THE NEXT STEPS: 20 POSSIBILITIES

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ABSTRACT. In the field of bioastronomy, at least 20 search strategies and other next steps are possible at present. Which of these are most appropriate at this stage? Twenty possible strategies and projects are listed. They are arranged in five clusters: (1) develop the field of bioastronomy and its ideas; (2) search beyond the Solar System; (3) search inside the Solar System; (4) search our planet; (5) take action to make the contact beneficial. Three assessments are provided for each strategy: (1) the likelihood of success if adequate effort and funding; (2) the magnitude of benefits to humanity if successful; and (3) the likely payoff from greatly increased effort and resources. Nine strategies are particularly high priority but all nine are neglected or at least underfunded at present.

1. INTRODUCTION

As one contemplates the vast sweep of humanity's future, it seems likely that contact or interaction with advanced extraterrestrials will play an incredibly significant role. This contact could occur next week, next year, or several hundred years from now.

What can we do now to increase the chances of early contact? What should we do now to make that future contact as positive and beneficial as possible for humanity?

At least 20 different strategies and projects are possible answers to these questions. They are presented in Table I. Some of the strategies listed in this table have been frequently discussed in the bioastronomy and SETI literature; others have been suggested by only one or two writers. It is useful at this stage in the bioastronomy field to contemplate the total array of potential strategies. Better choices and priorities may result.

The 20 strategies and projects in the table are arranged in five clusters: (1) develop the field of bioastronomy and its ideas; (2) search beyond the Solar System; (3) search inside the Solar System; (4) search our planet; (5) take action to make the contact beneficial. During the next few years, what strategies will most likely prove highly beneficial? Which of them are most appropriate

G. Marx (ed.), Bioastronomy – The Next Steps, 397–404.

TABLE I. TWENTY POSSIBLE STRATEGIES

Twenty possible strategies and projects	Likelihood of success if adequate effort and funding	If successful, how beneficial to humanity	Likely payoff from greatly increased effort
DEVELOP THE FIELD OF BIOASTRONOMY AND ITS IDEAS			
1. Strengthen the infrastructure that will enable the scientific field of bioastronomy to progress	***	***	***
2. Study how biological evolution might occur elsewhere and obtain life-relevant data about planets and their moons in the solar system and beyond	**	*	*
3. For the potential bioastronomy benefits, continue doing good astronomy	**	*	*
4. Study the likely capacities, aims, help, and methods of extraterrestrials	***	***	***
5. Study dolphins and nonhuman primates as ETI analogs	*	*	
6. Develop arrangements for obtaining potentially useful data from military and security agencies	*	**	*
7. Provide opportunities for students and the general public to learn about bioastronomy	***	**	**
SEARCH BEYOND THE SOLAR SYSTEM			
8. Search for detailed messages sent from afar by radio, particle beams, or laser beams	**	**	**
9. Try to detect astroengineering projects, high energy consumption or discharge, unusual coherence, byproducts, or other distant evidence of technological civilizations	**	*	

SEARCH INSIDE THE SOLAR SYSTEM			
10. Search for a parked automated probe that can be triggered to release a message to us, or that is (or was) sending data to its home base	**	**	**
11. Watch for and communicate with a fast flyby probe that is unable to stop		**	
12. Search for intelligent visitors and current astroengineering projects in the Solar System	**	***	**
13. Search for traces of an earlier visit to the Solar System		*	
14. Try to intercept a virus that has been encoded with a message, or a spore that could be germinated		**	
SEARCH OUR PLANET			
15. Study claims of experiences with extraterrestrial visitors, spacecraft, and messages since 1940	**	**	**
16. Seek other evidence of current (live or automated) surveillance or help	**	***	**
17. Study possible evidence of visits to Earth before 1940		*	
TAKE ACTION TO MAKE THE CONTACT BENEFICIAL			
18. Send radio messages or otherwise encourage extraterrestrials interact with us	*	***	*
19. Prepare for positive contact or interaction that is successful and beneficial	**	***	**
20. Prepare to handle negative possibilities (alien bandits, hostile warriors, deadly probes)	*	***	*

at this stage? When wrestling with these questions, it is useful to make three assessments for each strategy, as shown in Table I. Although these assessments are necessarily tentative and subjective, they are based on an extensive effort to integrate the literature about likely extraterrestrial reality (Tough, 1986).

