

Understanding the Rules of Life: Emerging Networks

Please stand by for realtime captions.

> Welcome, we appreciate you being here today. To Understanding the Rules of Life: Emerging Networks Solicitation . Or URoL-EN as the acronym. We have some slight changes we will talk about in this webinar. As you will see from this list and from the variety of different people presenting today we have representatives from all of the participating directorates here at NSF with this diversity of directorates we are leading this convergent science research program.

Recording in progress

We're going to go ahead, Nick, you can introduce yourself and start us off

Thank you, welcome everyone to the Understanding the Rules of Life: Emerging Networks Solicitation webinar. My name is Nick Hunt. I'm part of the program working group. During this program working group will talk about the program discussed solicitation and do our best to answer any questions a couple notes, before we start, this webinar is being recorded and will be posted to the program website within a few weeks. Please use the question and answer teacher to submit any questions. We will be monitoring the questions and will answer it in the question answer session following the presentation. Please submit questions about the program if you have specific questions regarding your proposal please email the working group so they can get with us. With that I will turn over to Dr. Betsy von Holle.

I am the chair of the Understanding the Rules of Life: Emerging Networks Solicitation . I am from the biology directorates each of us will go ahead and from the representative directorates we went to dress ourselves and then we will launch into the webinar. So Zhilan Feng, is next. Thank you Zhilan Feng, if you can introduce yourself

Sorry, I knew myself. Thank you, I am Zhilan Feng. I'm in petition and program director in the mathematical biology in the division of mathematical sciences mathematics and physical science directorate. Thank you

I am Jeremy Guinn. On the program director for education and human resources or E HR. The choppers supports research, workforce development and participation research my home institution is United Tribes technical College in North Dakota.

Grace, your next

Thank you, I am Grace Hwang. On the representatives of the Understanding the Rules of Life: Emerging Networks Solicitation working groups from the directorate or engineering I'm from the chemical file engineering transfer assistance position. In engineering and from disability and we have a program. Like Jeremy I'm also a rotator. My home institution is the John Hopkins University. Thank you.

I met, I am traffic team. I'm resenting the director of geosciences. My program is out of network.

Good afternoon, everyone my name is Hector Munoz-Avila. I represent the CIS he directorate. Thank you. Hello Mech everybody, my name is Trisha Van Zandt I resent the social behavioral sciences, might network is human data sciences. I'm a rotator. My home institution is the Ohio State University.

Great, if we can move to the next slide. Thanks.

Excuse me, just a second understanding rules of life emerging networks is a cross directorate program of NSF it aims to develop a predictive understanding of how key properties of living systems emerge from interactions such as genomes. And how emerging networks of organismal, natural social and human systems with bond to her influence evolving environments. Emerging networks describe our environmental, social or human engineers systems that are complex and often, so the behaviors of living systems depend on but are not wholly predicted I chemical and physical properties. Unit level biological properties these were molecules or sells organisms or pop populations as well as communication among nodes in the network.

Thanks, Tricia. Tamra, if we could move to the next slide, please. There are a number of requirements for this solicitation the first one is that the proposal should identify a roll of life around research is oriented or to which the research is applied. We include more information about that in this solicitation, which we strongly encourage anyone who is a applying to this solicitation, reading it very carefully. In addition to that have a research plan. And in terms of submissions, again within this solicitation, really specific information how those sections should be titled. Overall, this should be, NSF, as a basic or fundamental science agency. This should be a basic or fundamental research approach to investigating new understanding of Emerging Networks. And organisms and earth, human, natural and or human engineers systems in evolving environments. And because we have this idea of convergent science. We require there are two PIs. One PIN one co-PI, on the proposal. Those PIs on the proposal need to have expertise in different disciplines that are pertinent to at least two of the following directorates of which we are representing today. Each of the program directors who are here are representative. That would include the biological sciences, computer and

information science and engineering education in human researchers or E HR. Engineering, geosciences, mathematical and physical sciences and the social, behavioral and economic sciences. These map out to the National Science Foundation. Your expertise in these various disciplines, can be devastated by earn degrees from these disciplines. Current departmental, and, or center affiliations. Orc spirit such as papers published in that disciplinary field. We do ask that you come again you map these out in that convergent science section of the proposal. Next slide, please.

