{FROM THE QUAD TO THE STAGE TO THE LAB, MADISON EXPLORES THE COMPLEXITY OF GENETICS}

SEE THE SCIENCE

A couple of scientists and some dancers walk into a Chinese restaurant. It sounds like the beginning of a bad joke.

It really happened, though.

The scientists joined the dancers to talk about deoxyribonucleic acid. You may know it as DNA. Over dinner, as they talked about amino acids, proteins and ribosomes, someone suggested a visual aid might help.

So the scientists, Judy Dilts among them, turned napkins, knives, forks, spoons, chopsticks and glasses around to demonstrate the intricate way DNA sustains human life. The dancers grabbed a mini video camera, capturing the impromptu science seminar.

"If you can use analogies — things people see — sometimes it's easier for people to pick up the concepts," says Dilts, associate dean of the College of Science and Math who has been known to get her own students up in front of the classroom to demonstrate protein synthesis.

The dancers with whom Dilts and other JMU professors were sharing Chinese food included choreographers from the D.C.-based Liz Lerman Dance Exchange. The dinner was a planning session for a yearlong exploration of science at JMU, an investigation that uses the arts as that analogy, the spark for a conversation about some of the most complex scientific issues of our time.

EXHIBIT, DANCERS, AND QUAD DANCE PHOTOGRAPHS BY DAN GORIN ('11); *FEROCIOUS BEAUTY: GENOME* BY KEN KENNEFICK

(Left): Ali Hammond ('11) puts final touches on a double-helix sculpture that includes close-ups of facial features as art of an advanced photography class exhibit. (Right): A scientist's question spurs the creative process. Gregor Mendel, the 19th-century scientist who studied the inheritance of traits in pea plants, comes to life in the Liz Lerman Dance Exchange performance, *Ferocious Beauty: Genome*.

BY BRAD JENKINS ('99)

DANCE

(Above): A master class in motion, conducted by Liz Lerman Dance Exchange, with JMU dance students in the Forbes Center. (Left): Freshmen embrace science in the Dance of Art and Science during Orientation on the Quad.

Many of the yearlong explorations and discussions happened in perhaps the unlikeliest of places on campus: the new Forbes Center for the Performing Arts, where a soprano recital or musical comedy usually draw audiences. Here, almost as far as you can physically be from students in biology and chemistry labs on the east side of campus, science and art merged in a way uniquely possible at Madison.

Students wrestled with the complexities that arise from genetic advancements. Dancers and poets interpreted intricate biological processes, giving audiences a dynamic view of what usually is seen only under microscopes. The university community pondered a future where genetics will be a major player for everyone from biologists to businessmen.

"We believe all citizens need to be scientifically and quantitatively literate," says Jerry Benson, interim provost and senior vice president of academic affairs. "Just as important, we want to show that there are many ways to experience and understand science so science is accessible to all students."

With opportunities and possibilities widespread since the historic mapping of the human genome 10 years ago, scientists' knowledge of how genetic anomalies contribute to some diseases is growing, as is the ability to treat those ailments. Still, the deeper scientists dig, the more questions they unearth. The implications run the gamut, from health care (what do you do if you know you have a lethal gene?) to business (what are the ethical issues for companies who sell genetic testing?) to politics (what role does the government play in regulating how far we push the limits of science?).

The possibilities are real. Consider: You could get online right now, point your Web browser to one of several genetic-testing company sites, and within days, you could be spitting into a vial that will make its way back to a lab where your DNA will be analyzed within six to eight weeks. Then, you'll be back at that same website, finding out what ailments may be lurking in your future. And you can do it — as one site promises — for just $199.

But should you?

This question is deeply personal. Yet society must address the resulting issue: What should we do with this knowledge? Producing students who can participate in that discussion is at the heart of a rigorous education, Benson says. "The educational experience to meet this goal must include a focus on both the specialized knowledge typically associated with a student's major, but also broad integrative knowledge that requires students to frame complex societal problems and issues from the various perspectives of the humanities, arts and science," he says.

