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Samuel Morton’s Skulls
For over a year now, I’ve been pursuing an agenda with colleagues across the School and beyond, working to better organize the efforts of the many individuals and units that make up Penn Arts and Sciences. The culmination of this process is our new School-wide strategic plan, which has just this month been shared broadly with the Penn community.

The title of this plan, “Foundations and Frontiers,” speaks to the equal emphasis that we have placed on vision and to the solid structures upon which vision must be established. For the School of Arts and Sciences, the foundation is the excellence of our faculty and educational programs. The School’s success in all aspects of its mission rests unquestionably on its ability to attract and retain faculty of the highest caliber. Our plan includes strategies to ensure that we make the most out of every opportunity we have in hiring new faculty, as well as strategies to provide appropriate support, incentives, and mentorship for all our faculty, at all stages of their careers. As the home of liberal arts education at Penn—enrolling approximately half of Penn’s student body, and with responsibilities for providing liberal arts courses across Penn’s schools—we have given equal attention to strategies that will assure the excellence and relevance of a Penn education for all our talented students, from undergraduate, to doctoral, to professional master’s and beyond.

By assuring the strength of our faculty and educational programs, we are well-positioned to explore new horizons. In our plan, we discuss two sets of academic opportunities: those that capitalize on our distinctive strengths, and those that engage with emerging areas of knowledge. Included in the first category are four broad areas where the School and University already possess considerable resources, but have the potential to realize far greater impact. These four areas are Arts and Culture, Global Inquiries, Public Policy and Social Impact, and Quantitative Explorations of Evolving Systems. Through a combination of enhanced coordination of research and teaching agendas, improved organization, and more focused investment of resources, we seek to strengthen overall academic impact, institutional visibility, and efficiency in these areas.

The second category calls for strategic investments in four targeted areas of interdisciplinary inquiry. These four—identified in the plan as our Advancing Integrated Knowledge initiatives—represent compelling and far-reaching opportunities to define our presence in the next several years. They include initiatives in Diversity, Inequality, and Human Well-being; Energy, Sustainability, and Environment; Humanities in the Digital Age [see page 26]; and Mapping the Mind. Each one of these new initiatives holds the promise of accelerating the pace of discovery and promoting pedagogical innovation, and each both draws upon and will benefit the humanities, social sciences, and natural sciences, as well as other parts of Penn.

Also part of the plan is a realistic assessment of the resources required for successful implementation of all that we envision. We know that investments in information technology and staff must be made. Facilities are another area of need, and I’m happy to say that in this regard, we are off to a strong start. Thanks to generous supporters, we are moving forward with key projects such as the Neural and Behavioral Sciences Building [see page 5 in Fall/Winter 2014 Partners and Progress] and the Perelman Center for Political Science and Economics [page 4 in Partners and Progress]. The plan also outlines specific center and programmatic support—and here, again, we are indebted to friends such as Michael Price, W’79, and his wife Vikki, who have provided support that will fuel our digital humanities agenda (page 3 in Partners and Progress). Funding for faculty support, undergraduate financial aid, and graduate fellowships are other areas that remain critical to the strength of our foundation.

With our planning process complete, I know that we’ll have many exciting stories to share with you, at events on campus and on the road, as well as on our website and in this magazine. I hope you’ll find some opportunities to keep in touch with the exciting new frontiers that are part of the daily life of the school.
NEW CENTER PROVIDES WINDOW TO THE PAST

This fall saw the launch of the Center for the Analysis of Archaeological Materials (CAAM), a new suite of conservation and teaching labs housed in the University of Pennsylvania Museum of Archaeology and Anthropology’s West Wing. A joint endeavor between the Museum and Penn Arts and Sciences, the center offers facilities, materials, equipment, and expert personnel to instruct Penn students in myriad scientific techniques crucial to a range of disciplines, including ceramics, digital archaeology, archaeobotany, archaeozoology, human skeletal analysis, lithics, archaeometallurgy, and conservation. In addition to providing facilities for regular courses, the center offers a mentoring environment in which students are able to carry out research-oriented independent studies, honors theses, and graduate work as they seek to interpret the past in an interdisciplinary context.

FACULTY ROUNDTABLE ON ISIS/ISIL

On September 18, political science faculty gathered for a roundtable discussion on the Islamic State of Iraq and Syria (ISIS)/the Islamic State of Iraq and the Levant (ISIL). Lauder Professor of Political Science Brendan O’Leary, who was recently awarded the International Political Science Association’s Juan Linz Prize, drew on his expertise in power-sharing systems and ethnic conflict to explain how ISIS came to be. He noted that “ISIS … is the product of more than 30 years of wars and civil wars in Iraq and most recently the civil war in Syria. It’s a Jihadist force of Iraqi origin.” He also argued that “ISIS has one redeeming feature: Everybody else despises it. Shiite Arabs, Kurds, Democratic Sunni Arabs, Iran, Turkey, the European Union, the Russian Federation, Christians, most Muslims, atheists, and feminists. Even Al-Qaeda has disowned it. So the question before us is, can that joint hatred and fear form the basis for a new Iraq?”

A video of the full discussion, which also included Bess W. Heyman Professor of Political Science Ian Lustick, a scholar of comparative, international, and Middle Eastern politics; and Professor of Political Science Rudra Sil, who spoke from the vantage point of Russian/post-communist studies, is available online at: http://www.sas.upenn.edu/isis-roundtable
A team of scientists and physicians led by Michael Kahana, Professor of Psychology and director of the Computational Memory Lab, has received funding of up to $22.5 million for a four-year effort to develop next-generation technologies to restore memory function in people who suffer from memory loss due to disease or traumatic injury. The project will combine research on the basic mechanisms of memory function with the development of systems designed to electrically stimulate discrete regions of the brain. The team, which includes researchers from the School of Engineering and Applied Science and the Perelman School of Medicine, will study the neural activity from electrodes implanted in neurosurgical patients’ brains as they play memory games, and track memory formation and retrieval by measuring relevant biomarkers.

“This type of interdisciplinary research for the public good epitomizes Penn’s core values,” said Penn Arts and Sciences Dean Steven Fluharty. “We are excited to bring together some of the world’s top scientists, clinicians, and engineers, here at Penn and beyond, to do the foundational work that could one day lead to a cure for memory loss.”

University of Pennsylvania physicists Charles Kane and Eugene Mele have been chosen as 2015 recipients of the Benjamin Franklin Medal. Among science’s highest honors, The Franklin Institute Awards identify individuals whose great innovation has benefited humanity, advanced science, launched new fields of inquiry, and deepened understanding of the universe.

Charles Kane, Walter H. and Leonore C. Annenberg Professor in the Natural Sciences and Professor of Physics, and Eugene Mele, Professor of Physics, are among the eight scientists who will be awarded 2015 Franklin Medals. The award is in recognition of work that Kane and Mele have done on the creation of topological insulators, a new class of materials that have a number of useful applications ranging from low-power electronics to creating a topological quantum computer. They will be honored at the Franklin Institute in Philadelphia on April 23, 2015.
PROFESSOR BROADENS HIS SCOPE WITH A NEW DEGREE

Campbell Grey recently added a Master’s of Environmental Studies to his Ph.D. in ancient history. The Associate Professor of Classical Studies specializes in the social history of the Roman world and is co-director of the Roman Peasant Project, looking at the dynamics of small rural communities of the Roman period in Tuscany, Italy. “I didn’t have the common language I needed to talk effectively with geologists and other experts,” he says. “I tell my students that they have to find the right questions to ask and then work out how to get the answers, so I put my money where my mouth was.”

A Mellon Foundation New Directions Fellowship helped Grey earn his newest degree, which he says has set him up for his next decade or two of research. “I’ve been able to start asking questions about environmental and climate change in the late Roman period, about the social dynamics of responses to major natural disasters. It has been transformative for me in so many ways.”

PENN STUDENTS AND ALUMNI MAKE GLOBAL IMPACT WITH SIMPLE IDEA

Five friends from Penn launched Sweet Bites in Bangalore, India, where they spent this summer distributing xylitol gum to impoverished youth to help prevent tooth decay. The students and alumni—Thoba Grenville-Grey, C’14; Josh Tycko, C’14; Eric Kauderer-Abrams, C’14, W’14; Spencer Penn, W’14, GEng’15; and Morgan Snyder, ENG’16—raised over $16,000 for their company, which was listed as the #1 Simple Invention Changing the World on the Huffington Post and was one of six finalists (out of 11,000 applicants) for the million-dollar 2014 Hult Prize for social entrepreneurship. Now they’ve been awarded a $10,000 prize from Philips, which sells the Sonicare toothbrush, and written up in the New York Times.

