

Working Paper no.: 2007/2

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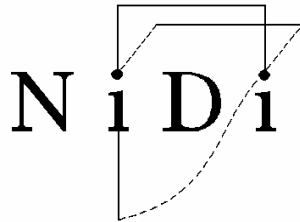
The Members of the Royal Netherlands Academy of Arts and Sciences:
1808 to 2000.
A demographic view

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January 2007

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1. Preface

This paper has been long in the making. The idea to investigate the demographic dynamics of the Royal Netherlands Academy of Arts and Sciences (KNAW) was conceived around the mid-1980s after the first author of this paper completed a term as the elected chairman of the Arts Division of the Academy and, thus, as a member of its Executive Board.¹ Experience had shown that repeated discussions within the Academy about the preferred age at election to that learned society and the ageing of the membership that was thought to occur, had to remain somewhat impressionistic due to a lack of factual information. Starting point of the research now reported was the assumption that an analysis of available data would improve the information situation sufficiently to allow a more focused discussion within the Academy and to provide a better basis for decision making.

It soon turned out, however, that the idea of carrying out a 'quick-and-dirty' analysis of existing data sources was a complete illusion. Maintaining an up-to-date and complete archive of its members apparently had never been a pre-occupation of the Academy. Occasionally a list of members since a given year had been published but without information about date and place of birth, date of death, and such other details as demographers commonly employ in the study of population dynamics. Instead of wisely abandoning the project it was decided to attempt to rectify the situation by searching archives, biographic dictionaries, obituaries, encyclopaedias, the civil registration system, and such other sources as one might think of. This, understandably, was a very labour intensive task that became more difficult as time went by and the easy cases had been dealt with.² Cleaning the data base had to follow as inconsistencies and errors were numerous and frequently made it necessary to go back to the original sources to resolve them. However, ultimately a data base resulted that was sufficiently complete and accurate to allow a meaningful demographic analysis.

The present paper contains the first results of the exercise; it has a dual purpose. It aims, first, to stimulate and facilitate ongoing discussions about membership issues within the Academy. With that in mind it will provide a factual overview of developments to date and, through micro-simulation, demonstrate the effect of two selection variables on the recruitment of members and age structure. It will, secondly, serve as a basis for further analytical work and international comparison. Consequently, it has been written in English, is likely to contain some information Academy members are familiar with or that, alternatively, demographers might find superfluous. It will focus more on the functioning of the Academy as such than on the societal changes that occurred over the nearly 200 years of its existence and that are sure to have influenced the decisions of successive national governments and the Academy's governing bodies.

¹ At the time its three other members were Prof. Dr. D. de Wied (President), Prof. Dr. J. H. van der Waals (Chairman Sciences Division) and Prof. Dr. J.T. Wiebes (General-Secretary).

² We should like to record our gratitude for the advice and assistance received in this daunting and painstaking task from Professor Frans van Poppel (NIDI), Mr. Rudy Gokkel, Drs. René van Haaster, Maarten Leopold, Dr. Dorien Manting and Drs. Saskia Voets. We are also grateful for the information, and for comments on the first draft of the paper, received from several members of the Royal Academy, in particular Pearl Dykstra, Wim Gerritsen, Jenny Gierveld, John Michon, Joan van der Waals and Frans Willekens. The support the former director of the Academy, Mr. Chris Moen, and his staff gave us is also gratefully acknowledged.

After a concise introduction of the Academy the paper will address a series of interrelated issues. These are:

- i. The construction of the data base, the categories of members, the statutory rules affecting the recruitment and retirement of members, and the numbers of members elected³ in each category of membership over time.
- ii. The age at election of the initial groups of members, the changes in the ages at recruitment over time, and the effects of such changes on the size and age composition of the membership.
- iii. The duration of tenure and age at death of the various categories of members.
- iv. The longevity of these categories.
- v. The results of a micro-simulation of the impact of age at election and life expectancy on the levels of recruitment and the age characteristics of the membership.

There are, obviously, many more aspects of the Academy's demographic history that could usefully be studied and that would lend itself to international comparative work. Thus, this paper is not intended to be the final word on the demographic dynamics and prospects of the Academy.

