Introduction

During the more than eighty years of their existence, the Nobel prizes have become an institution. Early on, the elaborate structures that were set up for making the awards and administering the fund gave the prizes the permanence that is one of the defining characteristics of an institution. Over the years, the prizes have also taken on important social functions (this being another characteristic of an institution), particularly in the sciences, where they have become the main symbol of the system whereby scientists are offered recognition and reward for excellence by their peers. This, of course, results from the position that the prizes occupy at the very top of the hierarchy of honorific awards that has grown up with modern science.[1]

With the benefit of hindsight, it is easy to regard the present important position of the Nobel institution, particularly in the sciences, as inevitable. Yet the first and most significant step taken to set up the institution – the will of Alfred Nobel – did not in itself presage an institution, let alone an important one. (For the text of the relevant portion of the will, see Appendix A.) What Nobel instituted in his will (1895) were five prizes – in physics, chemistry, medicine or physiology, literature, and peace – to be awarded by four institutions: two academies (the Royal Swedish Academy of Sciences and the Swedish Academy [of literature]), one teaching institution (the Caroline Medico–Chirurgical Institute, known as the Karolinska Institute), and one legislative body (the Norwegian Storting or parliament).

To create the Nobel institution it was necessary for these four organizations to be bound by common rules and procedures so as to distinguish their role in awarding the prizes from the ones they normally performed and to prevent this role from being subsumed under these other functions. The statutes of the Nobel Foundation

(promulgated in 1900) accomplished this. In addition, they provided for the new organs that were set up to implement Nobel's wishes – in particular, the Nobel Foundation as the corporation managing the prize fund. In this manner, the institution came to represent much more than its original constituent parts – the prizes and the prize awarders – since the statutes provided the institution with an overall structure and also guaranteed its permanence.

On one level, the Nobel institution can be seen as encompassing all the prizes: This global view was the basis for the significance that the public attached to the prizes from the beginning. On another level, because of the important role that the prizes in science and medicine played (and have continued to play) in the creation of the institution, it can be viewed as a *scientific institution*. The fact that the Royal Academy of Sciences was entrusted with *two* prizes, in the neighboring disciplines of physics and chemistry,[2] made it – and its prizes – a particularly important part of the early Nobel institution. It is on this part that I have chosen to focus the present study. The following close examination of how these prizes were awarded (within the framework of the general rules set for the functioning of the institution), and how they fitted into disciplinary developments as well as the scientific culture of the time, tries first of all to reconstruct the initial stage in the development of the institution. It also shows, I hope, how this stage contained many of the sources of its subsequent growth into a significant scientific institution.

Needless to say, such a reconstruction would not have been possible without access to the Nobel Archives – in the present case those of the Royal Swedish Academy of Sciences and its Nobel Committees for Physics and Chemistry. As a result of the new rule, instituted in 1974, making archival materials dating back fifty years or more available for historical research, I was given the opportunity to study the inner workings of the prize selections at the Academy* during the formative years. I have chosen to focus rather strictly on how this part of the institution developed in its

* Throughout the book, references in the text to "the Academy" and "the Academy of Sciences" are to be understood to mean the Royal Swedish Academy of Sciences. To avoid confusion between the Academy and other academies discussed, particularly in Chapter 1, the French Academy of Sciences will be referred to as "the Paris Academy" or "the academy" when its full name is not used. Likewise the Academy of Sciences of Berlin will figure as the "Berlin Academy."

first fifteen years – that is, before the First World War brought about a hiatus in the annual awarding of the prizes. This means that I have refrained from the free-ranging discourse on the role of the science prizes in general and over a longer period that has been so important in the literature on the Nobel prizes.[3] I feel that a narrower approach is justified, first, because the first fifteen years is too short a period to assess the significance of an institution, and, second, because there will be other studies based on materials in the Nobel Archives.[4] Once these have started to accumulate, I hope that such assessments will be placed on a more solid foundation of historical evidence than has been the case up to now.

The dictum "What does happen is not necessarily what had to happen" is particularly pertinent to the history of the Nobel institution in the sciences because of the fame and prestige the prizes have acquired over the years of their existence. At present, the Nobel prize occupies a unique position in the reward system of science in that it is as well known among the general public as it is to the scientific community. It also carries the distinction of being the only award of its kind that is regularly used to indicate the importance of a scientist or a discovery, not only those honored by the prizes but also the select group of scientists and works that are considered as being "of Nobel class" – *les nobélisables*, as they are known in French. That this is so is largely due to the way successive generations of laureates have contributed their prestige to the institution.[5] Over the years, their achievements have endowed the prize with an incremental value in a manner somewhat analogous to the contribution that each crowned head made to the institution of the monarchy in a bygone era.