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> — JERRY BENSON,
> *interim provost and senior vice president for academic affairs*

THE DANCE OF ART AND SCIENCE

A yearlong academic emphasis on the "Dance of Art and Science" is just one example of how JMU educates and trains students to participate in society's most complex issues.

JMU's newest students confronted the issues before they even arrived for Orientation in August. At home, all 4,000 freshmen had an assignment: Read nine *New York Times* stories about the issues that genetic advancements raise. The articles were part of a two-year series by *Times* reporter Amy Harmon, who won the 2008 Pulitzer Prize for her work and who came to campus in February to talk with students.

Her series, "The DNA Age," includes emotional stories of people faced with the fallibility of their own genes and the decisions they confronted because of the information they received.

Take Chad and Colby Kingsbury. Following in vitro fertilization, the couple tested their eight-cell embryo, wanting to make sure the embryo implanted into Colby Kingsbury did not have a defective gene that causes colon cancer, a gene that ran in her husband's family. The embryo did not, and it was implanted and later became the daughter they are now raising.

In small groups with faculty facilitators, students contemplated the circumstances of this embryo-testing example and numerous other scenarios. How should we respond when science gets ahead of current policy? How much science does a nonscientist need? What are the implications of sharing your genetic information

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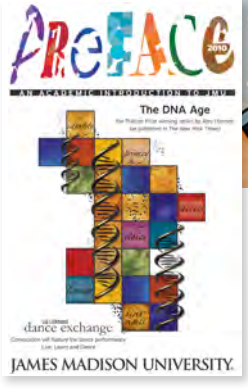

A PULITZER VISIT

In February, students met Amy Harmon, the author of this year's freshman reading selection. Harmon's multi-part series *The DNA Age* won a 2008 Pulitzer Prize for its exploration of the decisions brought on by genetic knowledge. Harmon brought several of her stories' sources into the discussion, including a woman who, after discovering she has a gene that makes her more likely than others to get breast cancer, had both breasts removed. "The knowledge they receive gave them choices they wouldn't have had without the DNA testing," Harmon told the hundreds of students at her lecture.

HARMON PHOTOGRAPH BY DAN GORIN ('11)

with family? Is stem-cell research that results in the destruction of an embryo OK in the name of curing diseases?

For Carly Starke, a JMU biotechnology major from Clarksburg, N.J., "The DNA Age" discussions were more than academic. Her father has multiple sclerosis, and Starke ('14) says the stories revealed to her the possibilities of DNA testing.

These possibilities really hit home during winter break, when doctors diagnosed Starke's mother with breast cancer. Starke thought back to one of "The DNA Age" stories she had read, the personal story of 33-year-old Deborah Lindner, whose mother had been diagnosed with breast cancer and had a mastectomy at 48. Deborah Lindner and her mother, they discovered, shared a defective copy of the BRCA1 gene, and that raised Deborah Lindner's risk of getting breast cancer sometime in her life 60 to 90 times.

With no signs of cancer (including a clear mammogram), but the high risk of getting it in the future, Deborah Lindner had both breasts removed, lowering her risk of cancer by 90 percent, but causing anguish among family members who didn't understand her radical approach to her errant genes.

Starke had gone into the freshman readings thinking about genetic testing because of her father's MS. Now, she's thinking about both of her parents' ailments. "Could I be predisposed to breast cancer," she wonders. "Could I pass it on to future children?

"I fall right in the middle still," Starke says. "It would be good to know. You could prepare for it, potentially treat it. But I don't know how my mind-set would be knowing."

In the next three years, as she continues to delve into her biotechnology major, Starke hopes to find her answer. Maybe her research will cross paths with an art major's exploration of ethical issues?

Liz Lerman Dance Exchange Choreographer Elizabeth Johnson visited campus several times. She helped freshmen dancers turn the process of cellular respiration into a dynamic visual experience.