2. Introducing the Royal Academy

The United Provinces of the Netherlands were deeply affected by the ideals of the French Revolution. But these were not shared by all. Foreign intervention ultimately ended the conflict between the Patriots, who regarded Britain as their principal enemy and who fought for a profound change of the old, oligarchic regime of their state and for the abolition of the stadholderate, and the Orangists who, supported by British cash and Prussian troops, were intent on restoring the orangist regime of Stadholder Willem V. In 1795 the southern Netherlands were formally annexed by France, while in the north the Provinces created the Batavian Republic, which was acknowledged by the revolutionary government in Paris. This entailed the establishment of a central government there even though it took time to draw up a constitution and to develop a new administrative system. The Republic didn't last long. It was, as Israel (1995:1127) phrased it, '... crushed beneath the inexorable pressures of global war, [and] caught between the irresistible force of Napoleon and the immovable object of British power.' In 1806 Napoleon abolished the Republic and replaced it with a monarchy, headed by his brother Louis Napoleon. Even his cooperation didn't satisfy Napoleon for long and in 1810 full incorporation into the French Empire followed with Amsterdam, next to Paris and Rome, becoming its third capital. This constellation also was short-lived: in 1813, after the Russian campaign had failed and battles had been lost, the French troops withdrew from the northern Netherlands. The son of Stadholder Willem V was invited to accept the sovereignty and became King Willem I of the Netherlands. Very soon a threat to his Kingdom arose. On March 1.1815, after his escape from Elba, Napoleon began a rapid march north in an attempt to regain his Empire. However, on the 18th of June his definitive defeat at Waterloo followed. It was in preparation for that impending confrontation that, on March 16. 1815, King

³ For most of the Academy's history members were in a formal sense appointed by the King upon the recommendation of the Academy.

Willem I had seen his way clear to declare himself to be King over a United Kingdom comprising both the Southern and Northern Netherlands.

While the period of French dominance and occupation may have been brief it has had important, long lasting effects that even today make their presence felt (Roegiers and Van Sas, 1993:243). The country became more centralized than ever before; the Code Napoleon was introduced, as was a system of civil registration foreseen in it. In 1808, by Decree of May 4, the strong institutional modelling on France resulted in the establishment of a learned society called *Koninklijk Instituut voor Wetenschappen en Schoone Kunsten*, now usually abbreviated to KNIW. Quite appropriately the decree was signed by Louis Napoleon as King of Holland and *Connétable de France*. He also appointed its first members. As a Royal Institute, the KNIW was given a number of important tasks which in essence amounted to the internationalisation of the arts, sciences, and technology in the Netherlands with a view to its economic benefits as well as the greater glory of the country. Thus, they were rather practical and utilitarian but with nationalistic overtones. Before the Royal Institute was founded, formal attempts to further scientific investigation at the national level were unheard of in the Netherlands. As Mijnhardt (1997) has emphasized the science ideal in the country differed greatly from that in France. Not the production of science but the spread of scientific knowledge was considered to be the most crucial ingredient of a vigorous state. The orientation of the elite was not towards physics and the natural sciences more generally; their scholarly interest was encyclopaedic and humanistic.

With changes in orientation, title, and size of membership, the KNIW still exists today as the Royal Netherlands Academy of Arts and Sciences (KNAW). This paper will be devoted to the members of that Institute and that Academy. It will not be prosopographic. As against that the emphasis will be on demographic aspects of this elite population that have direct relevance for the long term development of the Academy and the composition of its membership.

3. Constructing the data base

It would appear that between 8 May 1808 and 1 January 2000, and whether by messenger on horseback, a letter delivered by carriage, stage coach, train or plane, or currently perhaps by telephone call or hurried e-mail message, a grand total of 2619 persons received news of appointment to the Royal Academy or one of its predecessors. For some this news may have come as a complete and pleasant surprise, others may have breathed a sigh of relief and/or may simply have considered it their due. In the very early years some others again are bound to have cursed their bad luck. There is clear evidence that a few members either found membership too much of an imposition on their time, or found it politically less than appealing and tried to wriggle out of it. But the vast majority will have appreciated it as a sign of recognition of their contribution to their discipline and their personal quality as a scholar or scientist.

As mentioned in the preface, keeping detailed, up-to-date records of the membership has not been one of the Academy's pre-occupations. From time to time a list of members ever elected since a specific date has been published in a yearbook, but for the purposes of this study a very great deal

of effort was required to build up a data base allowing a certain amount of analysis. The aim was to collect the names of all persons ever appointed to the Academy and to establish their year and place of birth, their year and category of first appointment, and the year and place of death. An attempt was also made to record their scientific orientation, and the possible mutations in their membership (change of class, change in category of membership, and date of retirement).⁴

In comparison to the normal standard of completeness of historical data sets the material ultimately brought together is quite satisfactory. However, not all members were 'immortal' and the material is by no means complete. In fact, it does not compare well with the information on similar august bodies in France (Leridon, 2004) and, probably, elsewhere in Europe.

