

Ask a Biologist vol 039 Topic: A Visit to NSF - Guest: James Collins

A Visit to NSF -

Hitting the road again, Dr. Biology checks out the Biological Division of the National Science Foundation. He visits with the Dr. James Collins the person overseeing all the research funding for the biological area at NSF. Learn how your tax dollars are being used and the cool things that NSF funds that you may not have known about.

Transcript

Dr. Biology: This is Ask-a-Biologist, a program about the living world, and I'm Dr. Biology. Well, I'm back in Washington D.C., and I'm just about to turn the corner where I'll see the building I'm heading towards. And, it's a good thing because it looks like it's going to rain at any moment. While we're walking here, though, I wanted to ask - have you ever wondered where some biologists get the money to work on their research projects?

Well, one of the places is the National Science Foundation, which is the building I'm heading towards - and, we actually call it by its initials, NSF. Today, I'm going to visit with one of the people that oversees the biology area at NSF. This means he watches over the types of science projects that get money, as well looking into what things we should be exploring in the future.

By the way, do you know where NSF gets their money? They get it from us. That's right. Part of our taxes is invested in NSF, which then invest in the research of some scientists, including biologists. And, since this is part of where our taxes, I thought it would be worthwhile to find out just what's going on here, and what we can expect in the future.

OK, we're at NSF. It's about time because it's getting to be a little bit rainy right now. It's a beautiful building, and we're going to go on inside. [door opening] Wow, what a building. Good morning.

Man: Good morning.

Dr. Biology: How are you?

Man: I'm wonderful. And yourself?

Dr. Biology: I'm doing great. I'm here to meet with Dr. James Collins. He's the Assistant Director for the Directorate of the Biological Division at NSF.

Man: OK. The only thing I need from you is your last name and a photo ID.

Dr. Biology: OK, that would be Biology. Dr. Biology.

Man: Dr. Biology. All right. He'll be in Room 630. That's the sixth floor. Elevators are to your right.

Dr. Biology: OK, thank you very much.

Man: Thank you.

Dr. Biology: So, let's head on up to the office.

[sound of the elevator]

Dr. Biology: Well, I get off the elevator, and I have to say I'm rather surprised. It looks more like a gallery here – a photo gallery of some rather amazing artwork, than some kind of government office. Most of these images I can see are of biological type. Yeah, biological subjects. It looks like we could be in for a really interesting interview.

So, I'm in the office with Dr. James Collins. You have quite a title. Let's see here. The Assistant Director for the Directorate of the Biological Division of NSF. Now, that means we must be really close to Washington D.C.

Dr. James Collins: We are really close to Washington D.C. Arlington is just across the river from the District of Columbia, which is where the White House is, and the Capitol.

Dr. Biology: We're looking out the window. And, I see from your office the Nature Conservancy. Quite a view here, isn't it? It's spectacular. Is there something else I'm not seeing out there?

Jim: Well, the Nature Conservancy is the one that's easiest to see. Then the Fish and Wildlife Service is just down the block, and the National Science Foundation is here. So, there's a cluster of science-related activities that happen out here in the Arlington area.

Dr. Biology: Now, a lot of people hear NSF, but they probably think well it's the National Science Foundation, and it's a bunch of scientists. What are you doing at NSF?

Jim: You're right. NSF is the acronym for the National Science Foundation. It is an institution within the Federal government of the United States that has a very distinctive role in supporting basic research. So, we have 600-plus scientists who are on staff here at the National Science Foundation, but we don't do the actual research here at NSF. We are a place where the Congress appropriates funds, and we make research awards to investigators, primarily at universities and colleges across the United States, and they actually do the research.

Dr. Biology: We're talking about giving out money, actually awarding money. What is the budget for NSF?

Jim: The NSF budget this year is just over six billion dollars.

Dr. Biology: Six billion dollars. And, you have one section. You're in the biology section, which makes sense for this podcast. What do you oversee? How much money?

Jim: Slightly more than \$600 million.

Dr. Biology: \$600 million. Now, you said it mainly goes to institutions, universities and research institutes. Are there other areas that NSF invests in that people would think of, or may not think of as important?

Jim: We fund field stations, for example, and marine labs. We fund research collections at museums, and those are the sorts of things that individuals might not ordinarily think about, and connect them with the National Science Foundation. We also fund the living stock collections, things like *Drosophila*, which is a small fly that's used by investigators for research.