Many of the aspects that have made the Nobel institution an important scientific institution were present from the beginning, but clearly they could not be the ones outlined above. What *did* happen during the early years was that Nobel's vague wishes were given substance and form, initially in the statutes and later by the statutory rules being put into practice in the selection of prize-winners. This was the work of the small group of Swedish scientists who formed the core of the institution and for whom Nobel's will represented an unprecedented opportunity to give an international dimension to Swedish science. Not surprisingly, Svante Arrhenius, who was the most internationally minded of Swedish physicists and chemists active at the time, was the chief actor in

this group. For Arrhenius and his friends, the awarding of the prizes was part of a larger vision: that of an institution that would embrace several new research institutes (the Nobel Institutes) and also benefit existing institutions (principally the science faculties in Stockholm and Uppsala) by bringing them into contact with developments outside Sweden. It was this practical view that gave the institution a *raison d'être* over and above the awarding of the prizes and also made it, first and foremost, a Swedish scientific institution.

It is clear that, in the early years, the prize decisions depended heavily on the internal dynamics of the group of Swedish scientists who served on the Nobel Committees for Physics and Chemistry, since there was neither a tradition to guide them in making such decisions nor strong links with scientific centers abroad. It seems reasonable to assume that their judgment both of what specialties should receive consideration within the general fields designated for the awards, and of what specific works should be rewarded, were influenced by what they themselves considered important in these fields. Opinions are shaped by knowledge. Hence, not unexpectedly, the works considered for the prizes were those familiar to committee members because they formed part of their own areas of scientific interest. Since the latter were often institutionally based, the prize decisions were influenced by intellectual and institutional rivalries peculiar to Swedish science.

For the Nobel institution to develop into an important scientific institution required, however, that it acquire a constituency of interested scientists outside Sweden and that it find a place in the international disciplines of physics and chemistry. In the early years, this process paralleled that described in social histories of other scientific institutions,[6] since it was largely by extending outward from the core of Swedish scientists and by creating a participatory interest on the part of other groups that the institution eventually came to have a hold on important segments of the international scientific community. Even before the prize decisions had started to make an impact, the Nobel institution in this broader sense had come into existence through the statutory provision that candidates for the prizes be officially designated by specially invited nominators. Among these two "ready-made" and partially overlapping constituencies, the interest of the candidates was, of course, not in doubt because of the gains that they and their institutions

stood to make if they were selected. But that of the nominators, too, was maintained, normally by the personal and professional ties that linked them to the nominees. These links had the greatest impact on the prize decisions when they involved Swedish scientists, and here the widest-ranging influence was that exerted by Arrhenius through his international network. That academic research in physics and chemistry (which produced most of the work proposed for the prizes) was practiced on an extremely small scale compared with the international scientific enterprise of today was a major factor making for participatory interest. Of the approximately one thousand physicists active in Europe and North America early in the century,[7] between one-fourth and one-third probably figured either as candidates or as nominators for the physics prize.

But apart from social and institutional considerations, the prizes also had to find their place in the *science* of physics and chemistry and in the scientific culture of the time. With respect to the latter, they broke new ground by being the first truly international prizes. At the same time, however (and this was more important for their recognition), they could be ranged with the innumerable honors that scientific societies in many countries were in the habit of bestowing on their own nationals as well as on eminent foreign scientists. However, it is with respect to the kinds of science and scientists that were honored by the prizes that the change in perspective on the institution that can be gained through studying its *internal* history during the early years becomes particularly important. This is so because the tendency to use the Nobel prize as the touchstone of excellence in science, referred to earlier, not only relates to the present but also has a strong hold upon the history of science. Invoking the Nobel prize in historical accounts is a form of shorthand: Simply mentioning that a discovery was recognized by the award of the prize is often enough to indicate its reception by the scientific community. Furthermore, invoking the Nobel prize in such accounts gives an impression of the inevitability of success befalling individual scientists: preselected "great men." Needless to say, this process of codification has been facilitated by the secrecy that until recently has surrounded the selection of prizewinners.