THE RIGOR AND LANGUAGE OF ART

Torsos spin. Feet leap. Hips twirl. Bodies roll across the hardwood floor as 15 freshman dancers warm up for an evening rehearsal inside the Forbes Center's new dance theater.

Elizabeth Johnson, a choreographer with the Washington-area Liz Lerman Dance Exchange for a Dance of Art and Science residency program, tracks the movements. Johnson, in black yoga pants and a woolen hat with multicolored stripes, gathers the group, and offers some advice. "Not all of the protons move at the same speed, so not everyone has to move so fast," she tells them.

Wait. Did she just say "protons?" Well, of course. How else would she tell them how to create a dance that interprets cellular respiration, the intricately complex process the body uses to harness energy from the food it takes in?

"In dance, we are used to tackling different concepts and putting them into movement," says Joanna Rose ('11), a senior dance major who helps lead this group of freshmen dancers. Doing that requires research. For this dance, the group collaborated with biology professor Carol Hurney, who offered the dancers a science lesson. The descriptive words she used in her lesson became the thread of the dance movements: carry, transport, slice, energize, break.

"It's a process," says Rose, who is referring to cellular respiration, but could just as well be talking about the process of interpreting science with a dance. "There are a lot of different steps."

For Logan Van Meter ('11), a senior in the School of Art and Art History, the steps started with research and ended on a canvas in the collaborative senior class exhibit *The Chromo Zone: Photo-genetic Art.*

During fall semester, Van Meter and four other seniors in art professor Corrine Diop's Advanced Color Photography class researched genetic issues and possibilities to develop a photo exhibit at Harrisonburg's Smith House gallery.

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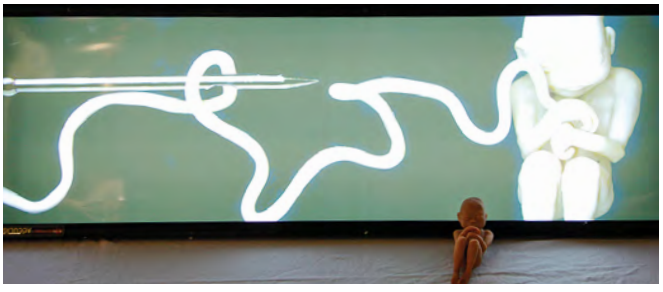


Students in the School of Art and Art History Advanced Color Photography class researched genetic issues and developed the *Chromo Zone* exhibit for Smith House gallery.

PHOTOGRAPHS BY DAN GORIN ('11)

Photos in the *Chromo Zone* exhibit by Logan Van Meter explore the ethics of creating "designer babies." He says his work acts as a "catalyst for thought."

Van Meter researched the ethical questions that arise when parents can manipulate DNA to create a "designer baby." It's possible already to select a child's sex and to screen for disabilities. If it becomes possible, should parents be able to predetermine cosmetic traits? "A baby, please. Blond, freckles — hold the colic" is how the *Wall Street Journal* put it in a 2009 story exploring the issue.

Van Meter says that digging into the questions surrounding designer babies and illustrating them with photos was "intense." He portrayed the dilemma with larger-than-life close-ups of a toddler's face showing different genetic/cosmetic choices. The images greeted visitors to the gallery with the instruction "Select Your Child's Eye Color."

"You start to learn about genetics, and it is astounding, and a really profound shake-up," says Rhonda Zingraff, associate dean of the College of Integrated Science and Technology who provided much of the leadership for the Dance of Art and Science initiative.

The shake-up — that's where the Liz Lerman Dance Exchange comes in. The arts, the group's eponym says, is the "town hall meeting" of our time. It can be one of the languages that bridges the gap between scientists and the rest of us.

Of course, that's true of many of history's major issues. "As human culture evolves, it tells its most important stories through the arts," says Linda Cabe Halpern, University Studies dean and an art historian. "It's part of how we understand ourselves as humans. Arts really are the place where people work out the real business of life and human aspirations."

SCIENCE AND CREATIVITY

Tell someone a university is looking at science through art, and they'll probably raise an eyebrow. But bring together two giants in their fields and you reveal the true power and insights of cross-disciplinary collaborations in the classroom and in research.