Dr. Biology: You also have a section that does a lot with education. And, if I'm not mistaken, when I watch some of the shows on PBS, I see 'Funds by NSF'.

Jim: That's right. There's a whole directorate called Education and Human Resources. And, they fund programs associated with research and education, again, often at universities and colleges across the country. But, they also fund so-called 'informal' education programs, and that's probably what you have in mind, in terms of things associated with Nova, for example.

Dr. Biology: What do you like about NSF?

Jim: We have a lot of very smart people here who are really dedicated to what they do. They take very, very seriously the fact that they are stewards of the funding that supports the basic research throughout the United States. This is the premier institution for supporting basic research across a wide variety of the sciences, engineering and education, which provides a great opportunity for integrative, inter-disciplinary studies.

Dr. Biology: NSF has a lot of cool things. So, let's think of one that you can mention that's for kids, and maybe teachers.

Jim: One of the increasingly interesting things about the National Science Foundation that we're finding is that we don't want our influence to stop at the walls of this institution. And specifically, what that means is we're finding that so-called 'cyber' infrastructure - the computer and information structure - that's being developed across the world is a way in which individuals can network in all kinds of diverse, complex and interesting ways.

So, increasingly, we are building programs that have to do with 'cyber' infrastructure that have to do with the digital age. And, one of the interesting things would be the National Science Foundation Digital Library that's being developed, and the way in which that kind of activity can influence students and educators in lots of different ways, in terms of providing content and ideas.

Dr. Biology: That's great. I was just at the conference for the National Science Digital Library. So, it's good to hear that you're just as excited about it as we are. While we're talking about NSF, one of the things I'd really like to know is, in the future, what are we going to expect from NSF, as far as exciting things? Not just simply from a scientific standpoint, but just cool things.

Jim: You'll expect to see NSF always try to be on the leading edge, in terms of where the very best science is being done; and also, the very best ways in which to be doing that science. That will really be the challenge for this institution as we go forward from here.

Will it be an institution that continues to adapt itself to the community of researchers, and the kinds of questions that are being asked, in a way that it can be flexible, and can be open - both in terms of administration, as well as the science questions - in order to allow the researchers in the United States, and indeed, around the world to benefit from the kinds of investments that can be made by this institution to move the science forward?

Dr. Biology: The other thing that's interesting with what you're doing is you're actually a working scientist. What we would probably call an ecologist would fit best for you. And now, you're in Washington D.C., and you're in this institution. You haven't given up your science side either, so I have a couple of questions and you can answer them however you want. One is how do you end up at NSF? And, the second thing is how do you balance that? That's pretty impressive.

Jim: You're right. My research areas are ecology and evolutionary biology. I wound up at NSF starting as an individual who applied to the institution for research grants. Then I served as reviewer, served on research panels here to judge awards, and then was asked to come here and interview for a position called program director. And I did that and acquired that position, and in 1985-86 was program director here in a program at that time called population biology and physiological ecology.

So, that was 20 years ago, and at that point, the National Science Foundation was downtown. So it was right across from the White House is where we were, which is a terrific location. We were there with the Secret Service in that same building at that time.

Dr. Biology: [laughs] Well, I hope they didn't need to have the Secret Service around just to take care of you.

Jim: No. We would just ride the elevator together. I finished that position here at NSF, which was a so-called rotating position. So I was here only for a year. At that point, I went back to Arizona State, continuing my research. I was continuing my research while I was here in the 85-86 stint as well. But worked at ASU as an investigator, was also chair of the department of zoology and then the department of biology.

During that time period also, the former director of the biological sciences here asked me to come and serve on what's called the advisory committee for the biological sciences, the national advisory committee. And I did that and chaired that committee, and I also chaired another committee in environmental research and education here.

Finally, I was asked if I would be willing to have my CV put forward for the position of assistant director of biological sciences. And about two and a half years ago, I was asked to assume that position. I stated about two years ago.

Dr. Biology: Now, as an assistant director it sounds like you're a couple levels down, but actually you're not really that far down from the director, right?

Jim: Right. It's the director of the National Science Foundation. He has an assistant director, deputy director. Then, we have the assistant directors right underneath the director. So each of us is responsible for a different area of research.

I have biological sciences, and then I have colleagues who have social behavioral and economic sciences, mathematics and physical sciences, computer and information sciences, geological sciences, engineering, and education.