Thank you, Betsy. I'm here to tell you about the objectives of this program. We are interested in conducting basic or fundamental research focus on understanding the emergent properties of networks of living systems. Which are reciprocally coupled with natural, built, social, and or human engineered systems in evolving environments. It is important to realize we do want proposals to discuss these ideas. At least two different systems and an evolving environment. An environment can race evolve in response to and it can evolution can occur in a variety of temporal scales. To be chemical, it could be physical, could be molecular, cellular. The second objective is to determine emerging properties of these networks. Which arise from complex and nonlinear interactions among different systems in isolation do not exhibit such properties. This is a critical gap in an unsolved problem. We hope the community will address. An objective is to support research and activities using convergent science. We went to support potentially groundbreaking investigations that cross disciplines. That involve and integrate STEM education and outreach that the values of our activities and research the project undertakes. The program supports project to take interdisciplinary approaches to better understand emergent networks and or mechanisms. Emphasizing project across audible levels of complexity and/or temporal scales and taxa anywhere within the tree of life. Next light.

There are many of the projects supported so far, in this program. They share some common features. They address a fundamental question in the life sciences. They crossed different scales whether their spatial, temporal, or biological organization or levels of complexity, et cetera. They produce results that will be probably generalizable, beyond the system under investigation. Then able to forecasting a prediction of change in a biological system in the context of other systems. Including earth, human, natural, and or human engineered systems. This is important that enables us to address some of the greatest challenges we currently face in the world. The projects focus on convergent approaches throughout the entire proposal. The plan to describe the clear innovation of knowledge, and expertise from different disciplines and how each is applied to explore emerging properties. Finally successful project that integrated STEM education and outreach into the research plant. Engage the public and provide opportunities for the next generation of researchers. The activities not only be mentioned but detailed. So yours can truly evaluate the merit and likelihood of success in those training and outreach activities. Next light, is sectors.

thank you, Jeremy. That is a success and evaluation and criteria proposal. Person must address NSF criteria. The proposal must address one or more rules of life around the proposed research is oriented or to which the research is applied. Third, the proposal should provide a compelling convergence research plan, with deep integration across disciplines. Finally the proposal should describe a basic, or fundamental, research approach to investigate a new understanding of emergent networks. Of interactions among organisms, earth, natural, and orc human systems in evolving environments. The next slide, please.

Thank you, Hector. Required parts of the proposals in this program. Some you mentioned before. Bessie, and others. First of all you need to have a project description. The uniqueness of this program is we need to identify our OL. And the proposed work. And specify what the convergent research would consider. And broader impacts for support. Proposal also needs to include data and management plan and a postop mentoring plan if applicable. For other information's you can include supplements including project management plan and the role of project personnel. And pay attention to the page limits. And a student training plan if applicable. Which is two pages. And letters of collaboration. Specified in the description. Next slide, please. Also include a budget. For this program, the limit is 3 million. Also the duration of the project is no more than 60 months. The full proposal deadline is March 1st, 2022. By 5:00 p.m., local time. Also this program does not allow collaborative proposals. You need to have one single proposal. With sub awards. And it's PI, and co-PI requirements. When minimum PI. And one co-PI. In research to at least two directorates. As requirement of the convergent research. No more than one submission per PI or co-PI. Next slide, please.

Great, thanks, all. As Nick said earlier, the intent for this is for general questions about this as it tasted to be answered, asked and answered. We are happy to take any questions you might have. If you have very specific questions about your specific proposal. Please feel free to reach out to us at this email that we have provided for you. We're going to open it up for questions, now. Those are as Nick said, you can do it through the Q&A function. We will go through them one at a time.