Choreographer Liz Lerman and scientist Francis Collins bring that perspective to their disciplines. Both agree that science and art are not so different in their approaches.

> 'Creativity is really what art and science strive for.'
>
> **— FRANCIS COLLINS,**
> *chief of the National Institutes for Health and mapper of the human genome*

After Lerman's company presented *Furious Beauty: Genome,* a modern dance that presents the questions genetics raise, the choreographer and

PHOTOGRAPHS BY DAN GORIN ('11)

Choreographer Liz Lerman, far left, with Francis Collins, says, "I think the question is, what are we going to do with our scientific knowledge?"

scientist casually sat on stage after a Dance of Art and Science event in January. Surrounded by the show's dancers, Lerman and Collins discussed the similarities in their fields.

Collins led the mapping of the human genome 10 years ago. During this discussion he recalled his work developing a treatment for progeria, a disease that causes children to age at seven times the normal rate. It affects fewer than 100 children worldwide, and most die from a stroke or heart attack when they are 12 or 13.

Collins had researched the disease for two decades when a post-doctoral student asked to help. He gave her a hypothesis, one that he was almost sure was wrong, but, he thought, at least she had a place to start. "Sure enough," Collins said, "the hypothesis was absolutely, completely, off-the-wall wrong."

Along the way, though, Collins learned some things about the disease no one else had. This led to a clinical trial of a drug that could help. Not a cure yet, the trial has so far succeeded.

"Creativity is really what art and science strive for. Some science is not that creative. You turn the crank and do the next obvious experiment," Collins says. "But those moments where science becomes something exciting is when you take that creative leap, and you say, 'I don't really know what I'm doing, but I've got this wild, crazy idea that maybe life works that way.'"

Lerman, who has worked with other universities on projects that use dance to explore various disciplines, says "Issues such as genetics ethics can't be decided by scientists alone. Ask a big question, and you need more than one discipline to answer it."

BREAKING THROUGH DISCIPLINARY BARRIERS

"Societies and higher education put people in these silos that are artificial," says Carol Hurney, executive director of the JMU Center for Faculty Innovation. Hurney was a star of an August Dance of Art and Science event that featured 4,000 freshmen creating a gargantuan replica of DNA. The freshmen, in neon orange, blue, yellow and red shirts (each color representing a different base in the DNA structure), shimmied, held hands and spun around as a massive double helix in the center of campus, stretching the length of the Quad. Donning a cycling jersey with two yellow paw prints and "Go Dukes" emblazoned on the back, Hurney then pedaled her bicycle through the double helix, "unzipping it" as it replicated.

It's an apt metaphor for JMU life, and in the end, the way students will gain the knowledge to tackle deep issues tied to complex science like genetics, says Hurney. Just as DNA has to be unzipped to work, so, too, JMU students can't live isolated; they must open themselves up to faculty, other students and the community.

"If you just show up and think I'll fill your head, you're not participating in the college experience," Hurney says. "Participation is the first step in becoming a part of a community."

Tisha McCoy-Ntiamoah, director of JMU's orientation programs, says the August Dance on the Quad emphasized how vital community is to the whole Madison Experience. "No matter their major, no matter their background, students must collaborate and engage in society," says McCoy-Ntiamoah. What they learn in their liberal arts classes — the wisdom of the ages and the promises of the future — will inform them no matter what they specialize in.

> The GenEds — history, sociology, literature, the humanities, and yes, arts and science — "that is the real stuff" of life.
>
> — **CAROL HURNEY,** *executive director of JMU's Center for Faculty Innovation*

Professors, meanwhile, show students that General Education courses aren't just something to get out of the way so they can move on to the "real stuff" of their major. "The GenEds," Hurney explains — history, sociology, literature, the humanities, and yes, arts and science — "that is the real stuff" of life.