“With chronic diseases like tooth decay, it’s a challenge to measure impact,” said Tycko. “You can think about the cavities prevented, or the family money saved on tooth extractions, or the government money saved on public health interventions, but sustainable change is created through education. That’s why we work in schools, teaching kids about tooth-brushing and xylitol. Sweet Bites is about a simple idea: ‘Your dental health matters, and you can do something about it.’”

From left, Morgan Snyder, Josh Tycko, Spencer Penn, Eric Kauderer-Abrams, and Thoba Grenville-Grey at the Hult Prize competition final. (right)
NEW CENTER DIRECTORS APPOINTED

The Herbert D. Katz Center for Advanced Judaic Studies and the Alice Paul Center for Research on Women, Gender, and Sexuality are under the leadership of new directors.

Steven Weitzman, who came to Penn from Stanford University in July, is the Abraham M. Ellis Professor of Hebrew and Semitic Languages and Literature in the Department of Religious Studies and the new Ella Darivoff Director of the Katz Center. Weitzman is a widely respected scholar of the Bible and Jewish studies.

Professor of Political Science Nancy J. Hirschmann is the new director of the Alice Paul Center and the Penn Gender, Sexuality, and Women’s Studies Program (GSWS). Hirschmann, who previously held the R. Jean Brownlee Endowed Term Chair, is the author of many monographs, articles, and edited volumes in feminist theory. She previously served as the graduate chair and vice chair of the Department of Political Science, as well as vice president of the American Political Science Association.
To be, or not to be, I there’s the point,
To Die, to sleepe, is that all?

If this most famous of English passages sounds a little deficient to you, you’re not alone. Scholars and laypeople alike joined in the debate after 1823, when Sir Henry Bunbury found an old, poorly bound book in the house he’d inherited. It included a quarto (a small and flimsy copy) of Hamlet that had been published in 1603, a year earlier than any version previously known. And this Hamlet was different in some major ways from the play that had become venerated in the intervening two centuries.

Associate Professor of English Zachary Lesser has just published “Hamlet” After Q1: An Uncanny History of the Shakespearean Text. He outlines some of the biggest differences: Q1 was about half the length, and many believed the poetry was not as good. The plot is basically the same, but the text is more religious, and Gertrude proclaims her innocence and plots against Claudius.

Everyone was talking about it. “The newspapers and popular magazines were filled with discussions of this,” says Lesser. “It’s as if not only the New Yorker but the National Enquirer were writing about it. People were fascinated.”

Just one added stage direction may have led to an entire reevaluation of the play. In performances through the 18th century the ghost generally wore armor throughout, but in Q1 when he appears in Gertrude's chamber in Act III, he does so “in his nightgown.” “Hamlet is a play about international affairs, about war, about regicide, about many other things,” says Lesser. “But once the focus was placed on this one stage direction, it was easier to imagine that the play was really this family drama around Gertrude’s sexuality. Which is what Freud takes up and then develops more fully into his Oedipal theory of the plot.”

One theory is that Q1 was a pirated script put together by actors who had played bit roles, leaving parts of the text more accurate than others. Hamlet may also be based on an earlier play, now lost, which would help explain the difference in Gertrude's character and the increased piousness.

After 400 years, Lesser is not sure the mystery will ever be solved, and he’s just as interested in Q1’s own history as a time traveler from the past—a ghost itself. “Scholars had been trying to figure out the origins of the text: Is it Shakespeare’s? Is it a rough draft? Where does it fit?” he says. “But no one had really thought about what happens when a text like this suddenly reemerges after centuries. How do we grapple with the problems it poses?”

Historians and literary critics often dream they’ll come across something no one has seen before, and that it will reveal answers to the questions we have. “But here is a case where it really did happen, and what it did was pose more questions,” says Lesser. “It is a paradox that is always there for us when we think about what we can learn from new discoveries.”
“We want to know what structures are possible in a human language and what are impossible,” says Julie Anne Legate, associate professor and chair of undergraduate studies in linguistics. Legate’s recent book, Voice and v: Lessons from Acehnese, takes on this problem by exploring the boundaries of passive voice sentence structure.

For her book, Legate homed in on a Malayo-Polynesian language spoken by the Acehnese of northern Indonesia. The Acehnese employ unusual syntax in the passive voice. Many languages employ this inactive communication style, but they still assure that the verb corresponds to the subject. Consider the following passive sentence: The meals are cooked by me. In Acehnese the sentence would be closer to: The meals am cooked by me. “That is not supposed to happen in any language,” says Legate.

Legate investigated other languages and found that the seemingly egregious error of human language practiced by the Acehnese actually does occur elsewhere. Celtic, Scandinavian, Slavic, and Bantu languages all have their own examples of uncommon syntax in their passive sentence structure. In a particularly interesting example, Legate observed a culture undergoing transformation. She says, “There is a change in progress in Icelandic where the younger generation of speakers has a construction that is the equivalent of this in Icelandic and the older generations don’t.”

Legate explores human languages with a scientific analysis that often surprises people. Survey the languages of the world and you might conclude they differ greatly. “But then when you start studying their properties and look beyond their differences, what you find is that they’re deeply very similar,” Legate says. All languages are hierarchical and structure-dependent. Legate maps the boundaries of language, marking well-established territories and unexplored frontiers. She analyzes how societies use language in new and different ways by breaking down a language’s syntax into fundamental parts to determine if it follows established rules.

Without realizing it, humans cut sentences up into clauses and split those clauses into different domains. We have an innate sense of where clauses belong in our language and we don’t cross the lines our language culture creates. Along with syntactic anomalies, Legate is curious about the origins of language development. How do humans acquire language? What do we come into the world knowing about the language we will speak?

As a Canadian native, French and English imbued Legate’s childhood. She is now an expert in many languages that she cannot speak. “It’s interesting—as a linguist you end up knowing a lot about a language,” Legate says. “I can’t speak Japanese at all, but I know exactly how a sentence is structured in Japanese.”

When asked what drew her to the field, Legate replies, “Linguistics is a unique combination of logic and language that I find fascinating.”
In *Defying the Odds: The Rise of Dalit Entrepreneurs*, Director of the Penn Center for the Advanced Study of India (CASI), Madan Lal Sobti Associate Professor for the Study of Contemporary India, and Associate Professor of Political Science Devesh Kapur relates the underdog story of 21 Dalit (previously known as “untouchable”) entrepreneurs in India who overcame the stigma of their caste to achieve financial success. The book is part of a larger CASI research project that has identified a thousand Dalit entrepreneurs whose cumulative sales reach over $2 billion.

Take, for example, Kishan Lal Singla, the head of his own multi-million dollar metal tubing company and one of the Dalit entrepreneurs profiled in the book. Orphaned at the age of two, Singla was not permitted to drink from the same water container as his peers in school and, at age 15, he was sold into bonded labor working in a brick kiln. From there, he was taken to clean the floors of a metal tube-making factory. Over time, Singla was able to learn machine maintenance and eventually became the supervisor of the factory, where he came up with the idea to start his own metal-tube company. Now he has several.

“Like the other entrepreneurs, Singla’s story combines grit, ambition, drive, and hustle—and some luck,” says Kapur. “His story can be an important source of inspiration for young Dalits in India today who need new and additional avenues for social advancement.”

Manju Rani, another entrepreneur featured in the book, employs seventeen workers and runs a factory producing 250 cotton shirts a day. Rani grew up in a slum, often without enough food to eat. When her family could no longer afford the kerosene needed to cook their food, she was sent to find a job at a local shirt-making unit. Later, she was inspired to become a street food vendor and quickly began to turn a profit. It was this entrepreneurial mindset combined with her previous experience at the factory that eventually led her to launch her own manufacturing business—starting with a single sewing machine. Rani now dreams about one day manufacturing shirts under her own brand.

The changes in the Dalit community are reflective of a greater shift in Indian society towards embracing markets and middle-class mentality over caste-based thinking. The May 2014 Lok Sabha (parliament) elections were largely seen as a vote for economic growth. CASI had predicted this attitudinal shift before the election, when they published findings from their pre-election Lok Survey. CASI’s “Lok Surveys” are a multi-year panel study sponsored by the Lok Foundation and carried out in conjunction with the Carnegie Endowment for International Peace. The Lok Surveys aim to track the attitudes of Indians as part of a significant new effort to understand the social and political reconfigurations taking place across India today. The pre-election Lok Survey revealed that three of the four most important issues for voters were economic.

In a December 9 article in *The Hindu* called “Being Middle Class in India,” Kapur and Carnegie’s Milan Vaishnav, C’02, present new findings from the second round of Lok Surveys focused on the aspirations and anxieties of ordinary Indians. They explain that “structural changes occurring in India—service-sector-led economic growth, rapid expansion of urbanization and higher education—are undoubtedly resulting in a massive expansion of the middle class” and reflective of a weakening of the status of caste. It is these structural changes which have allowed some enterprising Dalits, like those highlighted in the book, to break into the middle and upper classes.