Essie, there were two questions that came in one at a time. The first question has to do with convergent research, what is it? I'm going to put in the chat. Some links for you. To the various NSF webpages. From

those webpages, convergent research, Intel's integrating, I have to close the windows, integrated knowledge, methods and expertise from different disciplines. And for me novel frameworks. To catalyst scientific discovery and innovation. Convergent research is more than interdisciplinary. Convergent research has deep integration across dispersed disciplines. I convergent team bring together intellectual diverse researchers to develop effective ways to communicate across disciplines. By adopting common frameworks and new scientific language. I will put some examples in the chat of what is and is not a convergent research team. I would do that in just a second. The second question is what is a rule of life? From the NSF webpage having to do with the rule of life. Although we're still learning to identify rules of life projects. They may have the following characteristics. They address a fundamental question in life sciences. They may cross a different scales such as spatial, temporal, levels of biological organization and complexity. They generate results that will be brought and generalizable under this system often investigation so I will can be formulated. They may enable to forecasting a prediction of change in a biological system. Thanks, Betsy. Be great, thank you, so much. For bringing those up, Tricia. I'm going to turn it over to Nick to start going through the questions that have come up. As well. Then, the program officers will be working to either answer these questions at that have come in. Live, or types of of them out, thanks so much, Nick. Thanks, Betsy. I will start off with a question that was already answered. Question was are proposals limited to two PIs. It is a minimum of two. One question that came in was, what are some examples of human systems? Could conditions during space travel, microgravity, be considered human? Grace, would like to answer this question?

I would like to basically point out, to give some examples of human systems in solicitation. It is communication, information processing, robotics, artificial systems, that corroborate for a nondecision decision-making ability. In different dynamic environments. To the extent that the question involving conditions during space travel. Can be expressed. In the forms of an emerging network. In interactions with living systems. I believe this is within scope.

Thank you. Another question. Bessie, I see you are typing, would like to answer? Can a project examining my close association in an operable system reconsidered in this program?

Yeah, I was just about to answer that. By the chat function. Basically, it depends on the questions that are being asked. This is, the emergent networks program, understand life is a basic or fundamental science program. It would have to depend on what questions were being asked. Specifically identify operable, which reads to me as an applied system. It really would depend on the questions that were being asked. That would be one of those, it would be a specific question for the program, for a specific proposal. Thank you.

Okay. Next up, how open is this genetic go to program such as drug resistance? Would a program officer like to answer that?

Yes, I would need a bit of time. Nick, do you mind reading some of those answered once. I can jump back into this one. And I will answer it live.

Certainly.

Thanks.

Another question, does evolution have to be interpreted as strict biological sense? Could be taken as changing shift due to violence? This was answered changing shifty, not strictly biological. Can you explain with the basic fundamental research approach is? The answer, making use of basic scientific methods. Another question that Tricia, expanded on was about convergent approaches. I believe she posted that information, in the chat. Another question, do the emergent networks have to involve different organisms? Can they involve different genes and cell types in a organism that are reacting to a changing environment in different ways? The answer emergent networks to include different organisms or different genes or sell times within an organism. With earth, human, actual or human stems involving environments. Another question. Must a project involve humans in order to enter the systems? The answer is no. The next question, is there a number bound and the number of co-PIs? The number is 25 but the number is senior personnel is not limited. The next question of how many disciplines need to be included. For a convergent research. The answer at least two. The next question is how is a sub award different from collaborative proposal? The answer collaborative proposals have different be PIs from different institutions. For this there's only one PI and one co-PI with expertise into different intercept directives. And sub awards to other institutions as needed. Another question about PIs. The next number is five co-PIs. The next question is we have four PIs from different institutions and different research backgrounds. Should we decide for ourselves who will PI and you will be awarded? The answer is that is correct, the team will decide the roles. Another question, should we conduct at least part of research at the molecular level? The answer is it is not a requirement. Can bacterial systems, shall be used as a model system for this call? The answer is yes. The next question I'm given we are researching rules of life. Rules of life to be applicable to all systems. Can these be very different? Such as species interactions on one and societies in another? The answer is yes. Another question when can we submit a white paper for feedback before developing a full proposal? The answer is, please

