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A Quiver of Wonder

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From a conversation between University education professor Karen Eifler and chemistry professor Sister Angela Hoffman, in the book *Becoming Beholders*, from Liturgical Press, which will be published this fall. Sister Angela holds *four* patents for her work on recovering paclitaxel from soils and plants to use in cancer-fighting drugs like taxol.

Being a Benedictine nun — does that make a difference in how you teach chemistry? Are you conscious of that ancient spirituality having an impact on work with students?

Sr. Angela: Well, there was never a time in my life when I *didn't* think that everything is a sign of the presence of God, which is of course a big part of Benedictine spirituality. Everything has a chance to reveal something about God. I think the sense of mystery can't be helped when we simply start trying to explain what it is we are seeing. *The word mystery often pops up in the same conversations as grace and sacrament. That's how you mean it?*

It just makes sense to talk about wonder and mystery when we try to explain why things work so well. What physical evidence demonstrates over and over is that things work. Everything is connected to everything else in some way, and our job as biochemists is to figure out those relationships. I tell my students that we come at this work from a point of wonder, not a point of mechanism. This is something I have to communicate to my students who think they are going to get all the answers out of their textbooks: science is about the unknown, whereas textbooks are about the known. A chemist's entire life's quest might end up being two sentences in a textbook, because real chemistry is not about books. It's about the next set of questions.

Sounds like you are teaching patience, along with facts and questions.

Teaching students how to fail well is an important aspect of my teaching. They make a lot of mistakes. Their experiments and models don't explain how life works they way they planned them to. I am always telling them that failing is the surest chance of learning, and not to waste a chance to learn by failing to learn from your mistakes.

Describe a specific example of a classroom practice that helps you foster the kind of patience and resilience you are describing.

Let's say we are poking around the world of potassium-sodium ion channels. This is not a static thing. It is an elaborate set of interacting processes. I assign them the task of drawing a model of what they think that situation looks like, and then they have to explain why their model makes sense, given all the facts we have acquired from lectures and lab and reading. And they have to link that model and their own argument to another chemical reality. They have to

make their thoughts and reasoning very visible and they have to defend those to others who did the same task. Students are always saying that this makes them think of stuff they never dreamt of on their own, and it almost always leads them to more questions and see more possibilities of "correct" answers in the most unexpected places. Or right in front of their noses: literally, like the student who found herself wondering how many moles of air there are in a typical human breath. Someone else was reading a *1994 Saturn Owner's Manual* and got to wondering how much sodium azide it would take to fill up the car's four-liter airbag. It's those kinds of questions that make me know I am teaching real scientists, not parrots.

Do your students get to see your own thinking made visible?

Sure. I show them that all the time. Take my paclitaxel research, which my upper division students are involved with. I was looking at this one compound in yew trees and wondering why it might be that a plant would produce something that could possibly cure human cancers. Could that same chemical be in the plant as a kind of self-protection? What does a plant need to protect itself from? Something in the environment? If this model of explanation works, can we use it, or adapt it to a human environment? These questions all have long, intertwined answers that can all be traced back to the premise that God puts things together for a good reason, and those knots can be loosened if we do our biochemistry really well. I'm not afraid to use that language, and my sense has been that students who enroll at a place like ours are not only receptive to that spiritual dimension, they come in expecting it...but they also want to learn excellent biochemistry which prepares them for graduate research and medical school. I never apologize for the wonder in my voice when I am explaining something like potassium-sodium ion channels; I really hope that quiver of wonder comes through. I've never had a student complain about it. I have had atheist students say that they sense something different — something special from the inside out was the way one person put it — in my courses and labs. It's impossible for me to separate good teaching from spirituality.

One last question: how do you teach students the resilience necessary to keep moving beyond those failures, and keep seeing failures as opportunities to learn?

Kleenex and cookies. Your first reaction as a Benedictine has to be hospitality. Benedictine hospitality is my first rule of interacting with students, especially when they are falling apart. Building human relationships with students is number one, and every failure they experience in my class is an opportunity to build a stronger relationship. Moving beyond that initial disappointment is next. Often my students are receiving the first lower grades of their lives and they have no coping mechanism for dealing with that. But I don't want to show them how to change a C into an A. I want them to wonder about the concept and figure it out, so that they understand, not so they get a better grade. Remember, in my scholarly discipline our business is to figure out how life is put together. Mistakes are part of life, so my job is to help students figure out how mistakes fit in some bigger picture. □