“India has, until now, eschewed the transformational possibilities of entrepreneurship as a tool of social empowerment,” says Kapur. “The stories in *Defying the Odds* illustrate that this needs to change, not just for the Dalit community, but for all of India.”

*Defying the Odds* was co-authored by D. Shyam Babu, CASI Spring 2009 Visiting Scholar and Senior Fellow at the Centre for Policy Research in New Delhi, and Chandra Bhan Prasad, CASI Fall 2007 Visiting Scholar. The book was made possible by a multi-year grant awarded to CASI by the John Templeton Foundation.

To learn more about CASI’s publications and research projects, visit casi.sas.upenn.edu and its blog, indiaintransition.com, or follow @CASIPenn on Twitter.
Eighteenth-century philosopher Adam Smith referred to individual self-interest as the “invisible hand” of the market. Robert Kurzban, professor of psychology and departmental director of undergraduate studies, and senior researcher Jason Weeden believe that the same impulse has a significant influence on political decisions made by individuals and groups.

Their new book, The Hidden Agenda of the Political Mind: How Self-Interest Shapes Our Opinions and Why We Won’t Admit It, challenges the popular perception that one’s own beliefs emanate altruism and opposing positions are self-serving. Kurzban and Weeden contend that neither premise is accurate.

Building on their earlier collaborative work examining how socio-economic status and lifestyle choices predict political views across a variety of domains, the authors conclude that race and ethnicity account for the greatest divergence in contemporary American voting patterns. They also examine how such factors as religiosity, lifestyle, sexual orientation, education, and income divide voters on potentially polarizing issue like abortion, immigration, same-sex marriage, affirmative action, legalization of marijuana, and income redistribution.

“Although self-interest may not be a variable in domains distant from everyday concerns, it is otherwise a much bigger explanatory factor than many people realize,” says Kurzban, who is also founder and co-director of the Pennsylvania Laboratory for Experimental Evolutionary Psychology (PLEEP), where Weeden is based. “There is often a strategic element to what people want, but decisions based on self-interest can benefit others. I think our work has the potential to discourage people from dismissing self-interest as readily as has often been the case.”

“Conscious explanations have a lot less to do with political decisions that you might think,” says Weeden. “Most people, most of the time, take positions that are pretty convenient. In general politics, people care more about defending their own positions than about taking in the big picture. As voters, we get caught up in abstract arguments and forget that political decisions affect real people, real lives. Our book focuses attention on that.”

Kurzban concurs that the book’s arguments can be applied across the political spectrum. “Our arguments apply as much to the Left as to the Right,” he notes. “Positions adopted by either side are not necessarily driven by purely ideological motives, but by protecting and advancing the interests of people like themselves. “Self-interested actions sometimes benefit others, and we hope the book will cause scholars and educated lay-people to entertain the notion that self-interest can have some effect on political views.”

DEMOCRACY MAY BE LESS DELIBERATIVE THAN YOU THINK

MAUREEN HAGGERTY
SAVING
SOMETHING
WILD

Dan Janzen Races to Preserve the Natural World

by Loraine Terrell
Dan Janzen described his predicament succinctly.
“I am in a hurry. … I may have only 30 years to
go, and there is so much to be done.”

That was Janzen 30 years ago in comments he
made in accepting the 1984 Crafoord Prize, the
prestigious cousin to the Nobel, presented by the
Royal Swedish Academy of Sciences. Aside from
the fact that Janzen has done a lot since then, it’s
clear that, for him, not much has changed. The
DiMaura Professor of Conservation Biology,
Janzen feels as strongly as ever that there is no
time to pause in his race to convince humanity to
preserve some portion of the natural world that
has been the focus of his life’s work.

“If you can stack up enough different reasons why it will be valuable to
the curious school kid or the pharmaceutical industry or the ecotourist or the
birdwatcher to keep a piece of wild something,” Janzen says, in his lab on the
Penn campus in 2014, “then that piece of wild something may have some chance
of surviving.”

Janzen himself has been predisposed toward wild things for as long as he can
remember. A self-described “loner,” Janzen says, “The forest always attracted me
as a child. … I would be the kid who would not be on Twitter, who would not be
on Facebook.”

Early on he developed a fascination with caterpillars, butterflies, and moths.
“It’s totally irrational. For somebody else it would be snails, for somebody else
it’d be beetles, for somebody else it’d be birds. … I started out raising caterpillars
in the backyard in Minnesota, and catching butterflies. And I just keep right on
doing that.”

This youthful interest laid the foundation for important contributions as
a scientist. His breakthrough work, published in the mid-1960s, addressed
the interdependency between swollen-thorn acacias and a species of ant that
inhabits them. Janzen documented this “mutualistic system,” in which the ants
depend upon the tree for food and shelter, while the tree depends upon the ants for
protection from other herbivorous insects and competing plants—something that the ants accomplish by attacking anything that contacts their plant home. The Crafoord Prize was awarded on the basis of his detailed observations of this relationship and other mutualisms. But by then, Janzen’s focus was expanding beyond the study of nature to encompass its preservation. Janzen recalls a turning point where he realized, “I could spend the next 30 years doing the same biology … and I have a stack of publications this thick, and win prizes. And then I turn around, and it’s all gone. In other words, everything that I’m studying won’t be here anymore.”

EUREKA

This eureka moment was born of harsh experience in the mid-’80s. The biological paradise that is Costa Rica had been Janzen’s “study plot, sand box, and comfort” since 1963. For more than 15 years, Janzen gathered data in semi-pristine forests that could be easily accessed from roads. But in the space of a year, as many as half of these plots were lost as the country moved to put a national electric grid in place. Janzen, along with his wife and longtime collaborator Winnie Hallwachs, then moved the research operation to a national park in northwestern Costa Rica.

Even in that setting, it became clear that the survival of the wild places remained precarious. That’s when Janzen concluded that he had to develop expertise in the behavior of yet another species. “I studied people as though they were an animal in the forest,” he explains. “I had to understand, what’s the minister of the environment? … I had to understand politics and economics in 1985. I had to understand social behavior of people. They were simultaneously the enemy and the friend, the solution. What motivates the good, the bad, and the ugly? Win-win instead of lose-lose?”

At this point Janzen the loner became Janzen the activist, speaker, fundraiser, and promoter, working tirelessly to build a strong coalition including the neighbors, the Costa Rican government, and a network of international supporters to whom biodiversity mattered, for whatever reason. The result of these efforts is the still-evolving Área de Conservación Guanacaste (ACG). Today, ACG is a 165,00-hectare reserve—an area the size of Philadelphia and its suburbs—in northwestern Costa Rica. A government-private hybrid exercise in social integration and optimization, ACG contains 2.6 percent of the world’s wild biodiversity, is staffed and managed entirely by Costa Ricans, and has received World Heritage Site designation. In addition, Janzen helped establish—and later funded with the Kyoto Prize money he garnered in 1997—the Guanacaste Dry Forest Conservation Fund, a non-profit dedicated to promoting ACG’s long-term survival.

A STRATEGY FOR THE LONG HAUL

What makes conservation so difficult, in Janzen’s view, is simple: The human is, at its core, “a Pleistocene animal. And what did the Pleistocene animal care about? Food, sex, and shelter … and if you didn’t care about those three things you were dead. … Me and the guy fixing optic fiber across the hall here are exactly the same animal. The traffic cop giving a ticket is the same animal. The President of the United States and that schoolchild are the same animal.”
Taking these most basic human motivations into account, Janzen concluded that the best way to protect nature is to find a way “to make the wild area offer something to people. What people normally do is … flip the wild area into an agricultural landscape,” or freely subject it to all sorts of abuse. “If I want people to leave it there and let the wild stuff be there, I have to find something that it can offer people.”

One example of how Janzen and Hallwachs put this idea into practice is their invention of the parataxonomist—a new breed of specialist, trained to perform essential tasks in collecting and categorizing specimens. The concept, and the word, borrows from other professions such as paramedics and paralegals. Today, Janzen and Hallwachs work with a small army of 34 Costa Rican parataxonomists, people who formerly were “herding cattle, digging ditches, fishing, washing dishes, babysitting”—in short, smart people who were “bored out of their minds.” They recruited neighbors to the ACG and gave them training in necessary skills, from using a laptop to identifying insects. Now, he says, the specimens they handle are going to the Smithsonian and all over the world. And thanks to financial and in-kind support from a “collage of universities, foundations, governments, institutes, museums, and citizens of many kinds,” the research program is “going full blast in Costa Rica while I’m sitting here talking to you.”

