

Frank Taylor: We are at the Redfield Building of the Woods Hole Oceanographic Institution for our third session with Dr. John Stegeman. I had just been telling him about my trip to Europe. He told me that he was on his way over to Sweden to receive an honorary doctorate from the university there. He cannot see it but I can, another feather in a cap of a deserving career. Dr. Stegeman, the last time we talked in some depth about the kind of research you were doing, what is your interest, where you hoped a lot of this was going to go? One of the things that has really hit me as I have been talking with you and kind of hanging around the Redfield area and being an ex-teacher, was the number of students you have worked with. The mentoring that you have done. I know the last time we came here I had to go up and tap on your door and just remind you, I was here and there was a student hanging over your shoulder anxiously looking at a computer screen. That is not true of everybody in this institution. I have talked to people that said, "Even regarding the joint program, I have no interest in working with students. One of the reasons I came here was to get away from students." You have kind of gone the other way. Very large list of people that you work with. It has also showed up in the publishing. I asked one of the librarians about the publishing part of it. She told me that one of the things you are admired for is that you get your students as the first author, really early and get their names out there. That is a real good thing. Particularly, from someone that is an ex-teacher, hearing it. How did you get involved in the mentoring just to start? What kind of a philosophy behind this?

John Stegeman: I guess, it's largely, in my mind, the continuation of being a graduate student. [laughter] As a graduate student, , you are looking at those who are senior graduate students and your professor and other faculty in the university. I guess, for some of us anyway, maybe not for all, but certainly there is a sense of camaraderie and enjoyment with the collection of people that you are working with in a laboratory. I think part of the appeal of working with students is that you retain that through the course of your career. As you well know, as one gets older, one doesn't see oneself as being older [laughter], rather quite the opposite. I remember remarking to a postdoc at one time, Mark Hahn, who's now on the faculty here, that I looked upon him as a peer. I know he looked upon me as something different. But from my perspective, we were on the same level. He recently told me he now understood what I meant. So, if you get graduate students in the lab, you have a collection of people with whom you identify. I think that's part of it. Maybe I'm going off on the wrong track but –

FT: No, I think you are getting it right. I stayed athletically active for years, way beyond perhaps when I should have, simply because of the fact, given the client base that I worked with, I was always comparing myself against something that was younger and more vital than perhaps my age [laughter] actually determined. It kept me both physically and mentally pushing at a certain level that I might not have had I have been only measuring myself against my own peers.

JS: That's exactly right. I've always felt that having students in the lab really keeps you young and keeps you on your toes. That's true of teaching too. Now, I know since I came not long after the joint program was established. There were at that time quite a few people who didn't really have any interest in teaching or in the joint program. I don't know where that was going, but I certainly did.

FT: But what you are bringing up is something that I think is very important in terms of the educational aspect of the oceanographic. For a lot of people, the joint program was not popular.

I know of one individual that was made a trustee simply because they knew he would argue in favor of having this joint program. So, you came in at a time, went from awful lot of people, this was not vogue. It was not something that they saw the institution going. This was a research base. But by looking at students, first of all, you start to populate the fields for the future and that is very important. But you also brought in potential competitors.

JS: That's right. Some would say overpopulate the field for the future [laughter] because of the potential competitors.

FT: Yes. Every research dollar comes nearly [laughter]. Then the more people you put in, the more call is going to be for those few research dollars that are out there. Yet, from everything I could see, philosophically, you approach this as a more of a mission as opposed to something that should not be done.

JS: Oh, yes, I guess it is mission. I mean, to me, if the institution had not had the joint program, I certainly would not have stayed. Because having students and having an active lab is just part of the way that the life ought to be. Now, perhaps some of those who didn't appreciate the value of the joint program may have been in areas of science, where they could operate individually or with a few technicians. I know there are people who do that. In biochemistry, it's very difficult to operate individually, partly because there is a lot of labor-intensive research. So, the training of students in the process of doing science and having them contribute to the product of the lab in a very real way is very important for progress in biochemistry. So, there is a sort of a different culture in biochemistry and some other aspects of science that would be appropriate in the ocean sciences. So, it was more like home to me to have a group of people in the lab. It would have been unfamiliar and not very appealing to work by myself. I would have gotten pretty tired at my company, I think.

FT: [laughter] But you said something in a previous interview that really is kind of stuck with me. You said you could still picture yourself in a mahogany wall office –

JS: Yes.

FT: – with a tweed jacket with leather patches on the elbows. You had some difficulty – now, correct me if that is the wrong word. Some difficulty making a determination whether a career is going to be a research career, or it is going to be an academic teaching kind of career. So, it sounds to me almost as though one of the reasons that you might like look to have graduate students is that somewhere in your own mind you develop kind of a lifestyle model of what your life should be like in this combined research, academic sort of thing?

JS: Yes, I think so. But I'm not sure how if I could describe it for you, [laughter] but I think you're right. It just was the natural thing to do. I'm wanting to say, I don't recall if I mentioned when we last spoke, but it's like between our last meeting and today, I went back to Northwestern for a symposium in honor of my thesis advisor, who was on the faculty at Northwestern, celebrating his forty-five years on the faculty at Northwestern. I think thirty-five years of continuous funding in one grant from the NIH. So, it was going back to the lab where I did my research and wandering around there. I hadn't been back for decades. But I was

reminded at that time that it was very much the university research lab experience that was, I think, invigorating. There are people who can work solely and focus and do all things with their own two hands. I wish I were one of those. I'm not sure I could. Whether I could or not, I would still, I think, want to have a group of people. So, in mentoring, how does one get a group of people? I guess that's one question that sometimes is asked certainly of young faculty here. Why do they ask that question? Because they recognize the value of having students in the lab for the progress of the research of the lab, not in any way, having just hands around to do work, but rather, other minds that help you think and offer different opinions. Collectively, you do the work and you do the thinking, you do the writing. So, acquiring a group, building a group is a difficult thing at the beginning. In a university, maybe it's not so difficult because the student population is greater, there are far many more people who may pass through your lab whom you might interest in the research that you're doing. But here, it has been very much a competition for students in many cases. So, you have to make it comfortable for the student. You have to make it a happy place for them. You have to make it a place where they feel they are gaining something important and worthwhile, and that their contributions are valued. That they see that there is a future avenue for them for having been in this particular place.