The first column shows the likelihood of success if a reasonably adequate level of effort and funding is devoted to the given strategy. Those that are most likely to be successful are marked with three asterisks and the least likely have no asterisks at all. Intermediate levels are marked with one or two asterisks. (I have chosen asterisks in order to make the chart's 60 cells easier to grasp; words such as MEDIUM and HIGH make it hard to gain an overall picture from the chart and numbers are too precise at our present stage.)

If the given strategy is successful, how great will the benefits be for humanity's future? The second column estimates these benefits. Again the highest items are marked with three asterisks and the lowest with none. Rapid two-way communication with advanced extraterrestrials would probably have an enormous and positive impact on our civilization (***). A detailed one-way message that we decipher would also have a huge impact (**). A very brief message that simply reveals the existence and location of one distant civilization would probably have only a minor impact (*) because millions of people (50% of respondents in a recent Gallup poll) already believe that extraterrestrials exist.

Some of the 20 strategies and projects have already been tried, but only briefly and on a fairly small scale, and some have never been tried at all. One or two others have succeeded in obtaining a higher level of support and are making excellent progress.

Unfortunately, human society today is unlikely to support all 20 strategies adequately. Consequently, it is important to compare the priorities of the various possibilities, as shown in the right-hand column. Over the next few years, how large would the global payoff or benefits likely be from greatly increased attention, effort, and resources devoted to each particular strategy? Although we might wish that all 20 could receive adequate funding, the hard reality is that difficult choices will have to be made. The strategies for which additional funding and effort are likely to pay off particularly well are marked with two or three asterisks. The priority in the right-hand column is based on the other two columns and on a forced-choice assumption: if major additional support is available for only <u>some</u> of the 20, which of them would produce the highest payoffs for the field of bioastronomy?

Let me be explicit about one important point: I do not believe any strategy should receive <u>less</u> attention and funding than it now receives. Zero or one asterisk in this column simply means that major <u>additional</u> support will probably not pay off as well for bioastronomy as will additional support for a higher-rated strategy.

Let us now turn to each of the high-priority strategies (two or three asterisks in the right-hand column) in turn. Additional effort and resources for these nine strategies could lead to epic benefits for human civilization.

2. THE NINE TOP PRIORITIES

The first high-priority strategy in the table is to strengthen the infrastructure that will enable the scientific field of bioastronomy to develop, expand, and flourish. Although this field has made great progress in the past 10-15 years, it still lacks its own multi-discipline association and newsletter, its own journal, its own annual meeting, and a single index and abstract source. Ben Finney (1986) has suggested that social scientists and humanists might join together to lay the groundwork for the comparative study of cosmic civilizations and to form the interdisciplinary field of astrosociology. One can foresee the day when several broad-gauge Ph.D. programs and several interdisciplinary research centers will focus on advanced life in the Galaxy.

The next high-priority strategy (#4) is the study of the likely capacities, aims, principles, projects, help, and methods of advanced extraterrestrials. Each search strategy is based on major assumptions about extraterrestrial technology and psychology; enhancing our insight into their motivations and capacities can produce better choices of search strategies. We have to figure out what they are doing before we can figure out how to detect them. A sophisticated and empathic picture of extraterrestrial behavior could be developed through disciplined inquiry. Psychologists, anthropologists, sociologists, futurists, cultural evolution experts, astronomers, and biologists could all play useful roles in the inquiry.

Another high-priority strategy (#7): provide courses, conferences, books, TV programs, perhaps a semi-popular periodical, and other opportunities for students of various ages and for the general public to learn about bioastronomy. Not only will they benefit from the increased knowledge and enlarged perspective, but also they may become more supportive of government and university funding for this field.

Richly detailed messages from other places in the Galaxy may be reaching Earth right now. Detecting such a message is certainly a high-priority strategy (#8). Certain civilizations, at least at one stage of their development, may have broadcast advice, knowledge, techniques, values, ethics, principles of social and political organization, religious beliefs, even instructions for building something. Consequently, we should continue to flexibly check various possibilities within the electromagnetic spectrum. We might also check for messages sent by neutral molecular beams, neutron beams, neutrinos, or other particle beams (Bracewell, 1981) or by laser beams. We should also make arrangements now for sharing and decoding every potential beacon, signal, and message.

It is also quite possible that an intelligent civilization has chosen to send some sort of automated probe to the Solar System. The simplest type of probe or sonde (beyond a fast flyby that is unable to stop) would park or cruise in the Solar System and send data to its home civilization. In addition, a more complex probe might be programmed to release a significant detailed message to any beings who trigger it by approaching it, by directing certain radio waves or laser beams at it, or by achieving an advanced state of technology.