Dr. Biology: We actually will have to do a whole other program with you on your research, because there's so much to talk about. I do want to mention the animal that you work with, at least one of them, and that's the salamander.

We have a really interesting article on Ask a Biologist about your research. It says, "He Ain't Tasty - He's My Brother." Can you talk just a little bit about that? Because it goes into cannibalism even.

Jim: Right. So the research animal that we've used very, very successfully for 30 plus years is the salamander, and more specifically the tiger salamander, *Ambystoma tigrinum*. It has a wonderfully complex life cycle, where it starts as an egg, hatches into a larval salamander, it's called, that lives in an aquatic environment, has big, bushy external gills and tail fins.

It looks like a fish to the common observer except that there are these big bushy external gills and they're not covered over as in fish. Those animals will grow up and, depending upon the environment and their genetics, some of them can actually develop broad heads and enlarged teeth, and they will begin to eat other salamanders. So there's your reference to the idea of them being cannibals.

That will go on for either a very short summer season, or if the pond is permanent, they can actually stay in the pond and continue to just increase in size. They'll retain the external gills and become mature adults within the pond, or they'll transform, they'll metamorphose is the term.

They'll lose the gills, they'll lose their fin, and they'll walk away and live under a rock or some logs or in a mammal burrow for a year or two. Then they'll come back to the pond and breed. And remember, there are these other possible life stages that are in the pond that are matured gill forms.

So, you have this complex life cycle in which you can have adults that are very, very different in appearance. And you can have larvae that are very, very different in appearance, but also in terms of the way in which they function in the environment.

So, it's a great system for exploring everything, from genetics, gene-environment interactions, ecology, evolutionary biology, and most recently, host-pathogen interactions.

Dr. Biology: One of the things I forgot to mention is that, actually, as a kid playing around in the little ponds around my neighborhood, I found what a salamander was. But we called them mud puppies at the time.

And I brought it home and put it in a terrarium, and I was trying to feed it, and all it did was get skinnier and skinnier. So finally I had to take it back to the pond, because it turns out that I'm not a really good caretaker of these salamanders.

Jim: Right. So they of course have their own behaviors, their own habits, their own requirements as far as feeding is concerned. And as a young person you really have to understand those requirements, what they are, in order to keep the animal healthy and happy.

But, I would also, in this day and age, caution young people that when they bring an organism home. They are not only responsible for it, but they really should think twice about taking it back to the natural habitat because we now understand that these organisms can acquire pathogens.

And taking it back to the natural habitat may be the very, very worst thing to do, because it can bring disease back into that system that would infect other organisms in the environment, and that would not be a good thing to do.

Dr. Biology: So, the moral of that is, catch and release, right at the time?

Jim: Catch and release, right at the time.

Dr. Biology: Very good. You mentioned basic research, and in a previous program, we actually talked about basic research versus applied research. Let's talk a little bit about the difference between basic and applied.

Jim: The distinction is one that I don't want to push too much in that there is certainly a real integration between what counts as basic research and what counts as applied research in any particular time.

But to put a fine point on what would really count as basic research is the kind of activity that, at the end of it, really does begin to change what our theoretical and conceptual understanding would be of any particular area of science. If someone's doing that sort of work, then you can say that it's fundamental, it is basic. That's the other word that we've been using.

In a way that when they're finished, everybody else around can now understand. A basic concept has been changed. The basic theoretical framework has been changed, and that should be applicable then as you go forward from that point.

Dr. Biology: We're talking, as you said, basic science. And that's really, in a nutshell, almost creating a library that we can work with over time. And we keep learning, and what we learn sometimes we find out is wrong, and we find out there's another answer, right?

Jim: That's right. That's right. It keeps changing all the time in terms of the kinds of information that's available, the quality of the information, the way in which the information's being interpreted, the way in which we even conceive of the problem. And that's a fundamental piece of what we're trying to support as far as the National Science Foundation is concerned.

Dr. Biology: Right. A lot of kids think there's a book on the shelf with all the answers. We don't have all the answers.

Jim: We don't have nearly all the answers. No. That's the exciting thing about it, is that the answers are always changing. We're always looking for that new edge, that new idea, and support the investigators who want to pursue it for a while, take a look at it, see if there really is something to it, and see what might grow out of it.