FT: Let me interrupt you right there for a minute, because there is something I am really curious about. First of all, as you describe this, I can remember very clearly in my own college experience, only one professor ever saying to me that he saw me as a colleague. Perhaps a colleague that did not know anywhere near as much as he did at that point, but a colleague. To the others, I was a student. [laughter] There is a significant difference in between the two. I am just mentioning that as an issue with this. The other thing with gaining students to mentor, they have to want you to.

JS: Absolutely.

FT: That is kind of important.

JS: It is. Now, so I can say that at the time that I started here, being perhaps the only, "practicing biochemist" with a degree in biochemistry who was interested in biochemical things, and at the time that the biochemical sciences— and later molecular biology were increasingly recognized as important approaches to understanding life in the oceans. When people came with an interest in biochemistry, there was, in some respects, a natural gravitation to my lab. Again, there were very small numbers of students in the joint program. You consider a faculty of twenty-five to thirty, which is what it has been in the biology department all these years. When I first came, I think there were a total of fifteen graduate students in the department, maybe less, because it was early days. So, there were possibly fifteen. That's not one student in every lab. So, there was some decision on the part of the student as well as on the part of the faculty member recognizing a mutually beneficial and enjoyable relationship. You work hard to make it enjoyable. I remember this place most certainly was not then and in some respects, still is not physically. The laboratories in this building physically are not as appealing as the renovated labs at MBL down the street or the new buildings up at the Quissett Campus. So, you had to work to make it appealing. I remember getting up on a ladder, cleaning the dust off the pipes, so the dust wouldn't be falling on the benches where the students were working. For two reasons, one, because when dust is falling around, it's not a very comfortable place. Two, well, if dust falls

into something you're working with in biochemistry, then you got to throw it all out. So, you take pains to make it a comfortable working environment for the students. That's not coddling. That's just recognizing the value of the students and your value to them and making sure that they recognize that. That they're not put off by some other aspect.

FT: Yes. But it is an added backdoor to what you are going to be doing because you are creating an environment then. An environment that will allow certain kinds of things to go on. One will allow your own research, which is at a much higher level, and the students are bringing in to continue and prosper. Secondly, to have the student come in, contribute to that, but also learn and prosper in the kind of situation. So, what you are talking about is literally setting up a whole environment. Is that something that just came naturally, or is it something you thought about in great detail?

JS: I don't know that I thought about it in great detail. I did desire it. Let me put it that way.

FT: So, you made it happen?

JS: Yes.

FT: Now, in the early years, the graduate student comes in and going to be working with you. I almost use the word under your tutelage. That would have restricted, I think, too much the way you approach things. I think it is under your tutelage but in conjunction with kind of thing. Talk to me about mentoring a student. Give me Student A, and how you might treat with a person like that? What kinds of things that student might be working on that –

JS: So, most graduate students – well, I think there's a spectrum. Some graduate students when they arrive at the department, wherever that may be, where they're going to pursue their PhD work, come with a fully formed idea of what it is they want to do. In some cases, perhaps, how they're going to approach it. They're just looking for a suitable home in which to do it, somewhere where there is knowledge that can help guide them in this path. Others come without any formation of clear idea. So, if you have somebody in the middle are tending toward the unformed plan for research, or the lack of formed plan for research direction, you try to find their core interest. Clearly, if they're in a biology department and some aspect of biology, what is it that is their core fundamental interest that whenever they keep talking, whenever you explore things, they come back to something? Is it biochemistry? Is it how molecules work? Is it how molecules work in the cell? How that contributes to the functioning of the organ and organism? Or is it how the organism is able to interact with other organisms in a larger "cell" that is a community or an ecosystem? So, you question them. You sort of talk around until you find their core, and you tell them then "This seems to be your core. So, let's think about areas that you can pursue, questions that may be of interest to you," recognizing they have to be really strongly part of this core fundamental interest. There are two approaches that I think are important. One is to engage the student in conversation about questions that are unanswered, and that may be important where there may be the opportunity to gain that fundamental information, which we had talked about before. With an application in understanding how chemicals affect organisms that we had talked about before, how you may use that information. You sort of talk around it. I can very clearly remember the first couple of students who were in the lab. The first student was

Kathy Burns, but she was really John Teal's student, not mine. It was somewhat at a distance. The first student who was my own student was Bob Binder, who did work on the development. When I say development, I mean developmental biology. That is during the course of organism development from a fertilized egg to a fish. The developmental regulation of and response to chemicals in the embryos of *Fundulus heteroclitus* as well as a couple of other species, looking at this cytochrome P450 activity and how it was regulated during development. These were studies that were published in the early [19]80s. It was certainly the first work of its kind in fishes, which is now still it's a very important subfield, if you will, developmental effects of chemicals, and in fishes as well as other organisms. So, in talking with Bob about this, you kind of can offer ideas about. Well, this would be an interesting thing to do. You can think about this, or this would be an interesting thing to do. You can think about that, or this would be an interesting thing to do. You can approach it that way, or you cannot say this would be an interesting thing to do. But talk about things that are unknown and do it in such a way so that you gradually lead the student to come to you with the idea of pursuing this particular question that you thought was so important for them to pursue. That now they think they're coming to you and say, "I think this would be great to do. They see it as their own idea, which is where you wanted them to go at the outset."

FT: That is what guidance is about. [laughs] But what you are talking about here to me – and please correct me if I am wrong on this. I see that is an extremely critical part of a young person's career. You said that some students come with a very clear idea of where they want to go. Well, that is great, provided there is enough meat there to warrant ultimately a PhD, or for the student that does not have a clear idea – and I have always felt that one of the key stones, if you will, of attaining the PhD is the student who is mentored into a certain path and gets help, gets help, gets help. At a certain point says, "Okay. I own this now. This is where I think we should be going," as opposed to one that still needs more and more and more help. So, I see that as really kind of a critical area in getting a young person [laughter] to talk about putting him on the yellow brick road, I mean, to get him on the right path, to fulfill all the things that are necessary to ultimately attain a PhD.

JS: Well, so, the PhD is a research degree, and you have to do something that's original and hasn't been done before. You have to generate new knowledge. I think the steps along the way are first engaging the interest, having them see the question that they can pursue.

FT: At that point, do they keep coming back to you with something actually written out? Maybe some formulas, some mathematics, something that you can look at and say, "Yes, this looks like you have probably on the right track with this?" How is that work?