Beyond allowing the leverage of a life-long research program, the parataxonomists represent a bridge between the wild things Janzen and Hallwachs love and the needs of ACG’s neighbors near and far—as Janzen describes them, “the real owners of that ACG biodiversity.” The parataxonomists are among 160 people from the area who now have a good and intellectually uplifting livelihood thanks to ACG. The reserve promotes the welfare of the region in many other ways, from attracting tourism revenue to providing science education for schoolchildren. Janzen notes that ACG requires comparatively little of the kind of traditional “protection” found at so many wildlife preserves. Instead, ACG seems to be protected in great part by the value it creates for the community and the country. “Sounds idealistic,” Janzen notes, “but it works.”
Janzen and Hallwachs have continued to spend half the year in Costa Rica, serving as technical advisers to ACG, as well as working with the Instituto Nacional de Biodiversidad (INBio), cataloging the country’s species and setting them up for all kinds of users. But in 2003, a new strategy was added to the campaign to protect wild things: using genetic technologies to “barcode” species.

DNA barcoding was introduced to the scientific community by Canadian biologist Paul Hebert. In the 2003 paper “Biological Identifications through DNA Barcodes,” he and his colleagues argued that analysis of DNA sequences would provide a more reliable, cheaper, and quicker means of identifying species, in comparison to traditional classification through taxonomy that depends entirely upon individual expertise.

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Around the time this paper was published, Hebert invited Janzen and Hallwachs to a Sloan Foundation-supported conference at the Cold Spring Harbor Laboratory. While the idea of using DNA to barcode species was met with resistance by many
biologists—including, perhaps not surprisingly, a number of traditional taxonomists—Janzen’s response was immediate and enthusiastic. He opened up his vast collection of representative specimens and began sending them to Hebert for barcode analysis to validate the method. This collaboration, which was featured in a 2008 Wired magazine story, “A Simple Plan to ID Every Creature on Earth,” has resulted in numerous scientific publications and has helped to broaden acceptance of the new technology.

Janzen’s interest in barcoding was, however, never just part of a dialogue with other scientists. His vision was all about teaching people how to read nature. “What I maintain is that, biologically, you are illiterate,” he asserts. “I drop you into a piece of forest in Wisconsin, or a roadside ditch in Brazil or anywhere else, and it’s just green. It’s like putting you in the Library of Congress if you can’t read. What’s the point? Books are just stacks of firewood.”

But by combining a library of DNA with the right kind of device—ideally no bigger or more expensive than a comb, or part of a smartphone—any curious kid could immediately identify and access everything that is known about any organism, based on just a leg or a feather or a smudge of blood. “And then,” according to Janzen, “you begin to realize that the thing that would allow me to identify my caterpillars for my own curiosity is something that would allow the whole world to be able to know what’s around them at the moment that it matters,” from a beetle on a bean plant to a mosquito that may, or may not, carry malaria. The idea is that being able to “read” biodiversity in this way will create a fundamental shift in our relationship with the natural world, in much the same way that knowing how to read makes the Library of Congress something more than just firewood.

Butterfly Effects

As it turns out, learning to read nature closely has impacts that go well beyond satisfying a child’s—or Janzen’s own—curiosity. Penn School of Engineering and Applied Science professor Shu Yang is looking to Janzen’s work for insights into common strategies found in nature that can be applied to innovations in materials science and engineering.

Yang notes that, “the striking color seen on butterfly wings has attracted a lot of attention,” including from her own lab, but that “not many have studied whiteness.” But Janzen made a number of interesting observations about white markings on butterfly wings and, inspired by these observations, Yang says “Now we are trying to unravel the secret and learn from the structural design of the white [found on] butterfly wings for sensors or display technology, since whiteness is essential to many aspects of the world.” She is now working with a cross-disciplinary group that includes Janzen and Hallwachs, as well as a number of other faculty from biology, physics and astronomy, and engineering. While their discussions are still in early stages, Yang hopes the initiative will lead to advances that “could impact the human habitat.”

Thirty years, one month, and nine days after his acceptance of the Crafoord Prize, Janzen is in Tokyo, once again accepting a major international honor for his accomplishments—this time, the Blue Planet Prize. This award, which he is sharing with INBio, is the latest recognition for his work on sustainable development and the conservation of biodiversity.

Janzen and Hallwachs clearly have done a lot, but they also know that keeping ACG safe for a lifetime is nothing more than a start. When it comes to saving wild biodiversity, “If what you’re doing is just for the short term, then you’re betting that somebody else is going to pick up the ball and carry it later on. That is a bad bet unless you load the dice.” As he considers the remarks that he’ll make in Tokyo, Janzen says, “Frankly, I’m talking to the younger people in the audience.” Maybe one of them will reach for that ball.

For additional information on Janzen and Hallwach’s work in Costa Rica visit:

Área de Conservación Guanacaste
http://www.acguanacaste.ac.cr

Guanacaste Dry Forest Conservation Fund
http://www.gdfcf.org

Instituto National de Biodiversidad (INBio)
http://www.inbio.ac.cr/en/
IT’S THE LITTLE THINGS

A.T. CHARLIE JOHNSON MAKES BIG MOVES IN A SMALL SCIENCE

by DAVE LEVITAN
Photos by SHIRA YUDKOFF
“Small was always a big deal,” says A. T. Charlie Johnson. “I always wanted to be in small.”

Small, of course, means something different to physicists than to most of us. In this case, it means really small, on the order of a nanometer, or one-billionth of a meter. If you’re six feet tall, you’re 1.8 billion nanometers tall. Johnson’s small obsession means figuring out ways to work with graphene and carbon nanotubes, incredibly thin, strong, and often bizarre materials.

Johnson, a professor of physics, has a career that has spanned the very basic science of those nanomaterials up through some very practical applications for them. He has pioneered and commercialized manufacturing techniques that make mass production of graphene for research and other uses possible, continues to pin down the mechanisms underlying these tiny materials’ properties, and has worked to incorporate biology and chemistry with nanotech in ways that could offer big steps forward in everything from health diagnostics to environmental monitoring. Small, it turns out, is getting big.

Johnson came to Penn in 1994—“Almost 21 years now, my gosh”—by way of Harvard for graduate school, Stanford undergraduate, and a math-happy childhood in Lexington, Massachusetts. His father was an engineer, and Johnson says he always loved math. He realized that science in general was math-heavy, and then that physics was the most math-heavy discipline of all, so his path seemed clear early on.
His dissertation at Harvard was on small superconducting circuits, and his post-doctoral work at Delft University of Technology in the Netherlands shifted to semiconductors—still small ones, of course. He attributes his subsequent move into nanoscale work to Penn Professor of Materials Science and Engineering John E. “Jack” Fischer, who passed away in 2011.

“This is part of the Penn story, with strong interactions between the different departments,” Johnson says. “Jack Fischer put a little vial of black dust on my desk and told me, ‘You should be interested in this.’ I still remember thinking, this is crazy.” Crazy, sure—but also undeniably interesting and potentially useful. “These carbon materials, carbon nanotubes and graphene, they had such amazing properties! They were so unbelievable, you just felt like they had to be good for something.”

Excellent conduction of electricity and heat and incredible strength thanks to carbon-carbon chemical bonds are just two of the amazing properties of carbon nanotubes and sheets of single-atom-thick graphene. Johnson has been among the pioneers figuring out both what the materials are good for and why exactly that is. In one recent study, for example, his team—along with Penn physics professor Marija Drndić—has been able to correlate the particular structure of bits of graphene with exactly how they conduct electricity. Cutting a graphene “nanoribbon” in one direction will make the material act much like any metal in terms of conductance. Cut it another, though, and suddenly you’ve got a semiconductor. Understanding these sorts of properties will allow us to use these materials in computer chips and other devices.

As he worked more and more with graphene and carbon nanotubes in the early and mid-2000s, Johnson noticed that in spite of increasing research on the materials, there wasn’t a huge focus yet on actually creating practical applications. It was in that spirit that Johnson and a post-doc at the time, Zhengtang Luo—now a professor at Hong University of Science and Technology—decided to start a company aimed at making practical graphene research and development more accessible. Graphene Frontiers, of which Johnson is now the scientific advisory board chair, began in 2010 through the Penn UPstart program. The company perfected processes allowing for very rapid, large-scale production of graphene, which had previously been difficult or impossible. “Being a part of Graphene Frontiers has been a very exciting thing,” Johnson says. “It has helped further this interest in applications that might actually be useful.”

Both before and after Graphene Frontiers got off the ground, Johnson was talking with even more disparate departments at Penn, including chemistry and biology. These days he is most interested in combining the semi-miraculous carbon nanomaterials with biological molecules. If you mix nanotubes and graphene with other tiny objects that are more closely related to the stuff of humans, you can do some pretty wild things.

