INVESTITURE OF NEW ACADEMICIANS

Melecio S. Magno, Ph.D., Academician
Minister of Science

Dr. Campos, President of the National Academy of Science and Technology; Dr. Lagmay, Vice-President; Dr. Mijares, Secretary; members of the Council, Dr. Velasquez, the National Scientists, Dr. Juan Salcedo, Jr., one of my predecessors in the National Science Development Board, Dr. Alfredo Santos; fellow Academicians, distinguished guests, friends of science, ladies and gentlemen and friends.

First of all, I wish to thank Dr. Lagmay for the kind words of introduction. I remember him as a good friend at the University of the Philippines and I don't know if he recalls it, but he was the first one who sold me a Life insurance policy way back in 1946. I don't know if he still sells insurance nowadays, but he was very persuasive during those times especially because as a young instructor, I didn't have the funds to pay the policy premium but he succeeded anyway.

I wish first of all to welcome the new Academicians to the National Academy of Science and Technology and to greet everyone of you present here tonight, a pleasant good evening.

Many of the Academicians had been my colleagues at the University of the Philippines and, of course, this is no surprise because most of the qualified manpower in science and technology are in the University of the Philippines. In fact, during my four years in the National Science Development Board, I have always depended on the University of the Philippines for expertise. We have some colleagues of course in the Board who have the same ability as our friends in the University of the Philippines but they did not have the opportunity and the chance for graduate training. I shall try to refrain from speaking too long and too seriously, since I know very well that you have already spent a long, serious but no doubt interesting day attending the presentation of scientific papers, and by now everyone must be looking forward to have an enjoyable meal.

Tonight, I guess, is as good a time as any to ponder on the Academy's reasons for being and how it has fared since 1977 or 1978, the year of its creation. The Academy was established by the President in response to the need to provide meaningful incentives to those engaged in scientific and technological research as well as to give due recognition to outstanding achievements of

science and technology. The creation of the Academy was envisioned then to professionalize the government's scientific and technological services in order to effect the promotion of scientific research and invention and the advancement of science and technology for national development. I've used the very same words in PD 1003-A, so that our terms of reference will be clear.

As a member of this august body, I do indeed feel honored and consoled that the government appreciates the scientist and his work. The status of the scientist, in effect, has been elevated to that of the artist and for this we are grateful to President Marcos and the First Lady. Their words and their deeds indicate their recognition that while their arts serve to uplift the human spirit, science and technology are instrumental in bringing about material progress. This new found responsibility of the scientist, therefore, carries with it a great responsibility . Far from putting the scientist on a pedestal, he or she is expected to help in solving the Filipino's basic needs of food, clothing and shelter. As the Minister of the NSDB, I cannot help but be acutely conscious of this. The national structure in the country's reservoir of scientific manpower must respond to national priorities. Membership in the Academy should not place the scientist above the rest of the community. If anything, because of this greater or rather higher educational attainment, greater expertise and greater capability is looked up to for solutions and explanations to almost every problem or phenomenon under the sun.

Research, therefore, should not stop at the publication of a scientific paper for only fellow scientists may understand this. It is incumbent upon the scientist to explain to the layman and to the rest of society, the importance of his work and how this maybe relevant directly or indirectly to everyday human existence as well as social and economic activity. The mystification of science must be initiated by the scientist himself if only to prove wrong the general impression that he lives in an ivory tower.

I wish to bring to your attention an important article in Science Magazine of the February 22, 1980 issue. This article is entitled "Science: Our Common Heritage", authored by Kenneth E. Boulding who is a distinguished professor of Economics of the University of Colorado in Boulder. He is, I think, the President of the American Association for the Advancement of Science. One of the things that he talks about in this important article is that even scientists, nay, even Academicians, have some misconceptions or illusions about the so-called science. I would suggest that each one of us, study this very seriously because it affects the concept of our own discipline.

I wish to thank Dr. Lagmay for saying that I am an objective person, objectivity, of course, is one of the qualities expected of a

scientist. But, this is not a monopoly of a scientist alone. There is one important point that was raised by Dr. Boulding which is a little different from the regard that the layman has with respect to the difference between Science and the Humanities. You've heard of the two cultures of Charles P. Snow, he says that the scientific culture and the humanities culture cannot mix together. The persons in the humanities do not appreciate Mathematics or for instance the second law of thermodynamics in Chemistry or Physics, but at the same time the scientist does not appreciate the humanities. So there is a big gap between the two. Dr. Boulding suggests that it is not correct to make such a distinction between the sciences and the humanities or between the physical sciences and the social sciences for that matter. Of course, we may disagree, some of us in the so-called "hard sciences" may feel that our sciences are superior to those in the other sciences. But I suggest, and Dr. Boulding suggests, that this might not be the right perspective for looking at the different sciences as such. What he is suggesting is a unity of knowledge, unity of the sciences themselves.