JS: Do they keep coming back? Well, yes, you talk to them every day. You have regular meetings at which you assess what they've accomplished with a particular set of experiments. You help them evaluating the experiments and you have discussions about what next experiments should be done in order to address the questions that were raised in the previous experiment. How to get to the ultimate objective of understanding this process or mechanism or whatever it is? And so, there is a constant discussion and give and take and feedback. Eventually, the student is telling you in those conversations, not directly. But by the nature of the conversations is demonstrating that they are coming up with the ideas about the next step,

more than you are planting those seeds of ideas about the next step or saying specifically the next step should be.

FT: That is the critical part, is it not?

JS: I think that's a critical part. Yes. There's another critical part and that I think contributes to this. They do come with written things. They come with the results written. In the joint program, as in many graduate programs, there is a requirement for a graduate thesis committee. That is a committee of faculty members who will sit with you periodically and evaluate your progress. In the joint program, it's required that the student prepare a progress report and present that to their thesis committee and discuss what steps need to be taken next and whatnot. In some other places, it may operate pretty much one-on-one with the student and the adviser, without the benefit of a committee, both ways can work. It depends upon the quality of advice, I think, that one gets from an individual, as well as from a committee. There is certainly some value in the committee process. But ultimately, it's the one-on-one with the adviser that translates.

FT: They have to have you as a friend in that committee.

JS: Yes. [laughter] Yes.

FT: An awful lot said in that. Yes. [laughter]

JS: I reminded again of the advice that I was given. I think I mentioned this before that my adviser said this – he sat down and said – when I was embarking on the research in his lab, he said, "This will become your daily activity, your hobby, your entertainment, in essence, your life." Which I think is a very valuable thing to do. So, you try to bring that sense of investment of yourself in the activities that go on in the lab. When people are so invested, that they love to come, they love to do the research, they love to see what's going on, well, part of that is the group of people that you're with who share that same enthusiasm. So, I remember some years ago, Colleen Cavanaugh, who's a faculty member at Harvard, who was here through – not in the joint program but was around all the time when she was doing her graduate work. She's now a full professor at Harvard. She came into lab. It was one day. It might have been a Saturday. She came into the building. So, building was pretty much quiet except for my lab, which was bustling. She said you're the only one around here who operates a lab in the way I think it ought to be operated. I thought, "Well, that's right. It's the way I think it ought to be operated to." It's vitality and enthusiasm, and it's infectious.

FT: Yes, it is. I am not a basketball person, but I can remember several friends that were all coaches and basketball people and oh, my heavens, they could get together with a Dunkin Donuts on a Saturday morning and have a cup of coffee and some donuts, and they talk basketball, basketball. I mean, it was a passion. I am hearing the same kind of thing here that you are talking about. What you are talking about is a major part of the equation. The other part of the equation is integrating the young person into the Woods Hole community. As such, they come from all kinds of different places. Some of them going to breeze right in and take over. There is going to be kind of lonely, young folks, and so forth. I always remember one time, this is going back maybe eight years, talking to a joint program student. I asked him what was one of

the most valuable things he has done? He said, "Well, up where I am staying, every now and then our adviser comes up and we break out some beers, and we sit out in the front porch. We just talk." We talk what we are doing and things like this. He said, "That really is very special." That sounds like the kind of thing that you are developing here. Before I had to switch tapes, we were talking about this whole process of mentoring a potential PhD in the fields that we are dealing with. I had asked you or mentioned to you the fact that a graduate student at one time had told me they are just sitting down and talking with their mentor, as far as they were concerned, were one of the highlights of all of this. So, do you do anything in terms of integrating the young person into the Woods Hole society in general?

JS: Well, yes and no. In early days, recognizing that I don't have any students in the lab now. Well, I take that back, I don't have any joint program students in the lab. The idea of going out and spending time, at the least side, on Friday afternoon with the students and lots of others, that was very common. You try to integrate them into the community, although it's a small community and the integration period is pretty brief. They either get it or they don't. [laughter] Yes. I don't know that there's much integration in the Woods Hole community, per se. They do that by interaction with other graduate students in the lab and with others in the department and with people they meet and where they live. Because it is such a small community, things begin to gel pretty quickly, I think, for most individuals. Yes, it's an important thing that there be social interaction. Certainly, when I was a graduate student, that occurred. I certainly did that with students in the lab,

FT: I have this kind of mental image of coming into the Woods Hole area sometime in February that would not be a soul on the streets. [laughter] I have been there on those days in February. [laughter] I will say, "What have I gotten myself into here kind of thing?" It has always been one of my interest is how the institution integrates its people into the Hole Community of being at the oceanographic. Because I have so many people, primarily from the earlier years, describing this as a family atmosphere many times, and things no one else would think of, I am out to see but your wife's car breaks down, who gives her hand? That kind of thing?

JS: In many respects, I do not view it as here and the need for such interaction here any different than what goes on in small communities around the country. I mean, it's life.

FT: Which does not always flow as smoothly like that.

JS: Well, perhaps.

FT: I think it is just an issue. Now, you have got this young person. How do you kind of push them along? Are they going to have to go to sea? How do you prepare them for sea experience? Those kinds of things.

JS: That's more of an issue for some than others. So, it's not an issue for me because I don't do it very much. But whatever I went to see with students, and I did, it was as much me needing to be instructed on how to do go about it, as me helping students understand how to go about it. So, I came in 1971. The last time I went to sea was in 1979. There were, however, students from my lab who went to see during that period of the 1980s, and once or twice in the nineties. So, yes,

well, you just give them all the help that you can and getting everything ready. Getting them fully prepared mentally and materially for doing what they need to do at sea.

FT: Well, see, that to me is an issue because there are no Ace Hardware stores out there that you can pick up a spare piece if something breaks down. It is almost like going into space. You have to go out as a completely self-contained, ready to operate, ready to repair whatever breaks down entity.

JS: Yes.

FT: I would think that takes some doing.