The most charismatic and potentially useful of those projects, now ongoing, is an effort to create what is essentially a bionic nose to sniff out cancer. There are numerous hints that various diseases have a distinct smell. We humans and our feeble noses can’t detect this. But it seems that dogs can, and in the latest in a long line of seemingly odd collaborations Johnson is hoping to take a lesson from our canine friends to build a useful diagnostic tool.

“In your nose you have about 350 different types of sensors, and you have many copies of each type,” Johnson says. “A dog has more different types of sensors, and it also has more copies of each sensor.” Cindy Otto, an associate professor of critical care in the Penn School of Veterinary Medicine and director of the Penn School of Veterinary Medicine and director of the Penn School of Veterinary Medicine and director of the Penn School of Veterinary Medicine and director of the Penn
Vet Working Dog Center, has managed to train dogs to use those noses to reliably sniff out ovarian cancer. Almost every time, the dogs can pick out which of a number of blood samples comes from an afflicted individual. The trick is to take what the dog’s nose knows and use it to create a nanoscale sensor device.

Johnson’s group begins by making tiny circuits out of carbon nanotubes, which are only a few nanometers in length; the circuits themselves end up on the scale of micrometers, or a few millionths of a meter. Using tools at Penn’s Quattrone Nanofabrication Facility, they are now capable of fabricating hundreds of such devices at the same time. They then take a biological molecule—in this case, amazingly, they are using DNA, the stuff of your genetic code—and attach it to those circuits. Why DNA? It has some useful properties: It is capable of binding molecules out of the air and it does not easily degrade like various proteins would. It is also surprisingly cheap, easy to obtain, and precise in terms of its sequence.

Researchers expose a tiny circuit sporting a DNA coating with a very particular sequence to the vapors coming off a blood sample. They essentially tune the sensor to recognize certain compounds in that vapor; if the compound is present, the electrical output of the circuit will change in a signature pattern. In its ideal form, these sensors would yield a “yes” or “no” answer: Is ovarian cancer present, or isn’t it? The dogs, along with other researchers at Monell Chemical Senses Center, are providing the information on which compounds Johnson’s team should tune the devices toward.

If this idea pans out, it would represent a huge breakthrough in ovarian cancer. The bulk of diagnoses in this disease—around 80 percent—occur in the late stages when treatment is often ineffective. Johnson says he wants to reverse that, so that 80 percent or more of diagnoses come during early, much more treatable stages. The dogs, as well trained and effective as they are, won’t ever make much sense in a clinical setting—hospitals are full of distractions. Chemical methods such as gas chromatography could work if we do pinpoint which compounds to look for, but Johnson says they’re too expensive and specialized to ever really make a dent in daily practice. But a simple, easy-to-use device that sniffs your blood and says yes or no to a cancer diagnosis? That would fit in anywhere.

Otto, who trains the cancer-sniffing dogs, is optimistic. “If anyone can get an
electronic system that approaches the ability of the canine nose, it is Charlie Johnson,” she says.

It is early days still in this project, but there is definite promise. Johnson says that the nanosensors have indeed managed to distinguish cancer samples from healthy samples, even with only a few specific DNA sequences used to make a few different types of sensor. They plan to make many more, just like exist inside a real nose. “Everything we have learned so far makes it look like this is possible,” he says. “But we have a long way to go.”

In spite of the appeal and early hints of success, Johnson says the biggest challenge has been funding. “The reason is because this is a very unusual approach to medicine.” It is a truly pan-disciplinary idea, of a type that often raises more eyebrows than dollars. Carbon nanotubes, DNA, ovarian cancer—these aren’t usually in the same sentence, let alone the same grant proposal. But that’s where Johnson says the Penn focus on interdisciplinary collaboration
plays an enormous role in pushing research forward, and where his brand of innovation becomes clearest.

The most common descriptor used by his collaborators is “visionary.” “He’s an excellent condensed-matter experimentalist, but he sees new directions,” says Jeffrey Saven, a Penn professor of chemistry who has worked with Johnson. “Charlie and his group have been fearless about pushing the capability of [nanosystems] forward.”

Johnson’s focus now is to scale up the early experiments and show clearly that the bionic nose has promise; eventually, a simple device could be tested in clinical trials. Beyond that, there is no particular reason the devices wouldn’t work in other cancers, or other diseases entirely. The company Johnson founded, Graphene Frontiers, is now also actively involved in manufacturing not just graphene itself but types of these tiny sensors, capable in theory of wide ranges of applications.

And Johnson’s team is already using similar bio-nano approaches in other fields of medicine. Another project, in collaboration with Associate Professor of Biology Dustin Brisson, will use some of the sensory abilities of nanoscale devices to help diagnose Lyme disease.

In general, we diagnose Lyme disease by looking for our body’s immune response to the responsible bacterium (primarily *Borrelia burgdorferi* in the United States). But that response sometimes doesn’t show up until well after symptoms arise, making early diagnosis and appropriate treatment decisions a challenge.

Johnson’s group would make graphene-based devices that again are bound to biological molecules—in this case, a sort of engineered antibody that in turn can bind proteins from the Lyme bacterium. Those proteins are very different from any found naturally in humans, so their presence would all but guarantee a Lyme diagnosis. Just like with the ovarian cancer sensors, the presence of the protein in question in a blood sample would change the electrical current flowing through the nano-devices, yielding a yes or no response.

Implicit in these types of projects is the need to actually understand the nanomaterials in question and an ability to make them behave how you want. Before—and while—these biosensor applications began taking up much of Johnson’s time, he has published dozens of papers on the basics. These projects have ranged from realizing that common surfactants are capable of eliminating problematic “clumping” of nanotubes in water to practically proving and tungsten disulfide.

Nanotechnology on the whole has been projected to represent a trillion-dollar market by next year. The world, it seems, is finally catching up to what Charlie Johnson knew all along—small was always a big deal.
LEGACY OF LEARNING

by Blake Cole
When Eve Troutt Powell accepted an internship at the American University in Cairo as a newly minted college graduate, she didn’t realize that Egypt would become a second home. Since then, the Christopher H. Browne Distinguished Professor of History and Africana Studies has distinguished herself as a leading historian of the modern Middle East, with a special interest in the region’s relationship with Africa. She has written and edited such notable books as *A Different Shade of Colonialism: Egypt, Great Britain, and the Mastery of the Sudan* and *The African Diaspora in the Mediterranean Lands of Islam*. Her latest book, *Tell This in My Memory: Stories of Enslavement from Egypt, Sudan, and the Ottoman Empire*, examines the slave trade of the Middle East and its legacy through personal narratives of slaves and slave owners. She has been a fellow at the Institute for Advanced Study in Princeton and at the Radcliffe Institute for Advanced Study at Harvard, and in 2003 was named a MacArthur “genius” award winner.

In addition to her roles as a scholar, teacher, and mentor, Troutt Powell is now advancing the future of scholarship broadly as Penn Arts and Sciences’ Associate Dean for Graduate Studies. In this role, she oversees the School’s doctoral programs, which take place in 33 graduate groups and enroll nearly 1,700 students. We sat down with Troutt Powell to learn what it means to be leading the next generation of scholars, and where her research is taking her.

**BLAKE COLE:**
What sort of duties come with your role as Associate Dean?

**EVE TROUTT POWELL:**
A big part of our job involves admissions—and when I say “our job,” I mean Tracey Turner, the Graduate Division’s financial manager; Patricia Rea, our admissions manager; Judy Tjiattas, our business administrator; and Marco Manzo, our director of academic and student affairs. We meet regularly with the faculty directors of the graduate programs and the grad coordinators to learn the number of students they can admit before the process starts. We also meet to see how the students who are already in are doing, and we evaluate things like our requirements. For example, we’re looking very carefully now at language learning. … Is the language training something that can help students with their research?

**BC:**
What are some of the current priorities for doctoral education?

**ETP:**
Right now, one of the things we’re trying to do is to make sure the whole trajectory for Ph.D. students is clear and transparent, so that the students know what is expected of them, the grad chairs know, and the grad coordinators know. We’re working on policies that will be made available to everyone about what to expect your first year through your last year, how funding works—making sure everyone is clear on the basics of graduate education. We are also thinking very hard—along with the directors of each of our graduate programs—about both academic and non-academic career paths for our Ph.D.s. There are many opportunities in addition to tenure-track positions that are open to our graduates, and we need to understand what those opportunities are. Maintaining competitive
funding packages to attract the best graduate students is also very important, and so we need to be creative in finding ways to support graduate education, given the erosion we are seeing in external funding.

Another priority for me is innovation. I think most faculty train their graduate students in ways similar to the ways in which they were trained. Penn is becoming such an interesting place with educational technology. ... The College is flipping classrooms for undergrads and doing SAIL [Structured, Active, In-Class Learning] courses. We should be thinking about new approaches for grad students too. It will be challenging, but I think it’s worth starting the conversation with faculty who are deeply involved in educating graduate students, and with graduate students as well.