There is one important point that I would like to bring to your attention especially of the social scientist. And may I quote here: "Human knowledge becomes particularly insecure, when we move into unfamiliar regions of a field or a system. Experimental science tends to deal with the familiar for the laboratory, after all, is a clear descendant from the kitchen. This may sound a little insulting to the practitioners in the cathedrals of high energy physics which move into unfamiliar regions of science, in this case, very small. But even this region of experimental science, can deal only comfortably with events that are common within the field of the experiment. In extreme positions even of relatively familiar fields, strange things happen such as, pregozene, dissipated systems, (sorry I'm not familiar with this author). His work is relatively new, far from equilibrium.

The evolutionary process itself indeed is one in which rare events in unfamiliar parts of the field, are of extreme importance in explaining the overall pattern in time. While the sciences of the familiar are not very much of help, in probable events in a small field, they cannot be studied in a laboratory. This is perhaps, while experimental social psychology seems to be running into a severe crisis in fields where extreme positions are highly significant, the experimental method maybe of limited value, indeed, it is quite inappropriate. One of the unfortunate effects indeed of correlational statistics has been to divert attention from extreme cases which are simply rejected as deviations, whereas they may contain important knowledge about the extreme positions of the field. The uncritical transfer of statistical techniques which are entirely

appropriate in some epistemological fields in which they are quite inappropriate, has been the source of a great deal of western scientific efforts, especially in the social sciences. Statistical significance is by no means the same thing as epistemological significance and one of the underexplored frontiers in science is the tailoring of statistical methodology to particular epistemological fields.

Privately I have of course agreed with this, although I have not tried to argue with my social science friends, Dr. Lagmay or Dr. Encarnacion. But I have always expected that in the social sciences, it is not easy to quantify, because we are dealing with people, we are dealing with complex quantities. Maybe that's the reason why statistical methods are used rather than the methods of physics. But as Dr. Boulding finds out, there are pitfalls in this method. What he is suggesting is that for science to survive, we have to re-examine epistemologies of our different fields of science. And epistemology that works or that may work in a field like physics may not work in another field. So, well, that I cannot say much about this because I'm not an expert in the methodology of science, but I would suggest that the members of the Academy study this article and perhaps devote a session or two, to discuss it and perhaps to react to it if they find that it's not quite correct.

This is one activity which I would like to propose to the Academy. There are of course other activities in which the Academicians maybe involved that I would like to mention them now. Because of the rigid requirements for membership in the Academy it has been an association of the best scientific minds in the country. This is indeed quite a distinguished company. But as I have indicated earlier, membership in the Academy should be a source of not only pride but also humility for us, for the contributions to the people's well-being demanded of us are correspondingly greater. I nurture the hope that someday the equivalent of "barefoot doctors," will permeate all fields of science, so that the benefits of scientific information and technology may seep to the grassroots. Just as in the health sector, we have the rural health units of the barangay level manned by paramedics and auxiliary health personnel. So too should we "barefoot scientists" in all other areas of science. Perhaps this concept should be incorporated into the extension network. Such personnel would complement the professional practitioners and the scientist-researchers by way of insuring diffusion of scientific and technological knowledge to the end-users and providing feedback to them regarding the acceptability or applicability of technological solutions in the field.

I realize of course, that it's not the scientist's main job to disseminate research results and do extension work. Other segments of the society are responsible for these tasks. But the scientist has a great stake in the establishment of a mechanism for effective technology transfer and diffusion. Until such a circuit for the flow of technology is completed and made in good operating condition, then I guess the scientist will always be vulnerable to the charge of electism.

At this point, I am reminded of a story which the late President Eisenhower related in a convocation at the University of the Philippines. This was, I think, in the early 50's. He told a story of a man who went to the country and engaged the services of a hunting dog. The owner of that dog had the inclination to call his dog by the name of an instructor or an assistant instructor or an assistant professor and so on. I suppose he was a friend of the faculty of a certain university. And so when the hunter was asking how much the hire should be for one day's work of the hunting-dog, he was told, "Well, now, that he is an instructor, his fee, my fee for him is $3." So, he paid $3. The next year, the hunter came back and asked for the same dog, saying, "I liked his services last year. Could I hire him again? ". And the owner of the dog said, "Sir, well, you know he is now an assistant professor, so you cannot have him for $3, it's now $4." So, this dog was hired for $4. The next year, the dog was now called associate professor, so he was now hired for $5. And hence, the next year, he was now professor, $6. Alright, the man returned the next year and said, "Could I hire that dog again? It has been very serviceable and useful to me." But the owner of the dog said, "Well, sorry since that dog became college president, it does nothing but wag his tail and bark." Let it not be said of us Academicians, in order that we cannot do anything, but wag the whole tail and bark.