Dr. Biology: Right. Keeping an open mind in science is just as important as anywhere else.

Jim: Open mind is absolutely critical in science.

Dr. Biology: Now when I walked into your office, and actually into the NSF building, I was rather impressed when I got up on the sixth floor. I come out and I'm greeted with all these beautiful photographic images, lots of art. And I walked into your office area, and there's lots of art as well.

I love seeing that, because we have a tendency to separate art and science. And it's really not fair because both disciplines are very creative, and both of them take a certain amount of intellectual work.

It's not fair to make science into something dull and boring, and you have to be really, really smart to do it. I think, you need to be dedicated and really focused and really excited about it. And then say art is fun. What is your take on art and science?

Jim: You're absolutely right. They're both creative activities. They demand a level of scholarship and discipline. They depend on having great intellectual rigor when it comes to exactly what you want to be doing in terms of the exploration of the human condition, whether it has to do with science or it has to do with art.

And so it's at that place where they both intersect. It's sort of exploring what we are as a species, what we're doing on this planet, and what the future's going to look like. And science and art does that in different kinds of ways.

Dr. Biology: I like to ask three questions of every guest I have. These are common ones. The first one is, when did you first know you were going to be a biologist or a scientist? In other words, is there a spark that you can remember or a point in times that really triggers where you remember, wow, I'm going to be a biologist.

Jim: Yes. I was interested in biological kinds of things from a very, very early age, meaning grammar school. That was refined in high school, where I learned that one could

in fact become a teacher of biology, and that was really, really appealing to me. That was refined further when I went to college and learned that one could not only teach biology but could be involved in research in biology. And was really in my second year in college where I sat down and forced myself to make a decision between a career in history, actually American history, or the biological sciences. And within the biological sciences whether it would be medicine or something else.

And the thing that triggered a real transition was an opportunity between my sophomore year in college and my junior year in college to participate in a field course in marine ecology and evolution, and to have an opportunity to do some research. And that was absolutely the transition point.

Dr. Biology: OK; now we've heard how you got into the world of biology and you certainly have done both the academic side and the administrative side. Now I'm going to take it all away, you can't be a biologist, you can't be a scientist, if you had the chance to do a different career, or you were forced into another career, what would you do?

Jim: I'd be a historian.

Dr. Biology: OK, what kind of history do you like?

Jim: The history of ideas. How ideas come to emerge within a society or within subsets of a society. What causes them to take hold, what causes some ideas to be successful and others not, and how did those ideas shape the lives and the world of the individuals around them? How did they shape the institutions of the individuals who have these particular ideas?

Dr. Biology: So you're not actually taking one period of time. There are historians that will take 18th century history, or they might go back into the romantic period or something. So you like all of it, you just want to know what made things change at that point.

Jim: Exactly, that's right. No, it's not a particular period. It is definitely the history of ideas from ancient history up to the modern day.

Dr. Biology: OK. One last question, what advice do you have for someone, young scientist, or someone that maybe they decided, "I want a career in science", what's your advice?

Jim: To be open to opportunities that really are the key, in the moment, as far as being a successful scientist is concerned. The fields are changing so rapidly that you have to develop a basic set of interests, but then be willing to be adventurous and be willing to explore any kind of opportunity that comes along. See what you'll be able to do with that opportunity and then move on to others as they present themselves.

Dr. Biology: You mentioned the word explore, and actually another thing that comes up on this program is travel. A lot of people like to travel and would like to have a job that actually does that sort of thing. So they look for these careers where they have the potential of travel. I would say you have a lot of travel.

Jim: I do a lot of traveling, that's right. I've been to all of the United States, except for Maine. I still have Maine to get to, for whatever reasons it still has eluded me. I've been to all seven continents at this point in terms of travel and all the way to the South Pole.

It is a career that has enabled me to see just terrific places in China, Japan, Antarctica, New Zealand, Australia, Europe, Africa and Asia. It's just been wonderful in terms of travel.

Dr. Biology: How does an aquatic ecologist end up going to the South Pole?

Jim: Well as part of being here as a senior manager of the National Science Foundation I am responsible not only for participating in policy decisions relative to the biological sciences, in fact, being the last stop for policy decisions relative to biological sciences - excepting so far as I'm consulting with the directory and deputy on policy decisions in biology. But they expect me to also be able to advise them relative to activities within the other areas of NSF, math and physical sciences, engineering and so on.

