questions we’re trying to address are, what kind of land could be used for biofuel crops? If we have land, where is it, and what is the current land cover?” Cai said.

Cai’s team assessed land availability from a physical perspective — focusing on soil properties, soil quality, land slope, and regional climate. The researchers collected data on soil, topography, climate and current land use from some of the best data sources available, including remote sensing maps.

The critical concept of the Illinois study was that only marginal land would be considered for biofuel crops. Marginal land refers to land with low inherent productivity, that has been abandoned or degraded, or is of low quality for agricultural uses. In focusing on marginal land, the researchers rule out current crop land, pasture land and forests. They also assume that any biofuel crops would be watered by rainfall and not irrigation, so no water would have to be diverted from agricultural land.

Using fuzzy logic modeling, a technique to address uncertainty and ambiguity in analysis, the researchers considered multiple scenarios for land availability. First, they considered only idle land and vegetation land with marginal productivity; for the second scenario, they added degraded or low-quality cropland. For the second scenario, they estimated 702 million hectares of land available for second-generation biofuel crops, such as switchgrass or miscanthus.

The researchers then expanded their sights to marginal grassland. A class of biofuel crops called low-impact high-diversity (LIHD) perennial grasses could produce bioenergy while maintaining grassland. While they have a lower ethanol yield than grasses such as miscanthus or switchgrass, LIHD grasses have minimal environmental impact and are similar to grassland’s natural land cover.

Adding LIHD crops grown on marginal grassland to the marginal cropland estimate from earlier scenarios nearly doubled the estimated land area to 1,107 million hectares globally, even after subtracting possible pasture land — an area that would produce 26 to 56 percent of the world’s current liquid fuel consumption.

Next, the team plans to study the possible effect of climate change on land use and availability.

“Based on the historical data, we now have an estimation for current land use, but climate may change in the near future as a result of the increase in greenhouse gas emissions, which will have effect on the land availability,” said graduate student Xiao Zhang, a co-author of the paper. Former postdoctoral fellow Dingbao Wang, now at the University of Central Florida, also co-wrote the paper.

“We hope this will provide a physical basis for future research,” Cai said. “For example, agricultural economists could use the dataset to do some research with the impact of institutions, community acceptance and so on, or some impact on the market. We want to provide a start so others can use our research data.”

The Energy Biosciences Institute at UI and the National Science Foundation supported the study.