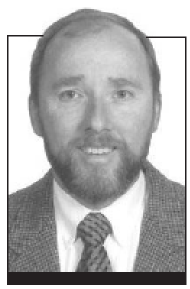
Life is hard; artificial life is no piece of cake, either



OPINION
BARRY FAGIN
Contributing columnist

I'm writing this column under 40 feet of water. This is bad.

I'm supposed to be concentrating. Breathe slowly, save your air. Watch your fins and hands, don't disturb anything. Pay attention to your dive buddy, watch what the dive master is doing. Above all, enjoy the astonishing variety of underwater life, the difference of the underwater world from our own.

A snake eel slithers by, a sea turtle rests quietly under a rocky outcropping. The colors are clear and vibrant; life teems everywhere.

The rocks aren't rocks, they're coral, living organisms. Our dive master wiggles his fingers at a pile of gravel. It spurts away, irritated, coming to rest on the sandy bottom inches away from me.

I hover weightlessly, almost completely inverted, and stare at the flatfish. He stares up at me, because he has no choice. His eyes migrated to the top of his head millions of years ago. Lest I get too smug with my superior visual anatomy, I remember he saw me, but not the other way around.

I'm here in Hawaii at the First International Symposium on Artificial Life, to present a paper on some work I've been doing with a colleague.

"Artificial life" sounds like Frankenstein or life in a test tube, but it's really not like that. The field is still too new. Right now, it's all about math.

Can we use mathematics to describe systems that reproduce? That grow? That learn? That evolve? What can this tell us about biological life? About human evolution? About the origins of life on earth?

I've only just started working in this field, but I know one thing for sure: When people say life is hard, they are right. It may be the hardest problem, the most complicated thing in the universe.

My own work involves looking at some very simple mathematical ideas that apply to artificial life, trying to discover what deeper meaning lies beneath them. It's very common in math to have simple ideas conceal great richness and complexity, without our knowing exactly why. The biggest leaps forward in math and science shed light on understanding how the complex arises from the simple.

A year and half ago, one of my brilliant colleagues casually tossed off a proof in a meeting and asked if I wanted to take a look at it. After several months of thinking and computer programming, we got some good answers, and wrote up our work for publication. That's how science is done. You come up with ideas, run experiments, and tell other scientists what you learned. They critique your work, you critique theirs, and over time we all learn more about the world.

It's exciting, but it can be humbling. My work is on very, very simple systems, so simple I can explain them to a high school math class. Last fall, my daughter's math instructor was kind enough to let me take over his class for a lesson. I know his students understood what I was talking about because I gave them some problems to work through. Most got them right, and a few even asked questions that showed deeper insight.

Still, just using simple concepts for artificial life you can teach to high schoolers, it took two specialists with graduate degrees a year and a half to answer what we thought were pretty basic questions. Even though we now have publishable results, we still haven't completely solved the problem.

Doing science is hard.

If the simplest ideas of artificial life present hard problems, what should we do when confronted with the mind-boggling presence of the real thing?

Lurking below the surface of Maunalua Bay lies just a tiny part of the reality of life on earth, teeming and bursting with complexity and activity that put our puny mathematical games to shame.

To me, the answer is to get to work. Life has had about 4.5 billion years to get to where it is. Humans ought to be allowed a few thousand more to work out the details. What better place to start than a conference on artificial life in Hawaii? Book 'em, Darwin.

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