Paul Bieniasz

Paul Bieniasz is a Professor at the Aaron Diamond AIDS Research Center (a part of Rockefeller University) and a Howard Hughes Medical Institute Investigator. His research focuses on the molecular biology of retroviruses, HIV in particular, and on the ways these viruses interact with host cells.

Your postdoctoral advisor Bryan R. Cullen, who nominated you for membership in the Academy, says your most important single discovery so far was tetherin. What is tetherin and what is its significance?
Tetherin is an antiviral protein that traps envelope virus particles on the surface of infected cells, preventing their spread, and one of the reasons it's significant is it's a target of the HIV access protein Vpu. It has broad antiviral activity and is one of the ways hosts defend themselves against viruses. It works against a range of enveloped viruses. We know that it works against Herpes, rhabdoviruses, arenaviruses, filoviruses, and retroviruses.

I understand you've made a Jurassic Park discovery as well: you've resurrected a retrovirus fossil? What was this virus and did it reveal anything about viral evolution?
This virus is called the "human endogenous retrovirus K." The resurrection itself didn't tell us very much about viral evolution, but it was important because it showed that it was possible to reconstruct infectious viruses from molecular fossils—that opens up a field that's been called "paleovirology" where extinct viruses can be studied. Our particular interest is trying to figure out how they became extinct.

We isolated it from human DNA—it is in essentially every human's DNA—multiple defective copies. We synthesized a consensus form of the viral DNA. The sequence information comes from the Human Genome Project, but we synthesized it. We built a bunch of olignucleotides and stitched them together. About 8% of your DNA is old retroviruses.

As a teenager in the 1980's, I was made very aware of HIV and AIDS, and learning about HIV was my first exposure to any sort of lesson in virology. You grew up in the United Kingdom. Did HIV and AIDS make headlines like that over there? If so, did exposure to media messages about HIV have any influence on your eventual career choice?
It certainly was in the news and the headlines. There was a very prominent government-sponsored scare campaign. It was incredible: TV commercials with tombstones falling over—it was very dramatic. It's hard to recall how much that influenced my eventual career choice, but as my interest in science grew, I knew this [HIV] was a problem of global impact and importance. I think that did draw me in.

HIV has been studied intensively since it was first observed in the 1980s. Thirty years and many millions of dollars and Euros and yen and renminbi later, we still don't have a vaccine for HIV or a perfect cure. Will we ever get there in your opinion?
Let's take the vaccine first: vaccines against a virus like HIV have never been created before. It's an incredibly challenging problem. There are some recent signs that perhaps a vaccine might be possible, but it's certainly not guaranteed and I think we should be proceeding on the assumption, from a public health perspective, that there will not be a vaccine for the foreseeable future.

I think you can say the same thing about a cure for HIV. The cure may be even more challenging than a vaccine. That's not to say that there haven't been great successes in tackling HIV. Combination therapy is a real life-saver for those that can get it, and really has come about because of basic science.

What is your lab working on these days?
We're working on many different aspects of retrovirus biology, how virus parts are assembled, and how the various parts come together to make a virion. The other thing that we're working on that I'm very interested and excited about is discovering host genes that have antiviral activity. We're very interested in finding more genes that have this property and how they work.

Where do you see your field in 10 years?
I think anyone who predicts where their field will be in ten years will almost certainly be wrong. Certainly if you'd asked me ten years ago, I would have been incredibly inaccurate. Simply put, "I don't know."

If you had to change careers today and you could do anything, what would you do?
There isn't anything else I'd want to do, but if I was forced, I'd perhaps be a journalist. Or in the fantasy realm, I wouldn't mind being a quarterback in the National Football League.

What, gridiron? Why not soccer?
No, I'm almost fully Americanized, assimilated. I am big fan of the Miami Dolphins, even though they're a terrible team at the moment.

What's your favorite science book?
My favorite book is Dawkin's recent book, the Greatest Show on Earth—it very nicely explains how evolution works, particularly for those that need to understand it, but don't.

What is something about you that most people don't know?
I used to be a pretty good athlete. I was a water polo player—I almost made it to the national team but didn't quite.