submit only a one page project. Summary. The next question are can you comment on the idea of emerging networks. The answer was a network theory can be a component of the project. It is not a requirement. Another question, must the proposal involve genetics or genomics? The answer is no. The next question, do all PIs and coal PIs focus on the same project? The answer is yes. The next question, are you interested in the level of cells that are more microscopic? The answer is focus on any level of organization. The next question, are proposals required to target networks that are known to have emergent properties? Or can we study networks that we think have emerging properties? The answer are so networks that you think have emerging product release. Properties. That looks like all of the answered questions, so far. We will shift over to the open questions.

Nick, I am ready to answer the question regarding medical science.

Okay. Let me review the question. The question, how open is this genetically relevant problems, such as cancer drug assistance?

Okay, great, we get this question quite a bit. The overall take is that two federal agencies can't find the same research. So NSF sig was it his cell from NIH in the biological sciences. By finding basic science or fundamental science. Whereas NIH is applied science for human health. The exception at NSF is bioengineering disease-related goals. Which is stated in the P.A. PPG. I will briefly summarize it, I also put the text from the solicitation that we wrote. Specifically in regards to this question, in the chat section, so you can see that there, as well. While we encourage solutions to a rule of life. We listed some of those. In the potential topics that are bulleted. That rule of life should be based on a basic or fundamental science approach. Rather than applied science approach. As stated in the solicitation. Were looking for a basic or fundamental research approach to investigate a new understanding of emerging networks of interactions, among organisms, earth, human, natural and or human or and or human engineered systems, in E evolving environments. We also included that's P.A. PPG, relevant text, that NSF does not normally support technical assistance pilot plant efforts, research requiring securities classification. The development of products for commercial marketing. Or market research for a particular project or invention. We do research with disease-related goals including work on antiallergy diagnosis or treatment for physical or mental disease per abnormality or malfunction in human beings or animals. Is normally not supported. Animal modules. Excuse me. Animal models of such conditions on the development of testing or drugs or other procedures for the treatment also are not eligible for support. As I mentioned research about engineering or information tech knowledge he would diagnosis for treatment related goals. That applies engineering or computer science principles to problems in biology and medicine while advancing engineering or computer science gnomes, is eligible for support. 28 persons with disabilities is also else eligible. Thank you, for that question.

Thank you, Betsy. The next question, does the rule of life need to be a new world okay to be a rule that is already been proposed? Some reviews from last year's limitations seem confused about this. The answer, it could have been proposed before. The next question, how much preliminary data is expected? The answer, there is no expert Tatian on the amount of preliminary data. How much is appropriate will depend on your discipline. Or the question you are pursuing. The next question, can proposals be entirely theoretical work? Or need integration with data? The answer, that would depend on what is appropriate for your discipline or the problem you are studying. The next question, how important is a modeling component for successful submission? Or could a potential proposal not have a model with it? The answer, this would depend on the discipline or the problem you are pursuing.

Nick, may I add something about the last question. If you provide a response, you would still have to satisfy the convergent requirements. It can't, it would have to still be convergent and theoretical. If it is truly just theoretical. I wanted to make sure that is clear. Go ahead.