JS: Well, it does but the kind of work that goes on in my lab is largely laboratory-based science. Whenever we would go to sea, it would be to collect materials in order to conduct the laboratory-based research, the bench work at sea. It wasn't collecting samples, just to see what kinds of organisms lived there. It was doing something with tissues and cells from those organisms. Sometimes you were able to do it at sea, and sometimes you froze material in liquid nitrogen and brought it back to do it on land. So, developing a laboratory at sea to do the kind of work that you would be able to do much more easily in your lab here was pretty difficult. I remember going to sea on one cruise. It was a cruise from Miami to Bermuda, I guess. I was a somebody who was just going along. It wasn't my cruise. I was just taking an opportunity that came. But still I had to prepare the laboratory to do the enzyme assays and get the instrumentation and to get the material to be able to break cells and isolate subcellular fractions, which at sea is a very difficult thing to do. Normally, you do that with a centrifuge. Centrifuges don't work well when the platform is not stable. As I'm thinking about it right now, I'm not sure that I would try to do the same thing again. Because the amount of information that you gained by doing it at the time in the laboratory, you were able to develop on the ship. The value added probably didn't justify the effort expended [laughter] in order to do that. Of course, though, at the time, we didn't know that. So, at the time, when we were looking at these enzymes and P450 and membrane fractions, everyone operating in the field, that is those with rats and mice and rabbits and whatever, always used freshly prepared membrane fractions. So, it wasn't clear that you could freeze either the membrane fractions or the tissues and then subsequently get membrane fractions that gave you valid interpretable, not artificial results. So, to try to get information from liver tissue from fishes from the midwaters, which is what I did on that cruise, according to the current wisdom of the day, you had to do it with fresh material. I had to do this. I had developed the laboratory, had to put the laboratory in a box, all the instrumentation, everything, to do all of this biochemistry. I had a gimbal table made that was in free in all directions, made of aluminum, constructed that I could put a centrifuge on. I had to hold the centrifuge so that it would allow me to be able to spin down subcellular fractions [laughter] at sea. I remember talking to the people at Beckman Instruments. I got them to give me a rotor, the item that holds the tubes that fits onto a spindle that spins and an extra motor. They said, "Well, sure, go. I would test." I persuaded them that it would be worth their while to have this tested at sea because other people would do it. So, I took the instrument out and did that and did all the measurements. Later that work became part of this paper that I mentioned, I think last week that was published twenty-five years later with his study of midwater fishes. So, that crew has provided all of the first information that led to this paper that I still think is one of the more important papers that we

produced. So, that began with me doing it all myself. So, that was really my work, my effort, my own hands. Later, students became engaged in the subsequent work on that progressing set of studies that culminated in this paper. So, those students are authors. But in that case, I was first author. This gets into the question about authorship, I think, that you were asking. When the idea and the effort to produce the result that you can interpret and write about, and the first draft of the paper belong to one person, that person is first author, no matter how many others are involved. So, now, when you have a student, and you bring that student into the office and you engage them in conversation and they take up your idea, whether they take it up as an idea given to them or whether you are successful in planting the seed that then grows in their mind and they think it's their own idea, for their own career, you let them run with the idea. They produce the results. When they are able to draft or write the first draft of the paper, it's necessary they do that because that's how they get a PhD is by writing. It's necessary for their career. It's recognized by some as an appropriate way to deal with authorship. So, if it's part of a student's thesis research, and they are doing the work and they are developing the idea, the idea may have come from somewhere, I mean, there are a lot of people who have similar ideas. If they develop the idea, and do the work and do the writing, they are legitimately and appropriately first author on that paper. This is something that is agreed to, sometimes at the start of the study. More often than not for the student, it is a tacit understanding. When there is question, you say, "Well, this is your paper. This is your baby. You run with it. You do it."

FT: There is several things I want to ask you, and actually a point that I would like to make clear right now, when you talked about the difficulty of centrifuging, I think back to just how difficult it could be to do a simple titration on board a bucking ship at one point or another. For someone who might listen to this, at some point, that has no knowledge of field whatsoever, the little things that make big jumps in the field. I mean, here you are with all your glass equipment, and what is this (Nalgene?) stuff that – that is a jump. Just exactly where is this ship? [laughter] Just exactly how deep down am I? All those things are things that everybody takes for granted but is not necessarily for granted when you are working in a field. You explained beautifully how these kind of incremental steps start to come along, and your area develops more and more and more. Just wanted to put that down as kind of a clearing up thing for someone who does not either understand science as such or the field. Back to your student again, how much work do you have to do with the average student in helping them with the form of the writing that they have to deal with?

JS: Sometimes far too much. I think we all have to write, and some naturally write better than others. I think it's one of the more important things to try to do. It's one of the more difficult things to impart is how to come to clarity of expression on their written page, so that you concisely and accurately articulate the question that you are going to be presenting in this paper. Why it's an important question? What is the evidence from prior work that pertains to the importance of this question, and what is unknown? What you do? What you have done to address the question, not with the results, but your approach to this in a page that I have? [laughter] Double-spaced, that's the goal. Some people have a knack for writing and others don't. So, I've had students in the lab who wrote beautifully. I've had students who, even though they have finished and are now faculty members in various places, when I get a manuscript from them that is finishing up their PhD work, I sort of cringe because I know I'm going to not be happy. So, what I would try to do is to get people to do a couple of things at the outset. That is

to think clearly about how they're speaking, and what words they use because words influence how you think, and then your thinking can become fixed improperly. So, it would sometimes be the case that students – and it's not just students, it's everybody, anybody will make a statement about an experiment they're doing or a result they have obtained. Incorporating assumptions into their thinking, when those assumptions haven't been tested, and the assumption comes out in the words they say, and often in the words they write. So, you have to get them to go back and examine their assumptions and to start out by assuming nothing, but letting the data tell you. You don't tell the data. That's one thing and then to be very careful about thinking laterally with regard to other things that may have been done and which may be known, that can influence the interpretation you are making. [laughter] And so, that requires the willingness to expend the effort to go and look for other explanations. It is sometimes the case that the people will come with an experimental result and say, "Look, I think this means such and such." Then I look at it, and I say, but [laughter] if you're a critical reviewer of a manuscript, they're going to look at the same data and say, "The data I see don't fit the conclusion this person has drawn." It's because there is this assumption that goes into their thinking and the conclusion they reach when they look at the data. So, you show it to a half a dozen other people and they might say, "No, I don't agree with that at all. It looks to me like X." Whereas the person who had the investment in it and wanted it to be some way said, "Hey, this looks like Y." So, getting people to examine the data and to think carefully about how they can interpret this, and what other information from other studies that they have done or that may be going on in the laboratory influence the interpretation that you can make. There were some papers published in the [19]70s about – not research papers, not research results, but more opinion papers. I remember one dealing with the value of and the ability to make strong inference from your results. So, what I would do, and I have a collection of various articles dealing with how to write and how to think, how to infer, and would give these to students and say, "Read this, pay attention to it. This is going to be important for you." So, at some level, someone like myself, beyond opening up a collection of questions, beyond making available a collection of questions that may be important to pursue, once a student grabs one of those questions and begins to make it their own, then you're left with helping to design experiments and seeing that and helping them to avoid those pitfalls in thinking and writing.