BC: Were there any surprises for you when you started working more closely with departments outside the humanities?

ETP: Before this, I had no idea how the scientists trained their students. This year, over the summer, I started going to different departments so I could see what they do. It’s been really interesting talking to the students and the faculty about how they come up with their ideas, how they work together, how they implement their research, what it is to work in a lab in general. These are departments who depend so much on graduate students—do they think faculty and students in the natural sciences are locked into research together in a way that’s very different from what I see in the humanities.

And one other thing—I didn’t ever use the term “time to degree” before I became grad dean. And it’s out of my mouth all the time now: “Think about your time to degree. We only have so much funding!” Timely progress toward completion of the degree is an important measure of success for both our students and our programs.

BC: What direction has your research taken since 2012’s Tell This in My Memory: Stories of Enslavement from Egypt, Sudan, and the Ottoman Empire?

ETP: My current research is actually based on a chapter that was edited out of Tell This in My Memory. Instead of focusing on oral histories, it examines the visual culture of slavery: why people took photographs of slaves, why people painted slaves, why slaves—and former slaves—chose to have these pictures taken. The central question is, what do these images tell us about an old institution and a new technology coexisting at the same time?

The Orientalist painter Jean-Léon Gérôme, from the École des Beaux-Arts in Paris, was responsible for a lot of the images I’m going to be writing about, and there were a number of Ottoman and Egyptian photographers who trained with him. Then there’s another scholar who worked here at the Penn Museum—actually he helped found the museum—named Osman Hamdi Bey, who had whole collections of this stuff in Istanbul. The relationship is very close between all these people. So I’ve had research trips to London, Paris, and Istanbul, and this year I’m going back to Cairo.

BC: What are some examples of the visuals you’ve discovered?

ETP: This summer, when I was in Istanbul, I went to the Ottoman Bank Museum. They have a photographic collection. Photography was used for ID cards, and very early on. Some of the palace eunuchs of the sultan had their pictures taken because they had accounts. ... And many people—especially the eunuchs—started having pictures taken of themselves so they could make a little money from postcards. They become like living monuments, in a way. Another part of the visual culture I’m looking at is medical records of eunuchs’ bodies and how they’re presented, because they’re fascinating to everybody. And Circassian women, who were enslaved after these households were broken up, often had their own pictures taken and put in newspapers as a sort of appeal to see if anyone recognized them and knew where their families were. I don’t have a narrative flow yet. I’m still looking to see where you find the images, how they look, and how they’re seen.

BC: Besides your own research, and your work as graduate dean, you continue to act as a mentor to graduate students in your own departments. What kinds of projects are your students involved in?

ETP: Yes, I work with a lot of students. ... I have a student right now who’s halfway through her dissertation. She’s an Ottomanist who’s looking at the movement of slave women in the very late Ottoman Empire: What happened to the domestic situation, and where did they go? It’s just brilliant. I’ve learned so much from her about Ottoman slavery. This dissertation is really going to be a gem. ... I have another student in the history department who hit the ground running with this idea. She’s looking at labor relations among Egyptian archeological digs, and how local knowledge of upper-Egyptian villages was used by Western archeologists. So basically it’s Egyptian Egyptology that wasn’t in universities. And it’s just fascinating.
I will say something about my students. They’re dealing with some unique challenges because their access to materials and sites is continually changing. I had a student in Egypt whom we were really worried about in this office. The archive was closed and they were fighting on the bridge that she would have had to walk across to get to the archive. So she met up in London with another one of my students who was supposed to go to Sudan and couldn’t go there. But they’re so proud of themselves. They call themselves “extreme historians.” I have another student who worked on Syria—I’m really afraid that the mosque that she’s been working on has been bombed. The people she’s trying to reach, she can’t reach. History is changing, as it has a tendency to do, and my students, I think, are going to be able to articulate a sense of struggle and war that’s very different from anything I could have done because then it just wasn’t the case for me. So I’m very proud of them for being tough.

BC: How do you go about balancing your time between being dean and being an educator?

ETP: There’s no balance [laughing]. And there’s no balance between being a professor and dean. What has helped is that being dean has led me to evaluate my role as a professor. I have become more grateful, or more aware than I was before, of how intellectually freeing it is to teach. And coming back to teaching undergrads this semester, and continuing to teach grad students, I think it’s saving the part of me that is a scholar. But I think about the broader structure more clearly now that I’m associate dean.
HUMAN AND MACHINE

THE HUMANITIES TAKE THE DIGITAL REVOLUTION AND RUN

by SUSAN AHLBORN
Computer programs that can detect infinitesimal traces of color to show how Roman statues were painted 2,000 years ago. Data mining millions of pages of writing to discover word frequencies and patterns that couldn't be found before. Maps that show the movements of people across centuries.

Technology is literally changing the way we see—and hear—the humanities. “I wish there was smell,” says Professor of Religious Studies Justin McDaniel—but that may be coming. Right now we’re at the beginning of the beginning.

The digital humanities are so new that no one can agree on a definition. The simplest and most inclusive is that they are the interface between the humanities and digital technology, creating new approaches, new knowledge—and ultimately new questions. “It’s very important that digital humanities be understood as something that humanists are doing for humanities reasons, and not as some tech-y, isolated thing,” says James English, John Welsh Centennial Professor of English, director of the Penn Humanities Forum, and creator of the Digital Humanities Forum.

All such projects at Penn will soon have a home in the Price Lab for the Digital Humanities, thanks to Penn Arts and Sciences Overseer Michael Price, W'79, and his wife Vikki (see “Opening Up a Virtual World” in the Fall/Winter 2014 Partners and Progress). The lab will have all the technology and support that faculty and students need to stay on the leading edge of this transformational wave. In a field that is inherently collaborative, it will also provide a campus hub for interdisciplinary work by people across the University.

“We’ve all got our smartphones and our laptops. We’re using these digital tools in various ways to conduct our research, but we don’t call this digital humanities,” says English. “It will be the same with a lot of the things we are calling digital humanities right now; eventually they will be like using Microsoft Word.”

We talked to seven Penn Arts and Sciences faculty and students about the work they’re already doing in the digital humanities.
**Mapping Migration**  
**Siyen Fei**

What happens when a nation can’t hold on to its people? The Ming Dynasty returned China to native rule after centuries of Mongol occupation. State rhetoric stressed that the power of Chinese civilization would maintain a homogeneous China, but Associate Professor of History Siyen Fei is making a digital map to show just how much was being lost across the borders.

The nation was under attack on its frontiers, by the Mongols on the north, pirates in the south, and tribal kingdoms in the southwest. China and its foes would each invade the other to get needed supplies, including workers: “People took money, took men, took women, took goods with them,” says Fei. Kidnapped Chinese would often find they were treated better by their abductors than by their government. Many decided to stay, and others left China on their own.

Fei is mining court records and using geographic information systems (GIS) to map immigration and emigration rates throughout the dynasty. The visual representation of how, where, and when the rates changed will help her see in what ways the different flows of population and political dynamics affected what was once seen as an all-powerful imperium.

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**Digital Monastery**  
**Justin McDaniel**

Justin McDaniel’s Thai Digital Monastery project opens the walls of a Buddhist monastery in Bangkok. In a panoramic, immersive walk-through of the Wat Ratchaorot, users can see rooms and rituals and hear from the people who live there. “I try to provide as little commentary as possible,” the professor of religious studies says.

To create the site, McDaniel has worked with monks and nuns as well as technical experts and scholars in Thailand and around the world. He’s now scanning Buddhist manuscripts, beginning with the collection at Penn Libraries. Eventually he plans to create hypertext editions where visitors can view the documents while seeing a running translation and listening to a monk or nun chant the words. “It will be a one-stop shop for the history of Thai Buddhism,” he says.

McDaniel believes that pulling information together in this way will generate a world-wide knowledge community whose members will create new research initiatives, juxtapose previously disconnected concepts, and inspire and train others, whether their interest is academic, religious, or cultural. “That’s what digital humanities are allowing us to do: maximize resources,” he says. “I want to get information out to as many people as possible.”
Liz Lastra’s digital images of medieval churches in Spain let you zoom in until you can see the toes of the saints. They are Gigapans, created using photographs—sometimes hundreds—that are stitched together by computer into what are essentially very high-resolution pictures. She’s also created 3D digital models so that you can look down into a 13th-century baptismal font.

A doctoral candidate in art history, Lastra is examining three churches built at different times in Carrión de los Condes, a town on the Camino de Santiago pilgrimage route in Spain. She’s comparing the churches to see what design elements may have been kept or lost over time. She’s found “quotes” of earlier sculptures and repeated themes in the churches, suggesting that the town was self-conscious as it became a destination spot. “The urbanization of the town was being fueled by the pilgrimage economy,” she says. “How do you express local identity while also trying to appeal to the pilgrimage audience?”

