

# CAREERS

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Using crystal blocks, an exhibit displays the flights of bees in three dimensions as they learned a task.

## INTERDISCIPLINARITY

# Artistic merit

*Options abound for scientists who want to get in touch with their inner artist, whether professionally or as a hobby.*

BY VIRGINIA GEWIN

Christina Agapakis thought that her interest in art would always be separate from her pursuit of science, especially once she had decided to do postgraduate studies in biology.

But she found ways to meld the two. While earning her PhD in biomedical sciences at Harvard University in Cambridge, Massachusetts, Agapakis joined a social experiment called Synthetic Aesthetics. A joint project of the University of Edinburgh, UK, and Stanford University in California, funded by the US National Science Foundation (NSF) and the UK Engineering and Physical Sciences Research Council, Synthetic Aesthetics teamed artists and designers with synthetic biologists and encouraged them to come up with

interdisciplinary ideas and projects. Agapakis worked with Sissel Tolaas, a researcher and scent artist resident in Berlin. Together, they made cheese — using starter cultures made of bacteria isolated from the human body. They wanted to make the unseen biological world perceptible to the senses, and to call attention to how synthetic biology might alter microbial communities. “The creativity of designing, rather than studying, biology is really exciting for me,” says Agapakis.

Now a postdoc in synthetic biology at the University of California, Los Angeles (UCLA), Agapakis continues to collaborate with designers, incorporating principles of balance and scale — in this case, being mindful of microbial relationships and interactions — into the design of microbial communities that could, for example, yield new fertilizers or biofuels.

She is convinced that artists and designers stoke scientists' creativity.

Scientists are becoming increasingly open to artistic collaborations, which offer career benefits including improved productivity as a result of a new perspective or a more creative outlook; bolstered communication and outreach skills; and contacts among artists, like-minded scientists or funding agencies. Learning how to indulge artistic pursuits — and avoid professional obstacles such as being perceived as unfocused or undisciplined — is key to shaping a career that can sustain both art and science.

## SUPPORT ON SHOW

Hybrid art–science efforts have gained support in recent years. Some institutions see them as a means of enhancing creativity and innovation, and a growing number are creating cross-disciplinary centres. Examples include the Media Lab at the Massachusetts Institute of Technology (MIT) in Cambridge and the Art|Sci Center + Lab at UCLA. “We are absolutely on the brink of a new renaissance,” says James Gimzewski, a nanobiologist at UCLA who began collaborating with artists ten years ago in the hope of engaging and educating the public. Artistic collaborations seem to thrive particularly in newer areas of scientific exploration, including synthetic biology, nanotechnology, robotics and neuroscience.

“We’re trying to raise the visibility of our interest in supporting art–science collaborative projects,” says Bill O’Brien, senior adviser for programme innovation at the US National Endowment for the Arts (NEA) in Washington DC, which is increasingly directing funds to science- and technology-focused arts projects — responding, in part, to growing interest. It spent about US\$963,000 on such grants in 2012, up from \$304,000 in 2009.

Other major science funders are also fostering academic efforts to create art–science collaborations. Guna Nadarajan, dean of the University of Michigan School of Art & Design in Ann Arbor, is helping to build the NSF-funded Network for Sciences, Engineering, Arts and Design (SEAD) to help artists and scientists to connect and collaborate, and to explore how to conduct research at the intersection of art, science and engineering. So far, SEAD has 300 participants across 30 research institutions and art colleges.

Meroë Candy, senior arts adviser to the Wellcome Trust in London, one of the world's largest biomedical-research funders, says ▶

► that the organization's arts budget has grown from £100,000 (US\$153,000) in 1996 to £1.4 million this year.

Industry, too, has discovered the potential of artistic aspirations. "Executives are eagerly hiring people who bring a key element of creativity to produce game-changing ideas," says Nadarajan.

Artistic interests often help scientists to enhance their own creativity in the lab. After 11 years as an evolutionary biologist at the University of Montreal in Canada, François-Joseph Lapointe was restless — so in 2005, he started a second PhD in dance. These days, he pursues both dance and scientific research. When his science focused on finding genetic signals of evolutionary lineages, for example, he developed choreography that assigned movements to each DNA nucleotide, and performers danced out their own genetic codes. He has begun work on metagenomics, or the study of genetic material in a particular environment, and hopes to sequence his dancers' microbial genomes. Some colleagues suggest that splitting his time means that he is shortchanging his science, but he disagrees. "I am happier and more productive when I use my brain differently," he says.

Meaningful scientific advances can benefit from an artistic perspective, says Gimzewski. Scientists often think reductively, in terms of phenomena isolated from their environment; artists, by contrast, observe and study inter-related phenomena and then craft an interpretation. For three years, Gimzewski has been working on a project to build an artificial brain, funded by the US Defense Advanced Research Projects Agency, and he says that he would never have tackled such a complex project without his visual-arts experience, which changed his science. "I used to look at single molecules, but it's essential in the world today to work in complex environments," says Gimzewski.

