

# PROGRESS IN SCIENCE AND ITS SOCIAL CONDITIONS

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PROCEEDINGS OF A NOBEL SYMPOSIUM

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EDITED BY TORD GANELIUS

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FOR THE NOBEL FOUNDATION

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# **Progress in Science and Its Social Conditions**

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# Progress in Science and Its Social Conditions

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*Editor*

TORD GANELIUS

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# Introduction

TORD GANELIUS

*The Royal Swedish Academy of Sciences*

The Nobel Symposium "Progress in Science and its Social Conditions" was arranged by the Royal Swedish Academy of Sciences and held at Lidingö, outside Stockholm, from August 15 to August 19, 1983. It formed a continuation of, and a complement to, a previous Nobel Symposium "Ethics for Science Policy" arranged by the Academy in 1978.

In the earlier symposium, interest was quite naturally focused on the scientist's responsibility for the all-important threats to mankind, with extensive discussions of the problems in nuclear research and genetic engineering. With this background the organization of research and the need for restrictions and control were reviewed.

Depending in part on the problems just mentioned, we have seen rapid changes in the universities and other research organizations all over the world, with far-reaching consequences for research and scientific education. Thus the Academy considered it important to have a further discussion of conditions necessary for a healthy development of science and for creative activities in general. Attempts by outsiders to formulate rules and to impose restrictions seem to have a tendency to result in a control that hampers innocuous research but allows genuine abuse to slip by. The important problem is to find ways to regulate science without destroying it.

The relativity of the notion "progress in science" indicates why the first part of the symposium was devoted to a survey of views on this notion in different epochs and cultural surroundings. The lectures in this part were public and held in the Academy's Beijer Hall, where the Chairman of the Nobel Foundation and Preses of the Royal Swedish Academy of Sciences, Professor Sune Bergström, gave the opening address. The closed sessions that followed dealt with anti-scientism and charlatanism, elitism and mediocrity. They continued with the main discussions of the symposium on the conditions for progress in science. The topics concerned specialization and inter-disciplinary research, administration and organization of research, recruitment and selection of scientists and the relations between universities and industry. The similarity of creative work in different fields made it natural to discuss creativity in arts and sciences in the last part of the symposium. A report of the activities at the symposium was given in a final public session at the Academy.

Our symposium was the 58th in a series for which the Nobel Foundation receives grants from the Bank of Sweden Tercentenary Foundation and from the Knut and Alice Wallenberg Foundation. The other sponsors were IBM Svenska AB and the Sven and Dagmar Salén Foundation. It is my pleasant duty as Chairman of the Symposium to thank the sponsors for having made our deliberations possible.

It is our hope that this volume will be of value for scientists and others interested in the subject. I thank all the participants for their contributions, and for the activity and enthusiasm they showed during the symposium.\*

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\*Unfortunately, Professor M. K. G. Menon's contribution to the Symposium was not available at the time of going to press.

The organizing committee consisted of:

Professor Gunnar Eriksson, University of Uppsala,  
Professor Tord Ganelius, The Royal Swedish Academy of Sciences,  
Professor Lars Gyllensten, The Swedish Academy,  
Professor Carl-Göran Hedén, The Karolinska Institute, Stockholm,  
Professor Rolf Luft, The Karolinska Hospital, Stockholm,  
Professor David Magnusson, University of Stockholm,  
Professor Bo G. Malmström, University of Gothenburg,  
Professor Bengt Nagel, The Royal Institute of Technology, Stockholm,  
Professor Frans Erik Wickman, University of Stockholm.

During the 5 years of preparation and the symposium week the organizing committee was assisted by the personnel of the Secretariat of the Academy; in particular Eva Andersson, Solgerd Björn-Rasmussen, Birgitta Lundeberg, Karin Stenbäck and Margareta Wiberg Roland. I thank them all.

*What is Progress in Science?*

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# The Seventeenth-Century Outlook on Science

SIR PETER MEDAWAR

*Clinical Research Centre, Harrow, Middlesex, England*

For an intellectual - that is to say someone preoccupied by ideas and by the life of the mind, the first 10-20 years of the seventeenth century were probably the best time ever to be alive, for this was the age of Bacon and Comenius - the age when science began and that which represents the watershed between essentially medieval and essentially modern world outlooks. It was an age of exhilaration and high expectations, fizzing with ideas and born aloft by scientific ambitions. Although cognate movements were in progress in France and Italy and elsewhere in the world I shall be speaking mainly of England because that is where the evangels of the new philosophy lived.

It is very easy in writing of the seventeenth century or indeed of any other period, to fix one's attention only upon those movements of thought that point to or portend the future and to disregard all movements of thought that came to a dead end or have since been forgotten.