Thank you, for the addition. Another question about PIs. Can the PIs and co-PIs be from the same as addition? The answer is yes. Another question, is submitting the project one page required per participant in the proposal? Nope, it is not required to submit a one-page prior to submission. The next question, does this mean that population and community level questions are excluded? The answer is no. A question about sub-awardees, is there any limit on the project part of the sub awardee institution? That answer is no. The next question, can you comment or share a link abstracts were previously funded proposals on this call, other any shift in focus based on past call to current call? On the program webpage is a link to the funded proposals. Then, you can peruse them and find that information. Isolate related question asking if I Alyssa funded project specific to emerging networks? You can use the NSF award search function. Again, if you go to our program webpage there is a link with all of the previous awards. Next question I'm seeing, how many proposals per year can one PI submit to rules of my programs? Not only for this call but also others. The answer, an individual may appear as a PI or co-PI on only one proposal per annual cycle submitted. In the response to this solicitation. This count does not include submissions to other URoL programs or to last year's URoL EN competition. The next question, I notice most previous recipient seem to be into cellular

biology, have you received applicants in ecology or statistics? If so can you give any advice for examples the topics that did not meet the requirements. What would make project in these areas more successful? The answer is, we have received proposals across almost all the NSF directorates. We can't give advice or examples, at this time.

Nick, I can answer, sorry

Nope, go ahead. But I was going to say, I can answer the question about how exactly is this yours elicitation different from last year's solicitation? There are two similar questions like that. I can go ahead and answer that. What we did for this year's limitations, we really tried to make it crystal clear. The requirements. That are associated with the world of life emerging networks solicitations. We put that in several different areas, we repeated it multiple times. That was the slide that said using convergent approaches, proposals must identify a rule of life around which the proposed research is oriented. Or to which the research is applied. Including a compelling convergent research plan with deep interaction across. And evolve a basic or fundamental research approach to investigate a new understanding of Emerging Networks between organisms and earth, human, natural and or human engineered systems and evolving environments. The reason why, we just really tried to clarify that language. Some of those were garments were missed by some of the people who submitted the proposals. Also, there is a misunderstanding. The emergent networks of between organisms of natural and/or human engineered systems had to involve all those systems that is not the case. Proposals, can the get interactions between organisms and or systems or organisms and human systems and human engineered systems all of which would be within evolving environments. Those don't all have to be encapsulated in a single proposal. That would be really hard to do, anyways. In terms of building a research team. Some of our proposal is of our successful puzzles did involve a multiple of those different types of areas. The idea is that, that's not a requirement. That we are just suggesting that those interactions in terms of understanding Emerging Networks, should be between two of them. We just try to clarify that, throughout this solicitation. To make it more clear to the community. Thanks, Nick.

Thank you. The next question I am seeing. This solicitation has been heavily focused on biology. Mentioning pastor was, how specific must these proposals be? The answer, the requirement is that systems are by context of emerging networks. This understanding of worldwide Emerging Networks is a cross director program of NSF. Need to develop a pretty predicting understanding of living systems. Emerges from interaction such as genomes, genomes types and their environments. In organisms, human, natural respond to or influence evolving environments. The next question them at the focus is on Emerging Networks and energy producing back to your will be considered relevant to DOE? Even though DOE is not focusing on the spectator anymore? The answer, proposals that fall into the role of other granting agencies. On how U.S. Department of agriculture. Form of energy, and others are discouraged. You will need to clearly explain that DOE is not focusing on this area in your submission. We have a question about finding ways, the answer, we will provide funny rates for a programs. Question about the recording, yes, it will be made available to the public. We will have a link posted. On our program website. In the next few weeks. The next question, how important is a modeling component for successful submission? If it does not have a modeling component? The answer, it is up to the research teams to include a modeling component. But, it is not required. Another question, are you looking for a proposal that have extensive innovation of nonbiological factors? I.e., can we use resources for multiple types of PIs. To answer an evolving biological question? The answer is yes. Another question, would you consider a project as far as we focus on Michael biological related questions? The answer, that is seen noted. It may be more suited for the NIH. It is impossible to give good feedback on this. Please send a one page summary for better feed back. The next question, is it appropriate to work on something that might be formed in an early rule of life but which is not necessarily manifest throughout biological systems today? I.e., something that has been lost in organisms. The answer is yes, early rules of life are appropriate. Such questions arising in evolutionary biology. For example. The next question them and examples given on the slides and networks, they were all of the organisms scale upwards. One sub-organism or subcellular, are they allowed? The answer yes, some organisms are allowed but must involve other systems with human natural, and/or human engineered systems. The next question, does the interaction between organisms and human systems should involve existing human system? Or could the proposal introduce a new human system? Novel systems are in scope. The next question, it doesn't need to focus on one organism system? Or can it be competitive, saved school of fish or both are okay some proposal? It can include multiple species or a single species. The next question, can the proposal be focused on a single system or do they have to touch on multiple systems? The answer, they must touch on two systems. The next question is, will this call be repeated next year? That answer is, unfortunately, at this time we do not know. If we will return in the future.