By contrast, when one considers the candidates and not just the laureates, one finds that there were many alternatives to the choices made and a fair amount of muddling over these. That the field

could nevertheless be narrowed down to one final choice that generally met with the approval of other scientists was most often due to the fact that the choices were made in the context of prevalent specialties in physics and chemistry and, furthermore, reflected the judgments that specialty groups had already passed on the works or scientists proposed for the prizes.

In general, the drama of science in the making had been played out long before the works reached the prize juries. For this reason, only faint echoes were heard of the ongoing intellectual struggles of theoretical physicists who were giving new meaning to basic physical concepts in the first decade of the century. Rather, insofar as the physics prize highlighted major discoveries (those of X-rays, radioactivity, and the electron, to mention only a few), these were primarily in *experimental* physics, which was not only the prevalent orientation at the turn of the century, but also the one which, in the opinion of contemporary observers, had brought the most significant advances. The context of awarding the prizes was not that of discovery per se, then, but of justification, not only of discoveries but of their importance for given specialties and fields. Formally, this was linked to the statutory provision that only published works and hence *public knowledge* could be considered for the prizes (making the secrecy surrounding the process of prize selection somewhat incongruous). Informally, this resulted from the way members of the institution (in the narrow and wider sense) took their cues from the prior acceptance of works proposed for the prizes.

OUTLINE OF THE BOOK

There are three major subdivisions in this book. The first (Chapters 1–3) treats elements of what might be termed the prehistory of the institution. It gives crucial background on the Nobel prizes in relation to preexisting reward systems, on the Swedish scientific community around 1900, and on the drafting of the statutes of the Nobel Foundation. The second part (Chapters 4–6) concerns the internal history or private side of the institution; it analyzes how prizewinners in physics and chemistry were selected during the period 1901–1915. The third part (Chapter 7) discusses the Nobel prize institution in its interactions with the public and the

scientific community, or what might be called the public face of the institution in the early years.

In Chapter 1 I examine the national reward systems that were precursors of the Nobel prizes – in particular, the tradition to reward and encourage scientists by offering monetary awards that had evolved in the French Academy of Sciences. In this respect, the Nobel prizes continued a tradition, but as the first truly international prizes of modern times they represented a significant break with the past. Yet more important for the special status that they came to acquire in the eyes of the public were the large sums of money involved. With each prize representing 150,000 crowns[8] (when first awarded in 1901), they surpassed all awards of this kind created previously.

These and other unique qualities of the Nobel prizes did not emerge directly from Alfred Nobel's will. Indeed, his testament proved embarrassingly vague on so many points that putting it into operation was a long process, lasting from 1896 to 1900. In this initial phase, Swedish scientists shaped the institution by actively participating in the negotiations over the statutes. In order to learn more about the institutions that Nobel had named to award the prizes in science and medicine, and about the scientists (and their institutions) who would constitute the prize juries in physics and chemistry, an introduction to the Swedish scientific community in international perspective is provided in Chapter 2. Chapter 3 describes the events that led to the promulgation of the statutes of the Nobel Foundation in 1900.

In Chapter 4 I begin to examine decision making about the prizes in physics and chemistry. In this chapter, the relative weight of the system for proposing candidates for the prizes in the overall process of decision making is assessed through tabulations of the nominations that candidates and Nobel prizewinners received from different categories of nominators. These tabulations show that the convergence of nominators' opinions on the candidates who became prizewinners dissolved about midway through the period studied here. For the remainder of the period, only a few candidates (M. Planck, H. Poincaré, and W. Nernst in particular) received strong support from the nominators, but for a number of reasons their awards caused problems both in the committees and in the Academy of Sciences. The necessity of choosing from among several minority candidates increased the importance of the role

of individual members of the Nobel Committees for Physics and Chemistry as well as of the evaluations carried out by them. In Chapter 5 I examine the decisive importance of Arrhenius in shaping the decisions and hence the international standing of the prizes. To a considerable extent his influence, as well as that of Gösta Mittag-Leffler, Sweden's best-known mathematician, depended on their activity in international networks and on the interest in the prizes that they created among members of such networks. By considering the actions they took to promote or block given candidacies in relation to these networks, a qualitative dimension is added to the primarily quantitative analysis of the nominating system of Chapter 4.