A probe might also be self-replicating (a von Neumann or "Santa Claus" machine) in order to send its progeny to explore other stars. Creative efforts to detect any type of probe is a high-priority strategy (#10).

It is also important to search the Solar System for signs of intelligent beings and their activities (strategy #12). The intelligent life could be extraterrestrials who have come here in a spacecraft, maybe with a propulsion system that we have not yet discovered. Two other possibilities are pointed out by Barrow and Tipler (1986). One possibility is that the intelligent "being" may be some type of supercomputer or twentieth-generation computer combined with robots. "An advanced von Neumann probe would be an intelligent being in its own right, only made of metal rather than flesh and blood" (p. 595). The other possibility is a von Neumann probe that was programmed to synthesizè fertilized egg-cells of the living species that sent it and then to raise them to adulthood (p. 580). It could also build a self-sustaining space colony for them to inhabit. We could search the asteroid belt and other parts of the Solar System for signs of a space station, space colony, parked spacecraft, mining operation, materials processing plant, or some large-scale ongoing astro-engineering project. Waste heat could be a sign, for instance, as could evidence that asteroids or comets are disappearing at an artifically high rate (Tarter, 1985). Infrared data, too, could yield valuable clues.

Since the 1940's, a great many people have claimed that they have seen an extraterrestrial spacecraft and even its occupants. Most of these claims, when investigated, turn out to be the result of misperception, an inability to distinguish between fantasy experiences and reality, or even a hoax. Because there is a chance, though, that one or two of the reports are valid, some additional effort should be made to study any promising cases or avenues (strategy #15).

As we saw in the discussion of strategy #12, it is possible that some intelligent beings (or supercomputers) are visiting the Solar System or have been synthesized here. If so, there is a good possibility that they are making some sort of close-up but inconspicuous effort to observe us or even to foster our progress. They may, for instance, have some sort of inconspicuous arrangement in place that enables them to provide instant protection or some other sort of help behind the scenes (Tough, 1986). Strategy #16 suggests that we should think creatively about various possible methods of inconspicuous surveillance and help, and then figure out ways of detecting these methods.

Finally, we should increase our preparations for successful contact (#19). At least six particular steps could turn out to be useful. (a) List various ways in which contact and interaction might occur, and then think through or simulate possible scenarios for each of these. (b) Study the possible consequences of contact, particularly anything potentially negative that could somehow be avoided. (c) Develop and implement arrangements now that will ensure the wide dissemination of information about any beacon, signal, or

message within the scientific community, thus making it difficult for the military or the national government of the recipient nation to impound the data (Tough, 1987). (d) Continue formulating international protocol for activities following the detection of a signal. (e) In preparation for replying to a message or for some other sort of interaction with extraterrestrials, clarify globally our goals, priorities, requests, metalaw principles, and strategies. (f) Establish an international team that has global authority to interact and negotiate with extraterrestrials. All six steps are high priority now and should not be postponed until after contact occurs.

3. DISCUSSION

We have discussed the nine strategies and projects that seem highest priority for additional effort and funding. Most of the other eleven strategies in the table are also worth pursuing if resources are available.

Today the field of bioastronomy is at an early stage of development and much remains unknown. Despite enormous strides in this field in recent years, we must still operate with a high level of uncertainty about the number, characteristics, capacities, and motives of advanced beings in our Galaxy. Consequently, at this stage, it would be premature to limit our efforts to one or two strategies while neglecting the other 18. Instead, we clearly need a multi-path approach that emphasizes a variety of strategies. At this stage in its development, the field of bioastronomy needs as much diversity as it can get: the breakthrough may come from some unexpected source. As Thomas McDonough (1987, p. 232) points out, "There is no way to be certain which strategy is best, so the mere diversity of approaches being used by so many people for so many purposes increases the chance that one of them will be the right one." Ronald Bracewell (1981, p. 350), too, has urged us to be open-minded about strategies: "All unorthodox suggestions warrant consideration, even though one might choose not to devote personal effort to following them up, because the future undoubtedly holds discoveries that are not obviously implied by the present state of knowledge, and we should be on the alert for any phenomena that might contribute to the detection of advanced civilizations elsewhere."

The potential gains for human civilization are enormous. We could benefit from knowing some basic facts about intelligent life in the Galaxy, from the enlarged perspective that this new knowledge would bring, and from any practical information that we receive. Compared to the potential payoff for humanity, all nine of the high-priority strategies are underfunded; some are grossly neglected. Effort and resources for all nine should be increased dramatically. As one contemplates the long-term future of human civilization, it is clear that few other investments today have a better chance of providing such significant benefits for future generations.

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