Another question. About biology. About how biologists a specific must it be? The answer, the do not have to be specifically biological. There was a question about a one pager. Can you explain more about what goes

into a one page summary for feedback? In the one pager, you can describe your project briefly. Focusing how you see it fitted into the solicitation. Then you can send it to the email listed on the slide. The program, email. The next question, can we collaborate with industrial teams? Can we receive sub- awards? The answer, it is from solicitation and reads per the solicitation requirements. PIs Anne PIs can only be from higher institutions of learning. Two or four year college universities. Or from a nonacademic nonprofit institution. Research labs, professional societies and similar organizations in the U.S. with educational or research activities. Investigators from foreign operations are not allowed to be PIs or cope PIs. They can be a consultant or senior personnel. We encourage you to read with this solicitation says about sub- awards. Another question, so genomics and other biological tools, are not required so long to to identify some rule of life. The answer, that is correct. Another question about the future of this program. As of right now, that information is not known. The next question, what is the expectation of education for this program? The answer, the convergent scope, understanding rules of life projects also provides unique STEM education and outreach possibilities. And diversity of approaches. And to engage society generally. The roles of my program is dredges programs to research and the research plan to buy provide convergent opportunities for researchers. Students develop novel teaching models. Another question, can we collaborate with international teams? International teams can be funded through a sub award. Such a team needs to be justified. Another question about co-PIs. Can they be from the same institution? The answer is yes. The next stressing to the training activities include curricular development. For example interdisciplinary teams related to that project? The answer is absolutely. There are some questions about specific proposals. We encourage you to send a one pager to give a more complete was Ponce to the email listed on the slide. The next question is what is the total budget for this program this year? The answer the anticipated funding will be 16 million. Another question reads, a sub awardee and call PIs the same? The answer is it depends on the structure of the team. Those of different institutions from the submitted institution can be sub awardees. The next question reads, are there directed couplings that were more successful in the past and others? For example with Geo, bio coupling be considered? The answer, the only requirement is to have representation of at least two different directorates. No pair of two directorates it's considered two of those. The next question reads, and defining emergent behavior, is the unexpected Kaman essentials, specifically unexpected unintuitive is not this same as core differences between behavior and isolation and behavior and network context? The answer is, that is correct. Unexpected is not essential. The next question, we provided a link to NSF ideas page at the very top, it says the sets of rules that predictive organisms of characteristic genome type. The answer is yes, that is where the rules that can Beeks Lord with a paper proposal. That can be explored with a paper proposal. There is another question about webinar. This webinar will be posted. This recording will be posted to the program page. Once it becomes available. We are anticipating within a few weeks. Another question about co-tran18. I saw some funded URoL proposals . Be the answers they could be from the same or different institutions. Again co-tran18, they can be from the same institution.

Nick, can I jump in and answer a question live?

Yes.

Okay, thanks. Really quickly I want to clarify this. This is how it is difficult with this type of format. In terms of having questions submitted and us answering them. Just for clarification. One of the question was, I did not understand your response. Proposals on two systems, could you please elaborate. Must attempt on two distinct living systems? As in one, the living system and to seek him a human or otherwise engineered system. With which the living system interacts. It is the latter. However, what we specifically say. Those networks of living systems, what we are interested in is understanding the E Emerging Networks of those interactions between the networks of living systems with earth, social, or natural, or human engineering systems. It is that later. It's not just human and human engineered systems it is also earth systems, natural systems and social systems. I wanted to clarify that. I appreciate that kind of drawing down into that question.