Biology professor Carole Hurney, wearing a helmet-cam, "unzips" the human strand of DNA created on the Quad by 4,000 freshmen during Orientation. The experience introduced them to the complex intellectual issues they will encounter over their academic careers.

That perspective lured Brittany Hoehlein, a freshman from Long Valley, N.J., to JMU. While visiting and applying to more than a dozen schools, she told admissions counselors that she wanted to "major in dance but also something else." Most other colleges discouraged her from choosing a double major. "Here," Hoehlein says, "I was told to use the two majors to complement each other." She's majoring in dance and kinesiology. "JMU wants to create fully well-rounded students who go out and make a difference in the world," she says. "Nothing can exist on its own."

Biology and biotechnology students in the Biotechnology Lab 480 perform DNA straining.

That's true within the sciences, too. "Genetics is deeply ingrained in all other [biological] disciplines," says Tim Bloss, a biology professor. "And one needs to understand how they all fit together before one can understand one discipline completely." That, Bloss says, creates a science student prepared for the rapidly changing world of genetics.

Part of that preparation is being able to communicate with a non-scientific public. Hailey Huebner, a junior from Waterford, Va., has picked up that theme in numerous classes. "A lot of the professors are good about making sure we understand that not everyone understands what we are learning. We're not the ones making the decisions, and we're not the ones spending the money for us to do the stuff we do," she says. "It's important to be able to relate to those outside of the scientific community: those who approve grants or market what we do. It's important to communicate that this is what we did and this is how it's helping you."

'This is the century of biology. It's going to be a wild ride. ... It's going to get more complicated as we go along.'

— FRANCIS COLLINS,
chief of the National Institutes for Health and mapper of the human genome

Huebner, who with other students has been researching fish and rats to discover how a particular enzyme may be depleting estrogen and causing health problems in menopausal women, was part of an hour-long conversation Francis Collins had with biology students when he visited JMU in January. Collins discussed genetic advancements, induced pluripotent stem cells, the ethics of genetically modifying humans and the science-religion connection.

It's what Collins told the students as he prepared to leave —when he became more career counselor than scientist — that stuck with Huebner.

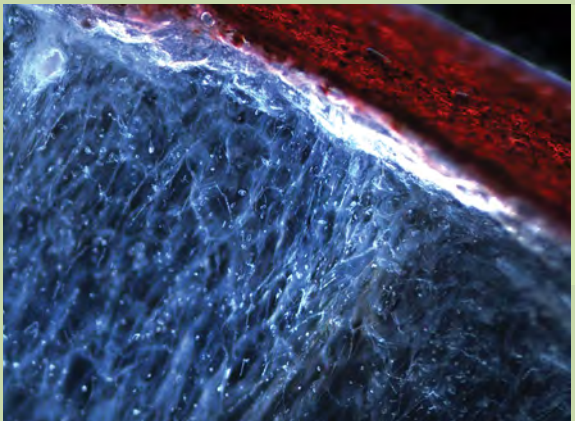
"This is the century of biology," Collins told students. "It's going to be a wild ride. … It's going to get more complicated as we go along." But scientists can't be the ones who make the final call on what to do with the knowledge we gain from genetic research. It'll take people from a host of disciplines to decide what to do with the advancements.

"It will be breathtaking," Collins added.

Breathtaking. Like art. And science. If we equip future leaders to make the right decisions.

Breathtaking. m

IT'S ART; IT'S SCIENCE: IT'S A GRAPE?



THE DANCE OF ART AND SCIENCE CONTINUES:

Watch the DNA Dance on the Quad! Listen to a DNA serenade by Francis Collins! Watch Dr. Collins' lecture. See more art. Read more stories.

See it all at www.jmu.edu/link/das

Can you guess what it is? It's a grape! Biology students took an artful look at objects under the microscope during a microscopy class and then created an exhibit of their photos. Take a look and try to guess what the images are at www.jmumicroclass.blogspot.com.

LAB PHOTOGRAPH BY DIANE ELLIOTT ('00); GRAPE BY TINA SAFAVIE ('11)