Lastra’s parents are computer scientists, and one of her goals has been to join technology and the humanities. Her website of Romanesque churches in northern Spain brings other academics, her future students, and all who are interested with her to Carrión and beyond.
Archeologists spend most of their time close to the ground, but Lucas Stephens is using 21st-century equipment to get a birds-eye view of Penn’s Gordion excavation site in central Turkey.

The Phantom 2 Vision Plus Quadcopter flies at 100 meters, giving the doctoral candidate in art and archaeology of the Mediterranean world a unique way of mapping the ancient capital city of King Midas—considered one of the most important dig sites in the world. The copter’s Global Positioning System (GPS) capabilities let him create models of the ancient landscape, as well as follow the progress of current excavations.

“I'm looking at how people moved around in the past, what routes they took, and how these relate to monuments and other sites in the landscape,” says Stephens, who is working with C. Brian Rose, James B. Pritchard Professor of Archaeology and Professor of Classical Studies. “I've been using the copter to capture imagery of landscape features such as quarries, ancient road surfaces, burial mounds, occupation mounds, and rock-cut tombs, which can be turned into geo-referenced 3D models with photogrammetry software. The goal is to produce interactive maps and more videos highlighting specific routes and the ancient landscape features along them.”

Thousands of pieces of clay marked with a cramped triangular script have been found in the area of the Middle East that was ancient Mesopotamia. They are the paperwork of that civilization: administrative records, religious and political material, mythology and narrative, and even writing exercises. Understanding Sumerian and Akkadian, the languages they use, gives us a wide window into that world.

Steve Tinney came to Penn in 1991 to help create a Sumerian dictionary based on the Museum’s collection and research. His timing was fortunate. The emerging digital world offered speed and made possible a new kind of dictionary: one that was richly linked to the texts and that could be used by scholars everywhere.

The electronic Pennsylvania Sumerian Dictionary (ePSD) was released in 2006. Now Clark Research Associate Professor in Assyriology, Tinney and colleagues at Penn and around the world are working on the Open Richly Annotated Cuneiform Corpus (Oracc), which will encompass the ePSD and other work in Mesopotamian languages and scholarship. “We can reasonably aim to build a complete corpus where you can find every word—maybe not in my lifetime but in my students’ lifetime,” he says. “It’s a matter of establishing very, very firm foundations for generations of research.”
A GIVEN NAME

TIMOTHY POWELL

Working with Penn undergraduates and the Native American community, Senior Lecturer in Religious Studies Timothy Powell is preserving languages and revitalizing cultures. Through his position as Director of the Center for Native American and Indigenous Research at the American Philosophical Society, he and his students digitized 3,000 hours of audio recording and 500 photographs of tribes in the U.S. and Canada, which they curated into digital exhibits.

Then Powell met Maria McKie, a Tuscarora tribe member and Mellon fellow working to promote digital knowledge-sharing. She found Charles A. Cooke’s collection of Iroquois names in the Society’s files and recognized its importance. Many traditional names of the Iroquois, or Haudenosaunee, were lost starting in the 1880s when native children were sent to boarding school and renamed. Powell and his undergraduates worked for three years to transcribe 6,000 names and their clans, along with a linguistic analysis and biography of the original person to hold the name.

“I think part of my work is to put the human back in the digital humanities,” says Powell. “We’re really instilling in the students a sense of how valuable digital humanities can be, that it’s not just an abstraction. Scholars in the humanities see digital technology as not just gigabytes and terabytes, but as an art form.”

THE WAY WE READ NOW

HEATHER LOVE

Jane Eyre may be a commentary on the history of empire, but it undeniably is the story of a woman making her way in the world. R. Jean Brownlee Term Associate Professor of English Heather Love has been working with Sharon Marcus of Columbia and Berkeley’s Stephen Best on a project on surface or descriptive reading: a set of methods to let the reader look at the text, not through it. In a graduate seminar Love and Marcus taught last year, they practiced the approach while reading Herman Melville’s Benito Cereno—a story in which the narrator himself seems to completely misread events—as a collaborative exercise in line-by-line reading.

Literary studies has always been a solitary field, but digital methods allow for “a collective reading process, not limited by the margin of the page,” says Love. They tried out software and tools that let readers comment on the text, respond to each other, investigate word frequency and other data, and more. The class even did a social networking analysis of the interactions in the book, which raised the question of what counted as an encounter: Did a memory? A court case that revisits the action? Love says, “A lot of the tools we used were as interesting for the problems and questions they raised as for the results.”
Ebola is inescapable. A recent Google News search turned up the following numbers of hits:

- Malaria: 98,900
- Heart disease: 126,000
- AIDS: 524,000
- Ebola: 28.1 million

We shouldn’t be surprised: Ebola presses all of the buttons. It is unfamiliar. It comes from an exotic place; outbreaks until this most recent one have been seen only in the Congo River basin—the original “heart of darkness” in Joseph Conrad’s novel. Its symptoms are fascinatingly lurid. It is incurable and often fatal. It is, in short, irresistible. Attention will fade when the epidemic is brought under control in West Africa—or, more likely, when isolated cases stop appearing in wealthy countries. But it won’t be long before another scary disease takes its place.

Duke professor Priscilla Wald’s conception of the “outbreak narrative” can help us make sense of our reactions to infectious diseases. An archetypal story of global interdependence, hidden dangers, and scientific expertise, the outbreak narrative has become the primary lens through which we perceive disease threats. It goes like this: Globalization has shrunk the world, rendering all of us vulnerable to hidden dangers lurking everywhere. Those unlike us, often stigmatized by race or class, endanger us as disease carriers. Germs, portrayed as beings with a conscious purpose, invade our country and our bodies like alien armies. Disease detectives persevere through daunting obstacles, aided by cutting-edge technology, and eventually save the day. The heroes of the story are usually doctors or scientists, and its scapegoated villains are most often victims of disease themselves, who through simple carelessness or exotic cultural practices contribute to an outbreak’s spread.

The outbreak narrative reassures us that our science can overcome the threat of strange places and strange people, but it fails as a guide for public health policy in several ways. First, it skews our national health priorities toward the sensational potential pandemic of the moment. In the past twenty years, the examples are legion: Ebola (the first scare), mad cow disease, West Nile virus, SARS, bird flu, swine flu, Ebola (again)—and there are more. Systematically exaggerated threats monopolize public attention at the expense of the everyday conditions that are actually killing Americans (usually slowly) and crippling our economy by driving up health care costs.

Second, the outbreak narrative distracts us from the mundane reality of ground-level health infrastructure: the people and facilities that are the first point of contact for patients and their families in vulnerable communities. This is the most obvious and tragic lesson of Ebola: Individual cases can occur anywhere, but epidemics are impossible wherever health centers or hospitals are capable of diagnosing and isolating cases quickly, and where their staffs have proper training and equipment. Guinea, Sierra Leone, and Liberia are among many developing countries whose health systems suffer from severe funding, staffing, and equipment shortages. These shortages often spell the difference between life and death, and they can be traced at least in part to the structural adjustment policies by which Western lenders have starved the public sector in these countries and forced the privatization of essential services. In such poor regions, rural health centers are not a profitable investment.

We can break out of the outbreak narrative. It is compelling and tenacious, but its stereotypes and distortions need not drive our policies or our discourse. What is required is a forceful and sustained articulation of a new public health vision—one that sees beyond individual disease threats to the deeper structural privations and inequalities that make
certain communities more vulnerable to all illnesses.

In this vein, there are lessons to be learned from the Dark Ages before the germ theory of disease revolutionized our understanding of health and illness. Half a century before the bacteriological breakthroughs of Louis Pasteur, Robert Koch, and others, public health was born as a modern field of scientific inquiry and public policy. One of its pioneers was Louis-René Villermé, a French physician and social scientist who co-founded the world’s first public health journal in 1829. In a landmark study of Paris neighborhoods, Villermé was the first to show quantitatively the direct correlation of poverty and mortality. He is also known for his massive two-volume investigation of the occupational and environmental causes of poor health among workers in France’s textile-producing regions.

What is most significant about Villermé’s work is his method. He insisted on rigorous qualitative and quantitative observation of health phenomena “in the field,” where ordinary people lived and worked. He was guided by a few simple questions: Who is sick, and who is healthy? Where, when, and under what conditions? Surprisingly, there is one question that he rarely asked: Which diseases do they have? By looking past specific disease categories, he was able to see the underlying problems that made certain people in certain places susceptible not just to one disease, but to a wide range of health problems.