FT: It is wonderful to hear this because when a young person asks me what they should be studying in any one of the scientific disciplines, I always tell them do not neglect your writing, your composition, all that sort of thing. Because you are always going to have to sell yourself and your ideas. You are going to have to ask for money and make people think you are worth giving money to.

JS: Oh, yes. It's critical.

FT: It is an absolute critical skill for a person in this field. How about yourself? Do you enjoy the writing process, or is it onerous to you?

JS: No, it's not onerous. I think it's invigorating. Everyone I know has difficulty getting those first words on paper. Sometimes they flow easily, and sometimes they don't. To some degree, it depends on the nature of the paper that you're writing. Some papers sort of grow together from a variety of experiments that have been done. You have to piece together these pieces to make the

story, recognizing that you had the title, the story [laughter] at the beginning, but you draw together various pieces. In other cases, there is a very clear set of experiments that are done. You do those and there isn't the struggle to say, "Okay. Well, now, how do we write the discussion for this or how do we introduce this?" Ideally, it would be that latter in every case, [laughter] but it's not. I do remember one paper that I wrote on the bus from Boston. I would say from Boston to Woods Hole, but I couldn't. For some reason, I had – I would have to go to Hyannis and somebody picked me up in Hyannis. So, I wrote the paper on the bus, longhand. Who does that today? [laughter] It was just so clear. It just flowed out of the pen and came back, typed it up, and three days later, submitted it.

FT: That is very unusual. [laughter]

JS: Yes, writing is very important. If someone writes very clearly, that to me is a big plus in how they will progress. There is someone on the faculty here who was a postdoc with me whose writing was about as good as any I had seen. I thought that person had to stay.

FT: Which brings up another point. When these young people have, through their efforts and through your efforts, managed to gain that degree, they have to make another decision at that point, whether to do postdoc, look for research, look for academics. Do you have a role in that?

JS: Of course, and every good adviser, I think should. My view of the student and your responsibilities for that student is you provide them with whatever guidance you think you can give them. You help them at any step during their process. Often in the case of graduate education, there may be a dark night of the soul, they go through a period when they are questioning, am I doing the right thing? Should I bail out and do something else? I think it's not uncommon that people have this. So, you help them through that phase. You help them with the process of preparing a thesis and you help them in preparing presentations. All for the benefit of the student, but also for the benefit of your own laboratory because this person represents and will be recognized as having come from your laboratory. The reputation of the laboratory is important for how the student may progress as well as the student's own native abilities and what they can do. When they look for a postdoc, you write letters for them. You suggest people you think would be good for them to work with. You explore again their objectives, as you did at the outset of their graduate career. You try to help them find the right place.

FT: It is really an enormous commitment, is it not?

JS: Well, it is. It's a very big commitment. It's one of the reasons that I don't have students now, who are my own graduate students. I have students in the lab who are students from elsewhere, who were here for a year as part of their graduate training, but whose faculty adviser is at a university someplace else in some other country. But the commitment to a student of four, [laughter] unlikely, five, hopefully, maybe a little more than five years, as a graduate student and then helping them to find the right faculty position, helping them get papers published – not faculty position but postdoc position. At this stage of my career, I can't see that I could make those commitments for four, five, six years, seven years of effort. So, yes, it is a big commitment, I think.

FT: You must feel a real deep sense of satisfaction. How many youngsters ballpark have you helped along the way like this?

JS: I think I've had eighteen PhD students, I think. I'd have to go back and count, but not all were in the joint program, some were in other institution.

FT: Professor, reasonable number, eighteen.

JS: I think so. Yes. Then there were a few masters students, and there quite a few undergraduates along the way. Then students from other places who come and spend a period of time but not their full thesis research period.

FT: Each one represents X number of years or parts of years that you are going to be dealing with them?

JS: Oh, yes.

FT: That is a lot of work.

JS: Yes, it is. It's a lot of work, but it's a lot of fun too. I had opportunities to go elsewhere. I was offered a job as the director of the Marine Science Institute at the University of Texas. I looked very carefully at that and thought about it, and there were a couple of factors in not taking the job. One was the quality of the students in the joint program compared to the quality of students in almost every other program that I could see. Having students of the caliber of those in the joint program was important because they challenged you and they brought you along as much as you brought them along.

FT: They are smart kids. [laughter]

JS: Yes.

FT: There is a certain amount of confidence too with that smartness that they go through.

JS: Yes.

FT: I really hear what you are talking about. It is when you get that classes with you every step of the way and anticipating and feeling good about what they are doing, it is a wonderful feeling. You must feel very good.

JS: Well, it was great fun. I mean, when the lab was real –

FT: You were saying you had about eighteen.

JS: Yes, eighteen students all together, eighteen PhD students. At the peak in the lab, I had about fifteen people in the lab all together, including graduate students, technicians, postdocs, and undergraduates at a time in the summer. I can't remember how many graduate students at

that time. But I think I'd have to go back and look, but it might have been as many as eight in various stages of their careers. To me, that was just wonderful. First of all, the students and postdocs and the people in the lab, they all teach one another. For biochemistry, in this kind of research, having a group that is of critical mass is very important. Because the senior students instruct the junior students in the technical aspects of the work at the bench. They collectively work to improve the technology with which the questions can be addressed. With a group like that, the faculty member, unfortunately or fortunately, depending upon your desire to work at the bench, doesn't have the time to work at the bench. So, I haven't actually done the kinds of experiments that go on in the laboratory or have gone on in the laboratory. I haven't been involved with these ten fingers for twenty years. But every part of what goes on in the laboratory, in a sense, is mine up here.