This would be a specially grave blunder in thinking of the seventeenth century. We must not forget for example that the reign of King James I was also the age of the darker Shakespeare of *Hamlet*, *Macbeth*, *Timon* and *Lear*.

But before turning to the darker thoughts that distinguish the seventeenth century let us consider first the hopeful and ambitious element that was epitomized by the motto of the scientific pioneers: the words *Plus Ultra* - the affirmation that there were no limits to the advancement of learning - that in science there would always be more beyond. The motto arose in the following way: the *impresa* or heraldic emblem of the rulers of Spain in the fifteenth century was a representation of the pillars of Hercules flanking the Straits of Gibraltar. According to legend Hercules who erected the pillars, inscribed on them the words *Ne Plus Ultra*, No More Beyond, for the Straits of Gibraltar marked the western limits of the known world and there was not known to be any land beyond.

But when under the patronage of Queen Isabella of Spain Columbus discovered the West Indies the motto *Ne Plus Ultra* had to be amended by leaving out the negative so that by the time of Charles I of Spain it had become *Plus Ultra* and this is the form in which we see it in the choir stalls of Barcelona cathedral - and so the cry "more beyond" came to be that which animated the pioneer scientists who later united to form the Royal Society of London. What a great day for a scientist to be alive! - a day when it seemed that there was no limit to the advancement of learning or to the power it would confer upon us.

But there was a much darker side to thought in the seventeenth century. The Lord was reputed to have created the universe in six days and it was accordingly part of the Judaeo Christian tradition that the universe would last six thousand years - of which according to Bishop Ussher's chronology - just over four thousand had already gone by. Folk with a religious turn of mind, who of course included scientists, many of whom were in holy orders, accordingly realized that the end of the world was approaching fast and that those still alive might well be witnesses of its ending. The thought crops everywhere. Shakespeare's sweet Rosalind in *As You Like It*, bantering with Orlando says "The poor world is almost six thousand years old", adding that in all that time no man had ever died - as Orlando had threatened to do - of love;

John Donne the poet said in a sermon that "I was borne in the last age of the world"; and in the most famous passage of all Sir Thomas Browne (MD, Leyden) spoke of himself as one of those "whose generations were ordained in this setting part of time" that it was vanity and folly to build tombs and monuments to last for many years. "Time may be too short for our designs ... the great mutations of the world are acted ... it is too late to be ambitious." All the same, it was very many years before the concept of futurity took root - the concept that the world still had an indeterminate future before it and need not be suspected of being about to come to an end.

A third very important element in the scientific revolution of the seventeenth century - an important ingredient of everyone starting afresh - was the process of freeing oneself from the doctrinal tyranny of the past, especially as it was represented by works of Aristotle as interpreted by the schoolmen. Francis Bacon, Henry Power, Robert Boyle and Joseph Glanvill could hardly find words strong enough to express their concept for the doctrinal tyranny of Aristotle for the strength of their resolution to cast him off. This was indeed a necessary condition for further progress. For these were all men who had developed for themselves a modern concept of the character and virtues of the empirical truth - the doctrine that whatever the virtues might be of "poetic" truth and the concept of truth implicit in the writings of infinitely credulous and gullible Aristotle, nothing in science could be admitted to be true except that which was demonstrably the case - as it might be revealed by observation and experiments. "Methinks I see now", said Henry Power "how all the old rubbish must be thrown away". The new philosophers showed excellent judgement, for Aristotle around their necks would surely have sunk them.

It is most important, though, that the birth and development of science should not be presented as a straightforward success story; I spoke earlier of the seventeenth century being a watershed between an essentially medieval and an essentially modern world picture - and the medieval persisted well into the seventeenth century and weaves into contemporary science. Joseph Glanvill who believed firmly in science and in the Royal Society, believed also in witches: Bacon was a firm believer in magic and alchemy and Professor Paulo Rossi\* was not unjust when he described Francis Bacon as "a mediaeval philosopher haunted by a modern dream".

So, in science as elsewhere the seventeenth century illustrates that the course of history is never linear but if we look back on it and try to appraise the durability of the movements of thought in the minds of the new philosophers of the seventeenth century, we need be in no doubt that it was the sanguine and hopeful element in their thinking that was most completely justified and borne out for in the outcome, when measured in terms of the degree of fulfilment of declared ambitions science may today be judged incomparably the most successful enterprise that human beings have ever engaged upon. Today we can say with exultation or gloom according to temperament in science that everything which is in principle possible will be done if the intention to do it is sufficiently resolute and sufficiently long-sustained. This is science's greatest glory and also perhaps its greatest threat.

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\*Francis Bacon/*from Magic to Science* (London 1968)