Penny Hopkins is crazy about crabs, *Uca Pugilator*, or fiddler crab, in particular. "Wait till you see them," she tells visitors to her lab in the zoology department at the University of Oklahoma. "They're really cute."

Her fascination with the little critters, however, goes well beyond their good looks. During the past 30 years, Hopkins has earned an international reputation for her research of crustaceans, from the basic mechanics of leg joints to the intricacies of intracellular chemical reactions associated with regeneration.

Robert Taylor

Proving that beauty indeed is in the eye of the beholder, OU zoologist Penny Hopkins describes her research subject—the *uca pugilator* or fiddler crab—as a "really lovely animal."

"I like to think I'm just looking for basic things," says Hopkins, who was named a Samuel Roberts Noble Foundation President's Professor this spring. "I want to know how come this little crab can do something, and I can't."

That "something" is the remarkable ability to grow new body parts to replace ones that have been lost or injured. Hopkins' papers, such as, "Ecdysteroid and retinoid receptors in the early blastema of regenerating limbs in the fiddler crab," do not translate easily to lay terms, but her enthusiasm for her topic is an easy read. It is on her face and in the motions of her incredibly articulate hands.

"You know how steroids work? . . . No?" she asks, giving one the benefit of a doubt before launching into a basic biology lesson. "All steroids, because they are small molecules, pass through the membrane into their target cell. They pass into the nucleus and interact with receptor proteins that function together to turn specific genes on or off.

"Crabs have steroids that interact with receptor proteins to turn on the genes which tell a limb to start reorganizing," she explains. "We have cloned the genes for the receptors of the hormones that control regeneration in crabs, and one of them looks very much like a human gene in one specific region."

Could this mean that humans might be able to use this gene to their advantage one day and regenerate organs of their own? "Well, that's very far down the line," admits Hopkins, "but we're certainly finding some basic similarities."

This summer, Hopkins will speak in Germany at an international workshop on ecdysones, a steroid associated with regeneration in crustaceans. Although she normally enjoys travel, she will be anxious to get back to her lab, where she, her collaborator, David Durica, and research assistant Kristi Housman are closing in on an elusive "hedgehog." Named for its spiky appearance, the hedgehog gene has been identified in the fruit fly and in vertebrates, but not, as yet, in crustaceans. Hopkins explains that the hedgehog is expressed during the initial differentiation of limbs in the embryonic development of vertebrates. "Hedgehog gives the message, 'Okay, this is the top and this is where the thumb needs to go, etc.,' " says Hopkins. "We would be very excited to find this gene or its homologue in the fiddler crab."

Another compound, which they also hope to identify in the crab, is a fibroblast growth factor associated in the early organization of the limb bud. Like hedgehog, FGF is associated with vertebrate differentiation. If they locate FGF in the crab, Hopkins says, the discovery would further substantiate the highly conserved nature of developmental processes, which means that evolution has narrowly defined the basic path along which varied species develop.

"Although animals are very different in appearance, at a biochemical level they are very, very similar. The enzymes in a cell that break down glucose are virtually identical between an amoeba, a worm and a human. And we've known for a long time that DNA [of different species] is made up of exactly the same components," she explains. "What we don't know is how far along the scheme of things these similarities go."

Hopkins always has been fascinated with the "why" and "how" of things. Growing up in Houston she spent many afternoons on the beaches of nearby Galveston. She remembers examining jellyfish she picked up on the beach. "As a kid I was really interested in how things worked," she says. She began studying endocrinology in high school and graduated from Texas Tech with a double major in English and biology.

From Texas she moved to New Orleans and, in the late '60s, lived in an 18th century house in the French Quarter while earning her master's and Ph.D. at Tulane. "A lot of grad students lived in the Quarter at that time. There were always huge potluck dinners, and during Mardi Gras, we could stop at friends' houses all along the parade route," she recalls fondly. *Continued*

In 1970, Hopkins took a postdoctoral position with the American Museum of Natural History in New York City. While in New York, she met and married a jazz musician and settled into a loft on the city's lower east side. She remembers her home being filled at all hours with musicians and writers. "I didn't get much sleep," she laughs, "but it sure was fun."

After seven years in New York, Hopkins' marriage ended, and she decided to pursue her career closer to family ties in Texas. In 1977, she applied and was accepted as an assistant professor of zoology at OU, at that time the only tenure-track woman in the department. "The week before I moved, I thought 'What have I done, leaving New York for Oklahoma?' My friends came over and packed my things or I never would have made it," she says. "But I can't imagine living in New York City now. I love Norman; I really do."

Her involvement with the community backs up her claim. In addition to a lengthy list of University committees, including a term as chair of the Faculty Senate, she has served on the boards of both the Women's Resource Center and the Firehouse Art Center and as a volunteer for Second Chance, an organization that finds homes for abandoned animals.

Hopkins, who finds it difficult to turn down a stray, currently shares her home with five cats, one of whom is deaf. She has taught the white male, Buster, an abbreviated sign language. For example, a 'V' for victory sends Buster running to his food bowl. There are also signs for "no" and "come here," although Hopkins says that if Buster does not like the command, he simply looks in the other direction.

Although Hopkins does not like to leave either her cats or crabs for long, every once in awhile, an adventure comes along that is too good to resist, like hiking in the Himalayas for her 50th birthday.

"It was a wonderful trip. I hired four sherpas and went into the mountains," she says. "It was monsoon season, so it was very dangerous. The first night we were out, lightning hit the ground right outside my tent." In spite of nearly being toasted and having to climb down the mountain with a sprained ankle, Hopkins recalls the whole trip as an incredible experience, delightfully outside the boundaries of contemporary American culture.

Robert Taylor

Using the high pressure liquid chromatograph in this photo, Samuel Roberts Noble Foundation President's Professor Penny Hopkins can separate out the hormones that control regeneration of body parts in crabs.

Hopkins seems to be blessed with good karma when she travels, like the time she got lost walking alone on the streets of New Delhi. "I stopped and asked a work crew how to get back to my hotel," she says. "After arguing among themselves, they finally agreed that they should just stop what they were doing and give me a ride. So I jumped in the back of their truck, and they took me right to my hotel."

Although last year found Hopkins in Italy, Japan and Boston, she is "really into cocooning right now." She had better rest up while she can. Any day now her catalog order should be in, and it will not be J. Peterman who comes a'calling. Instead a thousand fiddler crabs, more or less, from the Gulf Specimen Company will be making their way from the sandy beaches of Panacia, Florida, to their new digs in Richards Hall.

"We keep the aquarium in the lab tilted so they can have a beach," says Hopkins, who, by this time, knows how to make a crab feel at home. "They're really lovely animals. I try to impress upon my students that it's not just the genes we're interested in, but the biology of the whole animal, how it lives its life.

"A good thing about the crab is you don't have to harm them for research. If you just squeeze their leg with a pair of forceps, off it comes. That's how they protect themselves when birds grab them by a leg. It's called autotomy," she explains. "There's no tissue damage, you see, because they have a special little joint.

"There's a double membrane in there," she says, demonstrating the joint with her hands. "Part of it seals the wound, and the other part holds the severed nerve in place, and what we're showing is that nerve is necessary for the organization of the new limb. It regenerates. I think that's so interesting. That's why you stay in research ... you think it's so interesting. How do they do that?"

—*Lynette Lobban*