Thank you, for that elaboration. Those are the answered questions. I will move back into the open questions. The first one, is given the interdisciplinary nature viewers would consist of different experts that would view the proposal, not entirely. Reviewer matching will be based on their expert keys?

Thank you, so much that is a great question. What we do for these panels. For this cross directive, interdisciplinary program. As you see, the team here is comprised of experts from all of our representative directorates. Then, we choose panelists who represent our directorates. Once we see what is coming in. In terms of the proposals. We match those proposals to the appropriate panel. That has that expertise. These panels are comprised of representatives from all the directorates. They are able, then we match those panelists to their specific expertise. We do also ask for ad hoc reviews in some circumstances. That is requested, as well. We are tackling this from lots of different vantages. That cross a director, those cross

directive panels are reviewing all of these proposals simultaneously. They do get to calibrate across the range of proposals that are submitted to this program. Thank you.

Thank you. The next question, the solicitation says the project should be based on a rule of life to address associate outcomes for societal benefit. To what extent should the apply societal and that detail? The answer, to the greatest extent possible. Given the expectations of the proposal and the need to provide sufficient detail about your project. Moving back over to the open questions. The next one, does understanding the interactions between humans and human engineered systems is valid in terms of tackling two systems? I think I'm that was similar question to one that was already answered. Would anyone like to elaborate on that answer?

So the, sorry. It's a tricky question. It really depends on the context. This may be one of those ones, where folks would like to submit specific questions to us. The ideas that living systems. Networks of living systems are kind of the focus of this solicitation. How those living systems network was social systems, earth systems, and human and/or human engineered systems. If that human system is considered, you describe it and said it in terms of a network of living organisms. That would qualify.

Thank you. I see the next question. You just answered co-tran18 maybe from different institutions. You also mentioned call PIs must be sub awardees.

The reason why this is probably confusing. We are not allowing what NSF has a structure for what are called collaborative proposals. If there are people collaborating across different institutions. Normally, NSF allows people from different institutions to submit them together. As a collaborative proposal. We do not allow that in this case for this solicitation. In fact, collaborative proposals in that sense with this submitted from multiple different institutions, would be returned without review. While we do allow is a primary institution to submit to NSF. Anyone from a different institution would be a sub awardee. There will be PIs and co-tran18 listed. Those PIs and call PIs from a different institution from the main institution submitting. Would have to be a sub awardee. Be submitted as a sub awardee. Because they are from a different institution. Anyone from that same institution could be within a co-PI structure. It also depends on your institutional policies, as well. Who could be considered a PI and a co-PI, from your institution. Be okay, thank you, Betsy. I see a lot of questions about us Pacific examples. Microbial systems are living systems. I would encourage those people to send in a one pager. If you're taking about a proposal of these types of systems. Another question I'm seeing, can one PI submit to this rule of life was submitted another to another role in a year? A similar question was answered, I believe the answer was PI can submit once it to this solicitation. You can also submit to a different rules of life or understanding rules of life solicitation. Big Nick, in our lesMond can I jump in and answer a question live?

Yes.

Okay, great this is a reiterating that conception, the conception of different systems. Following on the systems question, again. I microbial system, in other words the living part in a link, the earth or natural part consider two systems then? So the answer, the short answer is yes. The idea is that an emergent never come a successful emergent network proposal will be understanding the interaction of the microbial of the living network with the earth the system or the abiotic components of that link even the natural components of that link. Thank you.

Thank you, Betsy. Looks like we are nearing the end of our time. If there are any more questions we encourage you to email the program and so they can be addressed. Thank you, all for attending. Have a good day.

Great, thank you, so much. [Event concluded]