Villermé’s macroscopic perspective has been eclipsed by the microscopic view that focuses on specific diseases, specific germs, and even specific strands of genetic material in search of weapons with which to fight one disease at a time. This kind of focus allowed us to eradicate smallpox—an astonishing achievement—but it has not necessarily made populations healthier. Malnourished, ill-housed, and overworked bodies that are protected from one germ remain vulnerable to all of the others. Historically, improvements in overall standards of living have done far more than medical interventions have to improve population health.

Imagine a public health system in which threats are evaluated based on their actual magnitude, and by the extent to which feasible interventions would improve overall population health. Imagine a different narrative, in which illness comes from our own environments and our own inequalities, and in which salvation comes not from a laboratory or from hazmat suits but from communities mobilizing to make change happen. It might not be good click bait, but it just might improve our vision.

David Barnes is an assistant professor of history and sociology of science at the University of Pennsylvania.
The first goal for most aspiring scientists and engineers is developing a research path—not creating a proposal to pitch to a room full of people. That’s where the Vagelos Integrated Program in Energy Research (VIPER) differs. The dual-degree program, founded through the generosity of Trustee Emeritus P. Roy Vagelos, M.D., C’50, Hon’99, and his wife Diana, is housed jointly between the School of Arts and Sciences and the School of Engineering and Applied Science. It is designed to not only get students involved in exploring energy research at an undergraduate level as soon as possible, but to prepare them to introduce their ideas to the outside world.

“How do you go about talking to people about science and engineering? It’s not something students magically learn,” says Carl V. S. Patterson Professor of Chemical and Biomolecular Engineering John Vohs. “They don’t know how to create an effective visual figure that’s going to be informative but also catch someone’s eye. So when we need to learn about presentation, we actually go out and bring in someone from the library. Even though they aren’t scientists, they can help in so many other ways.”

In order to ease freshmen VIPER students into a rigorous interdisciplinary curriculum, the program has an on-ramp-to-research seminar series that takes place during the second semester...
of freshman year, and continues through the first semester of sophomore year. Vohs acts as co-instructor of the seminar, alongside Professor of Chemistry Andrew Rappe and VIPER managing director Kristen Hughes. Throughout the first half of the semester, professors from a wide range of disciplines visit the class to speak to students and aid them in choosing their initial research path. By the time summer rolls around, students pair themselves with a faculty mentor who oversees their first block of research. Research choices run the gamut, from physics to architecture to chemical engineering.

“The summer research period is beneficial not only as a means to excel, but also to explore new areas of certain topics,” says Thomas Eng, C’17, ENG’17, projected mechanical engineering and architecture major. “It gave me proper lab experience and directed me toward a path I think will be more suited for me in the future.”

One of VIPER’s primary goals is to prepare students to approach research questions from a variety of different perspectives—and then be able to talk about it. “When undergrads think of energy research, they tend to think of applications: solar cells and wind turbines,” says Vohs. “But really you need to understand the fundamentals, and that means focusing on one very small bit of an overall problem and being able to communicate about it.”

In order to foster improved communication, students are required to give presentations on their initial findings. Once they have completed their summer research and have had the opportunity to formulate concrete results with their new faculty mentors, they give a follow-up presentation as a means of charting their improvement and examining what they’ve learned throughout the process.

A small class size is central to ensuring individual attention to students. “I didn’t really expect how relaxed VIPER would be,” says Carol Wang, C’17, ENG’17, who worked on a cross-coupling reaction in Alan MacDiarmid Term Professor of Chemistry Patrick Walsh’s lab, and credits seminar co-instructor Andrew Rappe with helping her connect with her mentor. “We learn a lot in the VIPER seminar, but we also have a ton of fun.”

As students’ research progresses, they will also have the opportunity to access the state-of-the-art labs at Pennergy, the Penn Center for Energy Innovation. Formed in 2009, the center’s mission is to bring together world-class researchers to solve scientific and technological problems, enabling the efficient use of current energy sources, the practical use of more sustainable energy, and the conversion of energy to different forms.

“The VIPER experience is like no other,” says Gautam Nagaraj, C’17, ENG’17, who spent the summer working with Professor of Physics and Astronomy Marija Drndić in her lab. “I got to work alongside Ph.D. students and post-doctoral fellows to design and build a microfluidics cell for DNA-sequencing experiments. There is no doubt my experience will play an important role in opening up the opportunities I have in the future to contribute to the energy solution at large.”
Movers & Quakers

V IS FOR VICTORIOUS

BY TRACEY QUINLAN DOUGHERTY

In five short years, Bing Chen, C’09, rocketed from the College to a spot on Forbes’ Top 30 Under 30 list as a YouTube executive. Here, he discusses the dramatic changes the Internet has wrought in the entertainment world and talks about his newest endeavor, Victorious.

Q: As a student, you were recruited to Google’s ultra-selective accelerated management program and quickly advanced to a senior position at YouTube. From this vantage point, how did you observe the entertainment field being changed by the Internet?

I’m part of the Connected Generation [anyone born after 1982]. We’re a generation that demands to have whatever it wants, whenever it wants, from wherever it wants—in media, relationships, life, et cetera—whether we deserve it or not. In 2008, when I was a senior at Penn, I realized that few were satisfying this insatiable desire for content as well as YouTube. At the time, most media entities were largely walled gardens, hindering access to production financing, distribution, et cetera. In contrast, YouTube was a catalytic platform—a place that, with a click of a button, a creator could stream a video to hundreds of millions of devices across the globe.

It ultimately boils down to creative liberation. Advances in hardware and software have democratized distribution and creation of content. This, paired with the Connected Generation’s desire for and to create content, contributed to the rise of creative community platforms like YouTube, Instagram, and Etsy. On top of these platforms rose a new-age celebrity: the digitally born star. Research tells us that the Connected Generation believes these stars are more popular than their traditional media counterparts because of their authenticity and accessibility. In fact, today the top five most popular stars in the country among U.S. teens are YouTube-born stars.

Q: You recently left YouTube to launch a new company. What does it do?

Victorious builds mobile platforms for the next generation of creative artists and companies. We like to think of our company in four ways. First and foremost is creative control: in contrast to other walled gardens or web platforms, Victorious enables creators—from digitally-born stars to media companies—to control their entire ecosystem. They control the algorithms, revenue streams, et cetera. Second is reimagining content consumption. In contrast to supporting a single format like videos or photos in a passive, “leanback” way, Victorious-powered platforms provide a continuous creative conversation where artists can enable their fans to create new content experiences together. Third, by extension, is having a great place for a community that allows a fan to communicate with and be a full participant in the artist’s career. Fourth and finally is unlocking new revenue streams that amplify the content experience rather than hinder it. In sum, you, the creator, are the studio executive, the platform CEO, et cetera. We hope Victorious becomes the first platform that’s fully built and owned by creators.

Q: Having once interned on influential Disney properties such as Frozen and Lost, you now say you’d like to be the next Walt Disney. Why?

I mean that conceptually, not literally. Walt Disney created an incredible, cross-pol- linating multimedia conglomerate that helps make “dreams come true.” It’s an altruistic mission: It’s not just entertainment to delight people—it’s entertainment to propel people forward. I would love to help create the next big media conglomerate that builds worlds, all to inspire people to become better than themselves.

Q: How did Penn prepare you for that kind of role?

A principal reason I chose Penn was because of its immense Hollywood titan alumni. The list extends everywhere from Rich Ross, C’83, who at the time was Disney Channel President, to Stacey Snider, C’82, who’s CEO of DreamWorks, to Steve Wynn, C’63, HON’06, PAR’14, PAR’16, of Wynn hotels, resorts, and casinos. As well, majoring in creative writing afforded me a true interdisciplinary experience by taking Wharton courses in marketing and additional College courses in psychology. Finally, as with many, my most profound experiences were outside the classroom. From student government to producing various films to summer internships at the Walt Disney Company, Penn absolutely provided a platform and forum to hone my intellectual capacities and professional prowess. I think Penn is really one of—if not the only—universities that nicely balances theory and practicality. Even though I had one of the most liberal of majors, I was still exposed—whether it was through extracurricu- lars or in the classroom—to endless vocational opportunities. In hindsight, pairing those two realms is not only vital, but incredibly rare.
Samuel Morton’s skull collection lines the walls of the Center for the Analysis of Archaeological Materials (CAAM) classroom, a newly renovated working seminar space at the Penn Museum (see page 2 for more about the launch of CAAM). Morton’s work on skull measurements and human variation has long been the subject of scientific controversy. Evolutionary biologist Stephen Jay Gould claimed that Morton (1799-1851) skewed his data to support biased views of human intelligence, but a recent paper co-authored by Adjunct Professor in Anthropology and Penn Museum curator Janet Monge argues that most of Gould’s claims about Morton are poorly supported. Today, hundreds of researchers globally use the collection—considered one of the best in the world—to study human global variation in cranial form.
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