And at the South Pole NSF has significant investments in math and physical sciences as well as engineering, but also in the biological sciences. We support a long-term ecological research site in Antarctica. In fact we support two of them.

And part of my responsibilities is oversight for those activities, but also being able to understand the science that's being done at the South Pole in a way that I'm able to advise the director and deputy and my colleagues and other assistant directors in terms of that research. And being able to see it first hand makes an immense difference in the amount of judgment you can bring to the multi-million dollar investments that are made as far as that sort of research is concerned.

Dr. Biology: So in essence you are a student often, right?

Jim: I find myself a student for my entire life.

Dr. Biology: All right, so you've had all this travel, can you pick one of your favorite spots and tell us why?

Jim: Probably the most exciting and the most interesting trip that I've taken lately was to China. It was just an absolutely fascinating country to visit right now. And the reason is that it is so obvious that it is a country in transition. It is a country in which you can see farms and fields being worked in absolutely traditional ways and yet you can come into their cities, like Beijing and Shanghai and see the most modern of skyscrapers.

My really favorite spot was when we flew into a city called Koming and then we drove south from there for several hours towards Laos and Myanmar into the old world tropical forests in that part of the world. It really was the kind of trip that's a National Geographic newsreel. Just as you're going along with the rice paddies and the tea plantations and the water buffalo just working the fields. It was just a terrific sort of experience moving along the Mekong River in that part of China. It was just terrific.

Dr. Biology: How about just Washington DC in general, do you like city, do you like the activity, do you like the energy?

Jim: I grew up in New York City and Washington DC is another global city, it really is. There are some global cities, New York City, Washington DC, San Francisco, Beijing, and Shanghai. When you're in these cities there really is energy. London is another great example, Cape Town. There is an energy that goes along with those cities as a result of being in them. And Washington is just a place that's like that.

Where you walk along the street and you hear multiple languages and you go into restaurants that have a variety of different kinds of ethnic foods. You go to bookstores that have different kinds of literatures, very different kinds of literatures. It really is energizing on a day-to-day basis.

Dr. Biology: It's kind of interesting because I've seen a lot of pictures of you and you're out in the woods with your blue jeans and maybe even waders and other times here you are tie and shirt. You actually have two worlds you like to go into.

Jim: I have two, actually even more than that, different kinds of worlds that I walk through at different times. And that also is very stimulating for me. Its one of the things that I had hoped would be able to come out of a career as I moved ahead from a very early point. That is that it would be diverse and it would be engaging. I didn't have all the particulars worked out but the career I've chosen and have been able to get into has been absolutely wonderful in terms of its stimulating.

Dr. Biology: You're also a bit of a sports fan, aren't you?

Jim: I am a sports fan.

Dr. Biology: OK, now fess up, what's the favorite football team?

Jim: The favorite football team would be the Sun Devils.

Dr. Biology: Oh, he's pandering here. No, no, no, no, no, what's your alma mater, what's your favorite college football team?

Jim: The college football team, oh it would be the University Of Michigan, of course, the Wolverines, yes.

Dr. Biology: And we won't go into baseball because this wasn't a good year for baseball.

Jim: Well you know I grew up rooting for the Brooklyn Dodgers and they still are my favorite team even though they no longer exist. And I couldn't quite transfer all my allegiances to the Las Angeles Dodgers, so I switched my allegiance at that point to the New York Mets. They have many of the qualities of the Brooklyn Dodgers that they've exhibited over the years, but we won't even go there.

Dr. Biology: Yes, we won't go there. I want to thank you for sitting down with us, I know you're really, really busy and being able to sit down... I have to say it is a beautiful office, and taking a little time out is great.

Jim: I'm happy to do it.

Dr. Biology: You've been listening to Ask A Biologist and my guest has been Dr. James Collins, the Assistant Director for the Directorate of the Biological Division of NSF. He's also a faculty member in the ASU School of Life Sciences.

The Ask a Biologist podcast is produced on the campus of Arizona State University and is recorded in the Grassroots Studio, housed in the School of Life Sciences, which is an academic division of the College Of Liberal Arts and Sciences. But for today's show we're in Washington DC.

And remember even though our program is not broadcast live you can still send us your questions about biology using our companion website. The address is: askbiologist.asu.edu. Or you can just Google the words 'Ask a Biologist'.

I'm Dr. Biology.