FT: It is interesting that you bring that up. Because in teaching the advanced placement courses in like physics, chemistry, biology, one of the hallmarks of the kind of youngster you get in a program like that, and we're talking pre-undergraduate days, it was expected that they would help each other. It was expected that I was going to teach at a certain level, and they were going to help each other get through this. I am trying to get a clearer picture now of how your whole career has developed here, because you have your own career, which has gone in some really interesting directions. You have dedicated in a large amount of time to building an environment of a vibrant laboratory with the future of the field coming in and working with you and directing them. But the other thing you've also done, which also takes away from your own research, is you've also gotten in some administrative ends that you go on here. Head of departments, the new institutes that they came up with four or five years ago, could you talk about that summit? How you made the decision to do that? Because it does take time away from your other interest.

JS: Sure. There are several things about the kind of activities you're referring to that are important to note. I think one is those that are internal to the institution and those that are external to the institution. Everyone owes something to the institution where they are working. It is not that the institution owes you everything. You owe something as well to the institution for the benefit it provides to you. You also owe something to the community of people with whom you work on a day-to-day basis. Sometimes that debt can be met by doing administrative duties to help oversee the operation or the running or the day-to-day activities of the unit with which you're affiliated. So, being a department chair, for example, is something that can be difficult, can be very enjoyable. It's not something everyone has the opportunity to do. It's not something that everyone would do well. There are qualities that some people bring, and other people bring different qualities to such a position. So, I was department chair here from the late 2000 until mid-2006. It was something I very much enjoyed doing in some respects. I found it interesting that when I stepped into being department chair that all of a sudden, my research took on a great new [laughter] appeal to me. Going to conferences and meetings, all of a sudden, was a real luxury that I absolutely relished more than I had ever before. Because I wasn't being required at those conferences and meetings to deal with the day-to-day issues of the department and to deal with people's wants as well as people's needs. So, when you're a department chair, you have to deal with all of the activities associated with the careers of the people in your department. In much the same way you would become associated with all of the activities of the careers of the people in your lab, except now it's a larger group of people. So, there's some hard decisions you have to make. At this institution, you have to deal also with the whole institutions'

activities, not just your department. You can be an advocate for the department. But the administration would tell you, "Yes, but you are employed by us. You are working for us, the administration, the institution, rather than just for your department." So, you have to reach a balance between how you respond to the needs and the requirements that are placed upon you by the institution and your superior, which is the director of research and the president or director of the institution, and the needs and desires of your department and how you can meet their wants and needs as well.

FT: Can I interrupt you here for a minute?

JS: Sure.

FT: You have a way of thinking that I find very admirable. I really like to develop a little bit more of this because this is an oral history that a lot of it has to do with how the person sees the world. I would guess that ninety percent of the people that are in an administrative position look at things in terms of putting out forest fires, so to speak. What is the issue that this person is concerned about? You did not approach it that way.

JS: I don't know, but that is very true. That's what it is. [laughter]

FT: That is true. But you use the word, their career. That is thinking in a much larger sense in terms of the responsibility of a department head than just I need another \$10,000 for glassware. When I was doing Bob Gagosian's oral history, every now and then someone would come and need to see him right away. I would see people come in with a very definite body language of supplicant on their face, and I would see other people coming in with steam coming out of their ears.

JS: Yes, I don't doubt that.

FT: I remember at that point, Gagosian said, "You know," he said, "It is really strange. People I used to party with, all this kind of thing, the minute I became the director of the institution, everyone changed. [laughter] No one looked at me in the same way anymore. Even my buddies were different." He was, as he expressed it, somewhat perplexed by it and somewhat discouraged by it. I could say no more than that.

JS: Yes.

FT: But just by virtue of saying that you have the person's career in mind, that to me is a very unique way of looking at running a department in an institution like this one. I understand the need to put out the little forest fires and all that. But there is a much bigger picture here, which I think goes along with the way you mentored people and your whole environment that you created for yourself.

JS: I don't know. There were times when I would be loath to answer the phone when I would see who was calling because [laughter] I knew there was going to be some –

FT: Unpleasantness is the word? [laughter]

JS: Well, yes, unpleasantness. But every institution, every group of people has a certain number who are needier than others. There have been a few who take up more time than others. It's hard because you have to be able to somehow deal with people's uncertainties about the future, their own future. When you're dealing with faculty members, you have career steps, you have the appointment and promotion process that they're most –

FT: Which was horrendous, I might add.

JS: – that they're most concerned with. So, you really have to help them through that and give them advice about how they do that. That's probably the most important thing. Then you do little things to try to make their lives happier. So, [laughter] I could go around periodically and visit the labs and say, "Hey, how's it going?" I have candy in my pocket and give candy to the workers. [laughter] I mean, silly little things like that I thought made a big difference.

FT: That is a big deal. I have had more people tell me, a certain director actually used to come in and see what was going on. "What do you need? It seems this place looks like it needs a paint job," that kind of thing.

JS: Yes.

FT: That was really important because it was a one-to-one relationship kind of thing. What you are bringing up here is how much larger that administrative position in an organization like this is than in some others, because you bring in the whole issue of career. If someone on the outside knew what you actually had to go through on the promotion line, and all of those kinds of things, [laughter] this is not for everybody. [laughter]

JS: No, it's not. But on the other hand, being the department chair was really most satisfying. When there were those people who were so talented and so good, that you were able to not have to argue on their behalf, but rather have the privilege of presenting their case because it was so good. That it just was really great. I mean, there are a lot of good people here and to be associated with them and to help them along sometimes, is important and it's good.

FT: That is why so many people tell me I have the best job in the institution. [laughter] I get to talk to all of these people and see what is what with them. It is really quite neat.

JS: There were a few things that I did that I would, and this may sound – I don't know what the right word is. I can't find words as well as I used to. I would look at people who would come in and sometimes as they were complaining or arguing or requesting or whatever, and I was thinking I don't want to do this or I'm really not happy with this, you just have to look at them and tell yourself you love them [laughter] in a very real sense. I think that is an approach that I think helped get through those.

FT: But you talk with enthusiasm about every stage of your career. I look at this and I see that is kind of like a wave coming in to ashore. [laughter] It starts low but then as it starts to show a

lot that way it goes and you got more and more math that is coming in, you get your own research, which I think is pretty important. I really do. I cannot tell you how impressed I was with it when you talked about it. That bringing new people into the field of the future, another big issue, and then guiding people through their stay here at the institution and making it a good experience is the development of a department. That is pretty big deal. Then ultimately, the institutes –

JS: Well, I didn't have much to do with the institutes. I mean, I accept it as a member of the administration. That is as a department chair, you were charged with sort of overseeing how the institutes were doing. But there is a Center for Oceans and Human Health, and it's in fifth year now. It's an NIH, NSF jointly funded Center for Oceans of Human Health, which I've been director of since its inception.

