THE LEWIS & CLARK
Chronicle
FALL 1996 VOLUME 6, NUMBER 1

Broide connects apple to moon

Michael Broide, assistant professor of physics, holds a spinning bike wheel as he steps onto a platform that can rotate. He flips the bike wheel over and rotates to the left. When he flips the bike wheel over in the opposite direction, he turns to the right.

"This is kind of strange," he says as students and parents watch in amusement. "Just moving a wheel around can set you in motion. I think it's pretty great."

That's how Broide greeted the Class of 2000 and their parents at Opening Convocation, Aug. 29. Here's what he said:

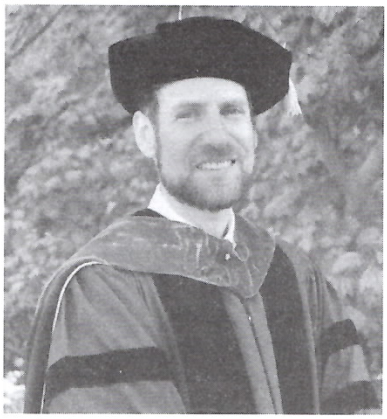
When I started college, I thought for sure I was going to be a pre-med student. And then I took a physics class, and I saw this demonstration. And for me it was love at first sight. I simply had to know more about physics. I had so many questions about the physical universe that I wanted to get some good answers to. Simple questions like how does a rainbow form?

'I was surprised to learn that creativity plays a huge role in scientific discovery.'

Why is the sky blue? Why does middle C on a piano sound so different than middle C on a flute? And importantly, where should I hold the boom of my wind surfer to go the fastest? These were questions I cared about because they had to do with things that I experienced directly, with my own eyes and ears and hands.

And then there were those really big questions. What is matter made of? What are the building blocks of an atom? What fuel powers the sun? When did the universe begin and what is its fate? Not just to the year 2000, when you graduate, but far beyond that? And what exactly is time?

In my second year of college, I did it. I decided to be a physics major. And it was one of the happiest days of my life. Now for my parents, I'm not so



Michael Broide, assistant professor of physics

sure that was the case. I remember getting a nervous phone call from my mother. She had looked through the classified ads in the *Los Angeles Times*, and she couldn't find a single job offer for a physicist. But we talked about it, and in any case, there was no turning back for me.

As I continued taking physics classes, I was surprised to learn that creativity plays a huge role in scientific discovery. Everyone knows the story of Newton and his apple. What really happened?

Newton was sitting in his yard, and an apple fell to the ground. Well, we've all seen that. Gravity pulls an apple down. But what Newton did that was so different is, he looked up. He looked up, and he thought, "Well, if gravity can reach to the top of the tree, maybe gravity can reach beyond the tree, beyond the atmosphere, out into space. Maybe," Newton thought, "gravity can reach the moon. And if it does, then maybe it's gravity that holds the moon in its orbit around the earth."*

In a giant leap of imagination, Isaac Newton connected the motion of an apple, an earthly object, to the motion of the moon, a heavenly object. His insight does not follow from the mere facts, such as "the apple is red," "it landed over there," "it rolled," "it went down there." No. His insight is personal and original, like a painting or a poem. Of course, it follows from the facts, but it's his interpretation of the facts, his creativity. That's what amazed me as a student and still amazes me today.

Another feature of physics that appealed to me in college is the simplicity and, therefore, the beauty of its theories. Newton's theory of gravitation says that any two objects, big or small, are attracted to one another. That's it. That's the whole story. You are attracted to the earth, and that force holds you down in your seat. The oceans are attracted to the moon, and they bulge toward the moon, causing the tides. The planets are attracted to the sun, and this force swings them around in their orbits.

Now for small objects, like a bagel and cream cheese, for example, the gravitational attraction is weak, as you must know. But with a delicate balance, you can actually measure this weak force between two billiard-sized lead balls. In fact, it's an experiment we do in one of our upper-division courses. Based on the measured force and armed with Newton's theory and a pencil and paper, you can calculate a remarkable thing—the weight of the earth. The weight of the earth from just two lead balls and a bunch of math.

By now, many of you are probably thinking, "He's trying to get me to major in physics!" No, that's not my intention. I believe that you should pursue all sorts of subjects to find out the thing or things that you truly want to do. For me, that is physics. For you, it may be art history or English literature. The main thing is to be open to trying new subjects. That is how I found physics, and that is how you will find your calling.

Yes, I've got physics in my bones. And seated behind me, each faculty member carries the same passion for his or her chosen field. What brings us together as a community is that we love to learn. We look forward to helping you develop new ways to express yourself, new ways to experience the world, and new ways to connect the apple and the moon. ■

* *Broide credits this poetic way of expressing Newton's discovery to J. Bronowski,* Science and Human Values, *Harper & Row, New York, 1956.*