## TWO-WAY PARTNERSHIP

In the past, art–science collaborations have tended to begin when artists hoping to learn about science have approached researchers. But increasingly, scientists are being proactive, seeking artistic tools to bolster their research. Karissa Sanbonmatsu, a molecular biologist at Los Alamos National Laboratory (LANL) in New Mexico, partnered with specialists in three-dimensional (3D) visualization at the LANL's supercomputing facility to make sense of ribosomes, cell organelles that can have several hundred thousand atoms in one molecule. "We couldn't see the big picture using straightforward computer code, but the 3D images made troubleshooting much easier," she says. Her collaborations have changed how she thinks about her research, inspiring new directions — in one example, seeing the ribosome's apparently random movements made her curious about how their gyrations affect how well they function. Now Sanbonmatsu has joined more than two dozen other scientists in



**François-Joseph Lapointe choreographs dances based on DNA sequences.**

the Scientists/Artists Research Collaborations initiative at the 1st-Mile Institute in Santa Fe, New Mexico, which aims to focus on issues of climate change and energy.

When artist and scientist come together, it is important to find the best working arrangements for both parties, and for the project. All collaborators should articulate their goals and intentions clearly. "Having artists in residence in my lab just didn't work for me," says Beau Lotto, a neurobiologist at University College London. "I didn't find it interesting to have them gleaning ideas only to go away and make art." So Lotto created a studio space in which artists and scientists could interact and conduct research together on perception and human behaviour. He even started running a monthly night club to observe people in a real-world setting. "The only way you get questions that have never really been asked before is to bring in different perspectives and question assumptions," he says.

Scientists may find that tapping into the art community is a good way to make contacts and raise their own profiles. "I have access to twice as many grants, potential students and conferences," says Lapointe. This year, he has submitted grant proposals to the Natural Sciences and Engineering Research Council of Canada; the Social Sciences and Humanities Research Council of Canada; and the Canada Council for the Arts.

Lotto found that funders often support the marriage of art and science to engage the public. But he no longer fell under that remit once he started conducting research, and he lost funding. He has since launched his own fund-raising efforts, and has made money from donations at art installations and corporate sponsorship of talks on creativity, among other ventures.

Some funders are experimenting. The European Union has granted €1.6 million (US\$2.1 million) to StudioLab, a Europe-wide consortium of arts and science centres that helps scientists and artists to create interactive outreach events looking at the future of water resources, synthetic biology and the future of

social interactions. One project, *Biohacking: Do It Yourself!*, which ran from January to March at the Medical Museion in Copenhagen, advises viewers on how to conduct scientific experiments at home using moderately priced equipment.

The Hub, launched by the Wellcome Trust in January, offers £1 million and a space at the Wellcome Collection museum and art gallery in London to teams conducting interdisciplinary art and science research. Applications are due by 3 May.

## ARTFUL STUDENTS

Graduate students who want to pursue both art and science have multiple options. Universities are responding to the demand from students with hybrid interests, who want to pursue the coupling of art and science rather than be forced to choose between the two, says Roger Malina, an astronomer at the University of Texas at Dallas and editor-in-chief of *Leonardo*, the journal of the International Society for the Arts, Science and Technology. His university opened an Arts and Technology (ATEC) programme in 2004; last year, Malina, launched an ATEC PhD programme that currently has 55 students and is planning to double in size in the next few years. "I'm sceptical of hyped-up claims that art–science is the next big thing, but I think it's really important and will definitely keep growing," says Malina.

He adds that other universities are also experimenting with how best to fuse art and science. Some, such as MIT, UCLA and the University of California, Davis, offer student training at their art–science centres or labs. In France, a partnership across the scientific research institutes and the decorative- and performing-arts centres of Paris Science and Letters has launched the Science, Art, Creation, Research PhD programme. Students are, for example, creating living pictures with microalgae.

And such training can help newly minted PhD holders to expand their job search to



**Christina Agapakis has created cheese using starter cultures from the human body.**

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include art-related posts. “We are starting to see a few positions for hybrid art–science professionals, and I believe this will continue to grow,” says Malina. Nadarajan notes that Google and IBM are hiring graduates with design backgrounds for their research and development teams; and companies such as 3M and Proctor & Gamble have a steady demand for those skills in their efforts to develop innovative materials.

Neuroscientist Siddharth Ramakrishnan is convinced that his work — which included an interactive exhibit focused on the *Hox* genes that define body regions in all animals — proved beneficial during his job search last year. “My art collaborations helped me stand out rather than being just one of hundreds of other neuroscientists who had done successful postdocs,” he says, noting that interviewers found his proposals for campus-based art–science salons intriguing. In October, he started a job as an assistant professor at the University of Puget Sound, a liberal-arts college in Tacoma, Washington.