Notwithstanding the power of personalities, their role was influenced and in many ways tempered by the rules and procedures that governed the decisions concerning the prize awards. Chapter 6 examines how the formal rules laid down in the statutes were interpreted and supplemented by ad hoc decisions. In this manner, procedures were established that placed the Nobel committees in control at the same time as they were made accountable to the Academy of Sciences through their obligation to justify their recommendations and put on the table the evaluations leading up to these. This was clearly important for the legitimation of the decisions, as was the ambition to have the awards meet the criteria of the will and the statutes. To elucidate this latter point, I give special attention to the interpretations of the wording stipulating that the prizes be given for *discoveries and improvements* made *during the preceding year* and conferring *the greatest benefit on mankind*.

Statutory rules and criteria, however, were not sufficient to allow the committees to make a final choice, especially in the absence of guidance from the nominating system. In the second part of Chapter 6 I examine how the committees arrived at the consensual mode of decision making that was the major way of ensuring that the prize selection process would operate smoothly. This demanded not only that the committees overcome the difficulties posed by inherent structural features of Nobel prize decisions (in particular, the fact that among the many candidates proposed for the prizes only one or two could be chosen as the final prizewinners), but also that they resolve conflicting views among the members and/or the nominators as to what constituted discoveries of significance for physics and chemistry.

In Chapter 7 I discuss the recognition given to the institution in its early years, in both the popular and scientific press. There is no doubt that the public took an intense interest in all the prizes from the beginning, but particularly in those for literature and for peace. Although the science prizes also gained public standing, primarily through the rewarding of Pierre and Marie Curie for their discovery of radium, the process whereby these prizes would become prestigious awards in *the reward system of science* was only beginning during the period studied here. Nevertheless, even at this early stage some of the sources of their subsequent fame and prestige are apparent. I have tried to sketch these out, especially when they concern the use of the prizes to legitimate new fields. An Epilogue describes the winding down of the process of prize selection as a result of the First World War and offers an appraisal of what had been accomplished in the first fifteen years.

Finally, some definitions may help guide the reader through the maze of prizes, medals, and grants, the history of which will be sketched out in the first chapter. In a general sense this study concerns the *reward system of science*, this being the comprehensive term used in the sociology of science to designate all the ways and means by which scientists are rewarded for their work, usually by their peers. Prizes, medals, and grants – the three recurrent terms of the first chapter – are specific rewards in science and hence form a subset of the overall reward system. As a general rule, *prizes* can be defined as *rewards carrying monetary awards*. In addition to their monetary value, prizes also have a symbolic one, since they also confer honor and prestige on their recipients. *Medals* are *rewards that generally do not carry cash awards* and hence have no monetary value (unless they are melted down and/or sold). In contrast to the prizes and medals, which are given out for work already accomplished, *grants* are *awarded to enable scientists to carry out projected work*. It should be added that this last definition is the one that currently applies to the term *grant*. As will be shown in the subsequent description of the historical development of prizes, medals, and grants, when the Nobel prizes were instituted in the late nineteenth century, prizes and grants were more similar in both purpose and use than they are at present.

1

Precursors to the Nobel prizes in the sciences

To place the Nobel prizes in their proper historical setting it is necessary to retrace briefly the growth and changing functions of prizes and medals in the eighteenth and nineteenth centuries. The use and significance of prizes and medals fall into two distinct periods. In the first, extending from the early eighteenth to the middle of the nineteenth century, prizes were important chiefly as a means to reward successful entrants in the competitions organized by academies on the European continent, primarily those of Paris and Berlin. In the second period (1850–1915), the link with competitions was broken, and prizes, as was already the case with the medals of the Royal Society of London, were used to reward scientific achievement in general or work to which the donor of the prize or medal attached particular importance. During this period, the number of prizes and their monetary value both grew significantly; they also came to be regarded, by donors as well as by the institutions awarding them, as a means to stimulate and guide future work. This development was most pronounced in the French Academy of Sciences, where an elaborate system of prizes and grants emerged during the latter half of the nineteenth century. This system may well have influenced Nobel, who made Paris his home as well as the base of his wide-ranging business activities from about 1870 until his death in 1896.

THE PRIZE COMPETITIONS OF THE SEVENTEENTH AND EARLY EIGHTEENTH CENTURIES

The idea of rewarding scientists for their work is bound up with the emergence of science as a distinctive social activity practiced by those whose special abilities and training made them adept at unraveling the mysteries of nature. At the outset, this idea prob-