FT: We were talking about the Institute of Oceans and Human Health. Is that a growth thing that has come out of the research that has been done in the last twenty or thirty years recognizing that the ocean is a place that can address human health?

JS: Oh, well, the ocean as a source of information that's pertinent to human health has been recognized for decades, which, as we spoke earlier, about the origins of the MBL and the Oceanographic Institution, using marine animals as models for fundamental biomedical research, or using the oceans as a potential source for discovery of drugs and things of that nature. Those are very real connections to human health. Also, the oceans as a source of our marine organisms, food organisms, as vectors of human pathogens back to human populations is also known. People have known for centuries that you can get sick if you eat fish or shellfish from the wrong place at the wrong time. I have reminded of the admonition not to eat oysters from months that did not have the letter R in them. [laughter] I don't know where that came from. But I can't help but say one of my father-in-law's favorite poems, which I doggerel, I should say, was *Let us sing a song of praise to Themistocles O'Shea, who ate a dozen oysters on the second day of May.* [laughter]

FT: Well, I asked that because, again, this could be listened to by someone that is not up on different sciences, and who still sees marine biology as kind of a taxonomic thing where you are swimming with whales and dolphins.

JS: Yes.

FT: In a day, like we have now, when issues like climate change year around and degradation of oceans and all this kind of thing, I really think it is important for the general public to be more culturally aware of the kinds of things people work on, and what is important? Obviously, health is very important. [laughter] It seems all we hear about is how you are going to have a national health scheme or something like that. Well, that is great. I am all for that a hundred percent. But the national health scheme is there to take care of some of the issues that you can come up with as a human being.

JS: So, understanding the connections between the oceans and the health of human populations on the coastal regions around the world is something of longstanding interest. The particular

Centers for Oceans and Human Health that are jointly funded by the NSF and the NIH arose as a result of community that is scientific community concerns and a desire on the part of the two agencies to address these concerns, which seem to be large and not adequately within the remit of either of the agencies to that time. So, that the two agencies got together and had a competition for centers to establish Centers for Oceans and Human Health. There were some constraints put on what the centers should focus on. These were competitive grant applications that were about three and a half inches thick [laughter] at the time they were first submitted. There were probably twenty of them. We were fortunate in being one of the four centers funded. It addresses issues related to harmful algal blooms and toxins from the harmful algae. Also, human pathogens in the coastal environment and how they get there, where they go, and how they can get back to humans? That center has pursued that. I've been director of the center even though my own research is not in the area of harmful algal blooms or pathogens, but yet as a person who has had an experience with the NIH community and the institute, in particular, that was involved in this, The National Institute of Environmental Health and Sciences, and having experience with centers that had been funded by NIH at other places through probably twenty years of involvement as a member of various scientific advisory committees for centers of this type around the country. I had some ability and some interest in seeing the center succeed. But you can look at these issues of Oceans and Human Health as, from the flip side as well, humans and ocean health, oceans and human health. The two directions are connected. It's a circle. So, one of the things that we pursued in my lab and the research over these years is really more humans and ocean health. But yet, in doing studies with model species, we go back to the human health part of that equation. The center is more directed at the processes affecting human health directly. It is an area that is probably going to gain importance over the next decades rather than diminish. As human populations increase, for example, the potential for pathogenic organisms, enteric viruses, and enteric pathogens to become more prevalent in coastal waters and come back to the humans either who are doing their recreational activities in the waters that are contaminated or consuming contaminated seafood. It's going to grow in importance. So, I think it is an important area for the field of Ocean Sciences. I think it's an important thing for this institution and the Woods Hole community. It's not just the institution. The center itself involves the Marine Biological Laboratory and the Oceanographic Institution and MIT. So, it's not the Woods Hole Oceanographic Institution Center for Oceans and Human Health. It's the Woods Hole Center for Oceans and Human Health.

FT: You just mentioned three pretty weighty institutions [laughter] there when you describe this. I cannot help but have a feeling that the general public is coming more and more to see this. I see more and more articles in popular press and things like this about climate change, about tsunamis, about contamination of one sort or another is it is almost like the idea is time is really starting to come now in terms of the public looking at it.

JS: Maybe it's the ideas time is coming back. I think this waxes and wanes.

FT: Yes. But when you have presidential candidates addressing some of those issues, it has come a little bit more of a big deal. Well, with all of this being put together, you are emeritus, right?

JS: Yes.

FT: You did not really retire?

JS: No. My activities day-to-day are exactly the same as they were.

FT: I have a feeling of I came in and went to the next lab and said, "I have a question. When did John Stegeman retired?" "He's retired." I will have that feeling. How did that decision come about? Can I ask kind of a big open-ended question here? How did that decision come about? What is the future hold for you?

JS: Good question. Well, there are a couple of things, though, that I'd like to touch on perhaps, if you can remember that?

FT: Yes.

JS: Oh, forget it. [laughter] There are other things that we didn't touch on, that are part and parcel of the contribution to the scientific community and to the community here. We talked about service in the institution in various ways in administration and whatnot. I think this is something that everyone would agree and probably many had brought up, science in this country precedes and progresses because of the voluntary contributions of scientists to help it do so. So, scientists do enormous effort reviewing papers, reviewing proposals, serving on committees, doing activities that benefit and augment the scientific enterprise and allow it to proceed and progress, that are volunteered effort and time. It is an enormous and to a large degree, unrecognized – I'm certain, by people outside the scientific community, unrecognized contribution, and an essential part of the way that science has succeeded in this country.

FT: I think that is because most people do not really understand what a scientific career is all about.