What I'm trying to say is that, we should keep abreast of the developments in our own fields. We are supposed to be the experts. You know, there are very few of us in the country, especially in a given field. There are very very few indeed and there are very few Academicians and in sum of duty, I think, to keep abreast of developments so we can inspire the young people. Of course there is a limit to this, I realize, but as long as we can do it, it is our duty, I think to be active in our own fields.

There is one other area of involvement to which I wish to invite the participation of the members of the Academy; that of the analysis of public policy. Our government, administration, the Cabinet, the Batasang Pambansa, or any of the ministries, make these policies. Sometimes they are controversial, sometimes they involve science and technology. Now, science and public policy and analysis are not quite the same thing and do not have the same

objectives. Many traditional scientists try to avoid policy analysis. While science has has its objective — the discovery of physical truth, good policy analysis aims to evaluate order and structure the current state of knowledge, although such knowledge maybe poor or incomplete, so as to allow decisions to be made with as complete understanding of what is known, its limitations and its implications.

Unlike science, in the exerscience, of which opinions, preferences and values play limited role, good policy analysis must deal with such opinions, preferences and values. But it does so in ways that are open and explicit and that allow different people with different opinions and values to use the same analysis in making their own decisions. Like science, however, good policy analysis does not draw hard conclusions unless they are warranted by an ambiguous data or well-founded theoretical insight. Just to cite a few examples, for instance, policy issues.

Take the case of the nuclear reactor. Our knowledge of the effects of radioactivity, radioactive wastes, nuclear fuel and all that, is quite incomplete. And ordinarily, scientists like us will not venture to advance an opinion. We can always say, "Well as a scientist, I'd rather suspend my judgment because I've known enough," which is of course, through the dispirit of science itself, because science awaits full understanding. It does not engage in speculation, except as, such speculation contributes to the design of future experimental and theoretical research. But, when the scientist is confronted with inadequate data, then he says, "that is not my line, I'd rather not venture into giving an opinion about the matter, because it would be unscientific". But, whether understanding is complete or not, about a certain subject, about a certain issue, the government or society has to make a decision, and it has to make that decision now, even if the understanding on the matter is quite incomplete. We can not forever postpone a decision on the Nuclear Power Plant. Otherwise, if we wait 10 years, 20 years, the cost of putting up a Nuclear Power Plant will have increased 5 times, 10 times, who knows. In fact, the delay in the putting up the Nuclear Power Plant has cost the government so much already. You might ask, "Well, it's easy to talk, when you don't live in Bataan, where the Nuclear Power Plant will be located". Alright, it is easy to desire that you will have a Nuclear Power Plant. But, how about the people of Bataan who will be closer? The matter, therefore, of deciding whether to have a Nuclear Power Plant or not, is a policy issue. It is not a scientific problem, it is a policy problem, and the government or the decision-makers have to make their decisions regarding these policy matters with incomplete knowledge. And they have to use, they have to depend on, as mentioned already, opinions,

preferences, values and two different people using the same set of knowledge. The same, or perhaps the same preferences, but different, say, values and attitudes will have different conclusions.

I nevertheless would like the members of the Academy, to involve themselves on issues like these, because they are looked up to by the leaders of the country. If you leave the decision-makers to non-scientists alone, then I'm afraid you'll always say, "maybe we made a mistake". (Baka nagkamali yung Minister, hindi n'ya alam lahat.) That will always remain a nagging problem. Of course, it's no guarantee that even with the use of the best or the most adequate science and technology, we will get a definitive answer to a problem. There will always be trade-offs, for instance, in the case of the Nuclear Power Plant. Which has more value to us: to have more energy or to have more protection against radioactive radiation or rays? And usually, the problem is not easy. But, as I said, society, the decision-makers have to make a decision. And I believe that the scientists and technologists should have them as much as possible by ordering, evaluating and assessing the available paper. Taking into account, even preferences, opinions and values.

I know that the Academy has been doing this in some cases, I have attended some meetings, for instance on the Nuclear Power Plant. The Academy did have some sessions on the matter. And, I don't know, but I like to think that the government's decision now to continue with the Nuclear Power Plant, has been influenced by the opinion of the top scientists and technologists in our country, as represented by the Academy and by other scientific organizations in our country. As I said already a number of policy involves science and technology. It is in the study of such problems where the members of the Academy, with their capability for thorough understanding of the technical issues involved and the ability to sort out good science from bad, are invited to participate. I've expressed these thoughts aloud not because I intended to spoil your appetites, but to give voice to a hope, which is as much a challenge and which I know the entire Academy shares the hope that in our country, science and technology may be harnessed effectively to contribute to national development.