Grants-in-Aid and Basic Research

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My research involves planetary raw materials, their diversity, and the process by which they are created. To describe it in a nutshell: At the time stars are born, protoplanetary disks form and revolve around them. They contain minerals and other minute particles that become planetary elements. Chemical reactions occur along with changes in the physical states of these particles, altering their types and constituents, creating large chunks of matter, resulting in the creation of diverse planetary raw materials. As this brief description reveals, my research is comparable to pursing a dream—one that has little if any direct impact of human beings. It goes without saying, therefore, that the only funding available for such basic research is from Grants-in-Aid. Accordingly, my research has always benefitted from these grants. I am very grateful for that support and for the opportunities the Grant-in-Aid program has accorded me to engage in research in neighboring fields with many colleagues.

I can trace back the path of my research by the series of Grants-in-Aid I have received over the years. The first one I obtained was immediately after being employed at the University of Tokyo. Privileged to be working under the eminent Prof. Kiyoshi Nakazawa, I used, or might I say "tarnished," his good name to acquire the grant. It was at a time when a new discipline was being formed that overarched physics and chemistry, giving rise to epochal concepts. Leading up to it had been the creation of new knowledge regarding the planet-formation process derived through physics coupled with empirical information obtained from meteorites. Those concepts would set the path for my ensuing research.

My research started by gathering and compiling chemical data derived from material analyses; but to draw a bigger picture, I decided that I would need to couple chemistry with physics. So, I devised an experimental approach. Photoplanetary disks exist at such low pressure as to be virtually a vacuum, in a human sense. They also have wide ranging temperatures: Highs of >1500 degrees centigrade needed to melt rock and lows so extreme as to allow the existence of ice. As it would be necessary to find how the distribution of rocks, organic substances, ice and gases changes with temperature fluctuations—that is, to quantitatively identify phase changes in these substances—my greatest challenge would be to develop an apparatus capable of evaporating and condensating rock at temperatures of over 1500 degrees centigrade. As there was no such product on the market, I had to myself conceptualize and design it, and commission a specialized machinist to build it. This consumed not only a lot of my time but also of my Grant-in-Aid money. Through a hit-and-miss process, I ended up building five of these apparatuses in an effort to improve their performance, each adding to the money spent, ultimately incurring a very large Grant-in-Aid expenditure. Though I was able to obtain the minimum limit of chemical data by coupling chemistry with physics using this apparatus, a level for which I could be fully satisfied was not reached.

As I was plodding along in this direction with my research, the world around me changed. Now, given the some 50,000 stars in the universe thought to have planets (actually, a little less than 1,000 have been confirmed to date), the prospect was that some must surely possess life, which had a large number of astronomers and life scientists immersed in a search for such planets. This new era poses a challenge for physicists: How can they go about finding traces of life on distant planets? One way would be to take a step away from a search for novel phenomena and think in more general ways. This would involve several theoretically predictions: What is the composition of planets formed while revolving around stars? Do they possess raw materials that produce water and gases? Concretely, what kind of organic and inorganic substances do they possess? Seeking the answers to such questions brings me back to the science I had initially set out to pursue.

Thrust into this new era, three years ago I obtained a new Grant-in-Aid. Working with many young colleagues, I widened the scope of my research to an investigation of the small astronomical objects, which, born from protoplanetary disks, are the “children” that grow into planets. What we are attempting to do is to elucidate the evolution of materials of life; that is, the precursor organic and accompanying inorganic substances that don’t even become amino acids. I am currently in the process of advancing this research.

From four years ago until last year, I had the opportunity to serve as a senior program officer in JSPS's Research Center for Science Systems. In that service, I gained a great appreciation for the effort that JSPS puts into the Grant-in-Aid Program. Not only do they work to continuously enhance it but they have also both created and maintain a system of application screening and project evaluation conducted by researchers themselves. Moreover, I've been impressed by the way the total budget for Grants-in-Aid has been continually increased amidst a stringent fiscal environment in Japan. Over the 10-year period from 1996, their amount was doubled. Then, over the past two years, it has again been dramatically increased. Given Japan's current circumstances with so many people still relegated to leading difficult lives in the wake of the great March 2011 earthquake and tsunami, researchers, including myself, should be ever more circumspect in their use of Grant-in-Aid funding.

Grants-in-Aid are now indispensable to the operation of universities. Following their incorporation, national universities must now expend excessive time on things other than research. An environment has evolved that seeks an excessive number of research papers to build a "track record" for universities. To accomplish this end, research personnel are hired who can produce "results." Concurrently, the fixed number of faculty members is being reduced, putting a heavier teaching burden on researchers. As increasing expectation is being placed on universities to disseminate their research results to society, various outreach activities are proliferating. The aggregate amount of time and effort consumed by these developments makes it virtually impossible for researchers to devote the kind of deep thought that need to their work. Money is spent on hiring young researchers, who, expected to produce results, are absorbed into the "track record" mentality. This gives way to a negative spiral, one that diminishes the opportunity to intensely pursue science while causing staff hiring from narrow perspectives. I believe the time has come to rethink the wisdom of continuing down the current path that deprives researchers of even a moment to rest. From a long-term viewpoint, we need to ask ourselves if this situation is really beneficial to advancing genuinely creative research and fostering talented young researchers. From my stance as a researcher pursuing pure science, I would like to see an end to this trend that requires every conceivable task from research and education to administration and outreach to be uniformly carried out by everyone. By respecting the individuality and diversity of researchers and giving them space void of haste to think, it should be possible to achieve truly meaningful research results. A society that passionately embraces an expectation for such research outputs will, I believe, enable a more organic and effective utilization of Grants-in-Aid.