JS: Right. This is all very much part of a scientific career. There are other people out there who are doing the same work that benefits you when they review your grants and your papers, and you, in turn, need to review other papers and grants to try to improve things, to try to evaluate, to try to judge. There's also contribution to various committees. So, I have served on probably a dozen scientific advisory committees for centers around the country and served on the Scientific Advisory Council for the National Toxicology Program. It's part of the NIH and spent probably all of the last twelve years serving on committees for the National Research Council and the Institute of Medicine, and both parts of the National Academies of Science. I raised this because it is an important thing to me to have been able to do service in one particular way. So, for the past eight years, I've served on four Institute of Medicine committees. Each one doing pretty much the same thing, producing a [inaudible] update of information concerning health effects of Agent Orange in Vietnam veterans. So, this is something that I was asked to do originally because of the work that we've done over the years with dioxin and chemicals like dioxin and how they can affect organisms. Knowing that dioxin is this toxic chemical that pretty much is the responsible agent for concern about the health effects of herbicides that were sprayed during the Vietnam War, I was able to provide some input into this committee and chaired the committee for the last two editions. We produced a book that's about this big, maybe one up

here. The reason that I valued this so is because I never did serve in the military, but I am of the Vietnam era, age, and a number of my friends from high school did serve in Vietnam. All of them came back, but I was never in the military. But this was a contribution that I could make to the veterans, by serving on this committee to evaluate the literature on health effects of Agent Orange. Our reports were the basis upon which the Department of Veterans Affairs decided whether or not to afford compensation to veterans for particular health conditions they may have.

FT: Yes, what you are bringing up here was an incredible hot potato. Because if the finding was one way, it means someone was going to have to spend an awful lot of money.

JS: That's exactly right.

FT: I am a Vietnam veteran, but only because I happen to be in the Army seven days after they decided that this is where the Vietnam War started. So, I was not there. [laughter] I even refused the bonus they gave because I just did not feel as though I could be part of it. But it was an issue that a lot of people tried to say had no effect on these people. But yet, I think, clearly, it was shown that it did have an effect on a lot of people. So, pretty important thing to be working on. Now, along with that, you also done a lot of lecturing at other institutions and places.

JS: Yes.

FT: Could you talk about that a little bit?

JS: Yes.

FT: What makes them call someone like you and say, "Could you come and do a seminar for us or... "

JS: Well, when that happens, it's because there's research going on at that institution or that university or medical school or college that is similar to or related to the kind of work that you're doing. So, it's usually because of publications that are out there that people want you to come and tell them about what it is you're doing. What's going on?

FT: They have to recognize the fact that you are an authority in that particular area?

JS: Well, I supposed so.

FT: I know you cannot see it, but I can. I want to bring this back to something else that you were just talking about, when you talk about scientists keeping science moving. A little bit more concrete example, your lab will receive a paper by someone who you do not know at all, but about a subject that you are familiar with and have to evaluate that. What is the value in this paper? Is it valuable? Are the conclusions reasonable? So, there is a lot of that kind of thing that goes on. Through all that, then you start to build a reputation of being an authority in a field, and you're invited to give talks in various places. You reluctantly say that "Okay. I suppose you could say I am an authority on it." You have done quite a lot of that, have not you?

JS: Yes.

FT: What are some of the places you have been? What kind of topics have you addressed in these places?

JS: Well, almost always, it's the research that we're doing in the lab. When I say we, of course, I mean, when you have students and postdocs working together, it's all part of the same package of research. You sometimes are invited to give talks on work that was done largely by a student or a postdoc, and that's okay. Because you give that student or postdoc the credit when you give the talk, but it's the effort of the lab. Oftentimes, it's the ideas that collectively are generated. But through the course of living long enough and doing the same thing, you do gain some wealth of history, I suppose, as much as current up to the minute progress. So, where am I gone? I had gone to lots of places. But some of the more interesting was going to, I guess, something called the Princess Conference in Bangkok, which was a conference organized by Princess Chulabhorn who's the daughter of the current king and great granddaughter of the king and the King and I. She's a chemist and has an institute and has every now and then a conference that is there, and that was very special. Very interesting entertainment that the Grand Palace in Bangkok afterwards. But I think probably the ones that I have enjoyed or perhaps appreciated the most were a couple of times when I was invited by graduate students at an institution to come. As it happens here, there are programs for visiting scholars here that the graduate students operate. They identify someone they would like to come. So, I went to Scripps quite a long time ago as a visiting scholar invited by the graduate students and University of Maryland invited by the graduate students. That is satisfying because you see that somebody is actually reading your papers and thinking that "Yes, we want this person to come."

FT: But it is different being invited by the graduate students and be invited by the faculty. There is a fine difference to meet.

JS: Yes. But I'd much prefer to be invited by the student.

FT: Oh, yes. Yes, that says that is successful. What I have done here, that is successful. That is a big part of your career.

JS: So, I'll give a talk in Sweden next week when I go there, [laughter] which I have to prepare yet so.

FT: I have a feeling we are going to have to do one more of these. Is that okay?

JS: Sure.

FT: You have a family too?

JS: Yes.

FT: You have a very full career. How do you squeeze the family with all of this?

JS: Well, I have a sense that I have sometimes shortchange the family. That has been one of the difficulties to me. Being gone and having to spend so much time writing and reading and focused on the work, I think that they would have to answer it for me to say whether or not they see the same thing. But there was a period when it wasn't quite that way. My wife had a problem in health twenty-five years ago or twenty-four years ago. She had leukemia. That was diagnosed on the day after her birthday, which is June 12th, so June 13th. It was tentatively diagnosed June 14th. She was in Boston, rather than Falmouth. It was diagnosed. She was in the hospital for most of that summer and then for much of the following year. This was 1984. So, the youngest was two and still in diapers and the oldest was seven, so seven, five, and two. So, having those three kids and not living close to family, having a very active lab and having my wife in the hospital in Boston, it was kind of a struggle. So, I would get up in the morning, come to the lab, talk with the students, do things in the lab, catch the 10:30 a.m. bus to Boston, be there at noon, take the 5:15 p.m. bus back in time to get home for dinner with the kids, pretty much that whole summer. One thing I learned was the degree to which a successful career that a man has if he has a family is built on the contributions of that family.

FT: I hear where you are coming from with that.

JS: So, try to be mother and father and do everything else and spend pretty much every day and every afternoon in Boston, in the hospital, it was challenging time.

FT: Well, it is not just the work you are doing, it is a mental part of this whole thing that must have been horrendous.

JS: It was a challenge.

FT: Look, we have had a pretty good day here. I noticed you are looking at your watch there on another go. It is approaching 12:00 p.m. There is one more thing I would like to do and that is this whole bit about your emeritus, but I do not think your routine has changed all that much in terms of being in here.

JS: Okay.

FT: I would like to get into this part of your life and where you hope it is going to go. Just give you the opportunity to talk about that.

JS: Sure.

FT: Then I think that will finish as well.

JS: Great.

FT: Let us do something else that...

[end of transcript]