

Interdisciplinary Education in Astrobiology

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INTRODUCTION

Astrobiology is a grand challenge that requires significant levels of collaboration and interdisciplinary cooperation [1], [2], [3], [4], [5]. Interdisciplinary research requires scholars who are trained accordingly [6], [7]. "Training the next generation of astrobiology researchers" so that they can operate in an interdisciplinary and collaborative fashion is indeed one of the mission statements of the NASA Astrobiology Institute (NAI) [8]. This study investigates interdisciplinary education in astrobiology, barriers and facilitators the astrobiology students and the professors experience, and NAI's support to early career people.

METHODS

One hundred and fifty NAI researchers at all levels (from graduate students to principal investigators) were interviewed in their own institutions, labs, and offices about interdisciplinary education and research, the role of mentoring, and job prospects. The interviews were verbatim transcribed and analyzed by QDA software.



NAI RESEARCHERS

150

RESULTS

Astrobiology community is a young community that is receptive to training. The main barriers for interdisciplinary research careers were identified as **job prospects**, **too many things to learn** about, different **terminology** in different domains, and **communication** barriers by the interviewees.



50%



"Out of 550 researchers, half of them received their Ph.D.s after 2000."



200
GRADUATE
STUDENTS

"Moreover, there is an additional 200 graduate students, which makes a young research network."

JOB

"So, a lot of places, particularly, meaning here, people talk about interdisciplinarity all the time and how awesome it would be if everyone is interdisciplinary, and when it comes to tenure review time, you get hit in the head with it. 'You only published half as much as this person' who was, kept their head down and didn't talk to anyone for the last five years, right?"



LC, Co-I

LANGUAGE

"Well, probably the hardest thing is that people train differently in every field. ... I think the most difficult thing when you put geologist, physicists, chemists, mathematicians and biologist together; they don't have a very common language. You understand you know, like a Portuguese understands a little Spanish or a Spaniard understands a little Italian but they [do] not ... possess the speaking, the language like a native does." ZZ, PI

COMMUNICATION

"But it turns out its really hard for biogeochemist and a somebody who studies star formation have a science conversation. It's really hard. And it's not just that they think in math and I think in chemistry ... It's partly special temporal scales, it's even the nature of the question that we ask, it's hard to find those connections." JJ, Co-I

"I think it really is having in a sense that kind of **intellectual peripheral vision** that allows you to [do] ... So, again, it gets back to the habits of my education that says, it's not enough just to do the narrow work that you're doing, that you really have to take some time during the day to at least wade into the water outside of your discipline. ... I think you have to have a broad enough understanding of your field to know what techniques that you don't do can help you and who are the people who are the better practitioners of those techniques. ... I think the biggest barrier to interdisciplinary work is simply our own failures to understand how other expertise's can help us. So, you know, **narrow education is the enemy of interdisciplinary research.**" BL, Co-I

TOO MANY THINGS TO LEARN

"There's a lot of information out there so it's hard to pick up things outside your field. It takes time." LM, Postdoc



On the other hand, increased **exposure** to other domains through field trips, summer & winter schools, visiting other labs, attending AbGradCon & AbSciCon helped students and postdoctoral researchers to overcome some of the barriers. **NAI's support** has been instrumental in the process. In addition, the **astrobiology Ph.D. program** that is being offered at the University of Washington that was initiated through NSF IGERT grant has been critical to the community in the earlier years. Students in the program have been trained in interdisciplinary presentation and writing skills and spend a semester outside their immediate field. The graduates of the program have been spreading the best practice so far.



"AbGradCon & AbSciCon helped students and postdoctoral researchers to overcome some of the barriers."

EXPOSURE

"Facilitators of interdisciplinary research are the kinds of community building activities that get people together. Like, interdisciplinary seminars, and symposia, and allowing your graduate students to enroll in classes in other departments and other disciplines ... because then the graduate student comes back and says, 'I just learned about this really cool thing' or 'I just met this professor, who's working on this other problem.'" BR, Co-I



"Well, one of the nice things is we have very broad seminar series here. So, there's a lot of subjects they get exposed to." DB, Co-I

"In fact, one of our grad students, who's paid by our astrobiology stuff, who has an office up here 'cause she's an astronomer, suddenly said she wants to be in the water pool. I was hesitant because that would set a precedent and all the grad students would want to be in there and we don't have enough space. She goes, 'But I've been excited talking to various people down there.' She's now wanting to do some lab experiments in the geochemistry area and she says, 'I need to be surrounded by those people in the different disciplines. So I've agreed.'" LN, PI

ABSCICON

"...this Astrobiology Conference is a great place to meet all sorts of people and listen to all sorts of different things and kind of have the chance to think about your general questions from a different point of view. That's helpful!" CT, Grad student

ASTROBIOLOGY PhD PROGRAM

"NSF IGERT, whereby we were able to support astrobiology students for two or three years with untied RA-ship ... you could pursue whatever branch of science you like and be interdisciplinary and integrative and try things out and fail and move on, which was really good for, especially a young discipline like astrobiology ... [we] allowed our students to do a research rotation outside their area of Ph.D. specialization, so an astronomer would go after microbiology for one or two quarters and do a microbiology research project." SC, Co-I



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