#### UNCERTAIN PATH

Not all research institutions or scientist colleagues embrace art–science collaborations. “You have to be aware that you could possibly jeopardize your career,” says Lotto. “Many universities don’t know how to assess the output of collaborations and some even actively discourage them.”

Steve Potter, a neuroscientist at Emory University in Atlanta, Georgia, agrees. For the past decade, he has worked with artists at SymbioticA, an art–science studio at the University of Western Australia in Perth. One project, called MEART, connected a robotic arm to a network of rat neurons cultured on a multi-electrode array, to study the essence of creativity. But even though his department supports his endeavours, Potter knows that some colleagues are less accepting. He advises young scientists eager to pursue dual interests to consider joining an art department. “The safest thing to do is join a department that is open-minded; often that is more likely to be an art department,” he says.

Systems engineer Leila Madrone says that aspiring artist–scientists should not despair if they have to do their art on the side at first. “Sometimes my work and art interests merge and sometimes they separate. It’s most important to work in a creative environment,” she says. As an undergraduate in MIT’s media lab, Madrone combined giant Tesla coils, which put out stunning arcs of high-voltage electricity, with robots to create an interactive musical performance. In 2006, she headed to NASA’s Ames Research Center in Moffett Field, California, to join the Intelligent Robotics Group. There, she worked on GigaPan, a robotic panoramic image-capture system. Now she is one of about 25 engineers at Otherlab, an independent engineering lab



The ‘Blue Morph’ uses images and sounds from the metamorphosis of a caterpillar to a butterfly.

in San Francisco, California, that focuses on innovation in areas such as robotics, solar energy and electric vehicles. She does not have the security and benefits that she might get at a larger, established company, but there are perks. “I get to define what I am doing — which is why, I think, people are attracted to this path,” she says.

That path is not for everybody. “There is no recipe for a career in art–science,” says Malina. Rather than looking for a formula or a well-trodden path, he says, students should identify specific career goals and develop the skills to achieve them, such as learning computer programming and design principles. And students might consider whether those hybrid skills are best suited to distinguish their art–science research aims, attract collaborators or simply provide a vehicle for artistic expression.

Agapakis is confident that she will continue to create her own opportunities. She has just finished a three-week stint helping to teach a graduate-level media design course focused on biotechnology at the Art Center College of Design in Pasadena, California. “For me,” says Agapakis, “playing it safe is riskier because I wouldn’t be pursuing the things I’m most passionate about.” ■

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#### CORRECTION

The Careers Brief ‘Online journal club’ (*Nature* **496**, 261; 2013) wrongly gave the impression that the journal club mentioned was the first to go online; it was, in fact, the first to use the Journal Club Live platform.

#### NIH

### Postdoc pay rise

Entry-level postdocs funded by the US National Institutes of Health would get a 7% stipend increase next year under President Barack Obama’s proposed 2014 federal budget. New PhD recipients who receive the Ruth L. Kirschstein National Research Service Award (NRSA) would earn US\$42,000; those with a year or more of experience would receive a 4% rise over existing levels. “This is a huge step forward in recognizing the value of postdoctoral researchers’ contributions,” says Cathee Johnson Phillips, executive director of the National Postdoctoral Association (NPA) in Washington DC, which since 2001 has been advocating for the entry-level stipend to increase to \$45,000. The stipend rose by 1% in 2009 and 2010, and by 2% in 2011 and 2012. A 2011 NPA survey found that half of US institutions base postdoctoral pay on the NRSA.

#### FACULTY

### Non-tenured jobs grow

The number of full-time non-tenure-track faculty members at US institutions grew by about 13% from 2007 to 2011, compared with 11% for part-time faculty members, a report finds. *Here’s the News: The Annual Report on the Economic Status of the Profession, 2012–13*, published on 8 April by the American Association of University Professors (AAUP) in Washington DC, also notes that more than one-fifth of assistant professors were off the tenure track in 2010–11. “Even among ranks that we would think of as tenure track, a significant proportion of faculty are not,” says John Curtis, AAUP director of research and public policy.

#### UNITED STATES

### Chinese applications fall

The number of applications to US graduate schools from students in China fell this year for the first time since 2006, when the US Council of Graduate Schools (CGS) in Washington DC first had sufficient sample sizes to keep track. An 8 April CGS report finds that total international applications to the United States grew by 1%, the smallest rise in 8 years. Chinese applications fell by 5%, after growth of 19% in 2012 and 21% in 2011. Services that help students to narrow down their choices may be a factor, says Rajika Bhandari, deputy vice-president for research and evaluation at the Institute of International Education in New York, as may be the cost of US applications.