Table 1. The lacunae in the data-base, by period of election

	KNIW and KAW	KNAW 1855-1942	KNAW 1946 to 2000	TOTAL
Date of birth				
Ordinary members	8	1	1	10
Correspondents	27(1.03)	24	6	57(2.18)
Foreign members	4	0	0	4
Date of Death*				
Ordinary members	3	2	1	6
Correspondents	1	29(1.11)	30(1.15)	60(2.29)
Foreign members	0	0	1	1
Date of retirement**				
Ordinary members	2	0	1	3
Correspondents	1	19	6	26
Foreign members	0	0	0	0
Discipline				
Ordinary members	1	5	0	6
Correspondents	27(1.03)	23	1	51(1.25)
Foreign members	4	1	0	5

* applies to members who are known or must be assumed to have deceased (N=1938)

** results when date of birth, date of death, or both are unknown

N.B. per cent, if higher than 1% of the specific group, given in brackets

⁴ N.B. In this paper a dash (-) between two figures means: from to inclusive (age group 55-59); A dash (-) between two years means: from to inclusive (1940-1999). If the last year of an interval is not included the notation followed is, for example, 1940 to 2000; A slash (/) between two years indicates: average over these years (1750/54; 1925/1928; 1945/49; etc.); A space left blank means that giving a figure would not be sensible or possible.

Table 1 shows that, with the exception of the date of election, lacunae occur in all the variables. However, in each of these the lack of information is almost exclusively found amongst the correspondents. In all, the date of birth remained unknown in 71 cases (2.71%); the date of death in 67 of the cases (3.46%) where the person is certain to have died. If the date of birth and/or the date of death are unknown this commonly implies that, where applicable, the date of retirement also remained unclear. It is striking, though not surprising, that the proportions of ‘unknowns’ are lowest amongst the most dominant categories of membership and relate mainly to the earlier periods. It should, finally, be noted that the concept of scientific ‘discipline’ is not quite appropriate for the early nineteenth century and that places of birth and/or death, which have also been collected, were sometimes difficult to identify.

4. The population of Academy members

4.1 Distinguishing analytic periods in the Academy’s history

In the history of this national learned society the main distinction to be made is between the period of the Institute that started in 1808 and ended with its abolishment in 1851, and the Academy-period that began in the same year. During the Institute-period the members were distributed over 4 distinct classes and the fine arts – painting, sculpting, composing, engraving and architecture – were represented amongst the membership. After 1851 these disciplines had disappeared. In fact, for the very brief period from 1851 to 1855 the members of the Academy were solely recruited from the natural sciences. It is, further, important to understand that the geographic territory covered by the society was reduced substantially when in 1830 the southern provinces declared themselves to be independent and separated from the Netherlands to become Belgium. King Willem I did not accept the new arrangement officially until 1839. He was severely criticised for the way he had handled this and other issues and, embittered, abdicated the next year in favour of his son who succeeded him as King Willem II. Opposition toward the figure of an absolute monarchy increased rapidly during the eighteen forties. During his reign sympathy for the Academy also declined sharply. Its usefulness was questioned and in 1843 a sizeable reduction in membership followed. In 1848 growing support for the liberal cause forced Willem II to accept becoming constitutional monarch. As a result his power to control the future of the Royal Institute was much reduced. Consequently the first cabinet to serve on the basis of a newly adopted constitution could go much further than reducing the Academy’s size. It felt the government had no role to play in, and didn’t have to pay for, any activities involving scholars and scientists raising each other on the shield. In 1851 the KNIW was abolished formally and was replaced by a numerically small Royal Academy (KAW) devoted solely to mathematics and physics. There was, however, a significant element of continuity in that the members of the new Academy were exclusively drawn from one of the classes of the old Institute.

After the fall of the first cabinet based on the new constitution in 1855, a restoration of sorts followed. However, the fine arts were never again represented amongst the membership of the

Academy and the class structure was given up. From 1855 onward the Academy comprises only two divisions. The *Afdeling Natuurkunde* covers the sciences, medicine, and to a degree, engineering; it will be called the Sciences Division; while the *Afdeling Letterkunde* covers the disciplines one would expect in an Arts Division. Until just after World War II the situation remained largely unchanged. Thereafter two substantial expansions of numbers occurred, about a quarter century apart. While each division is sub-divided into sections these have little function scientifically. The members mainly meet to review potential candidates for filling vacancies, to suggest representatives on committees or advisory boards, and speakers for festive occasions or regular sessions.

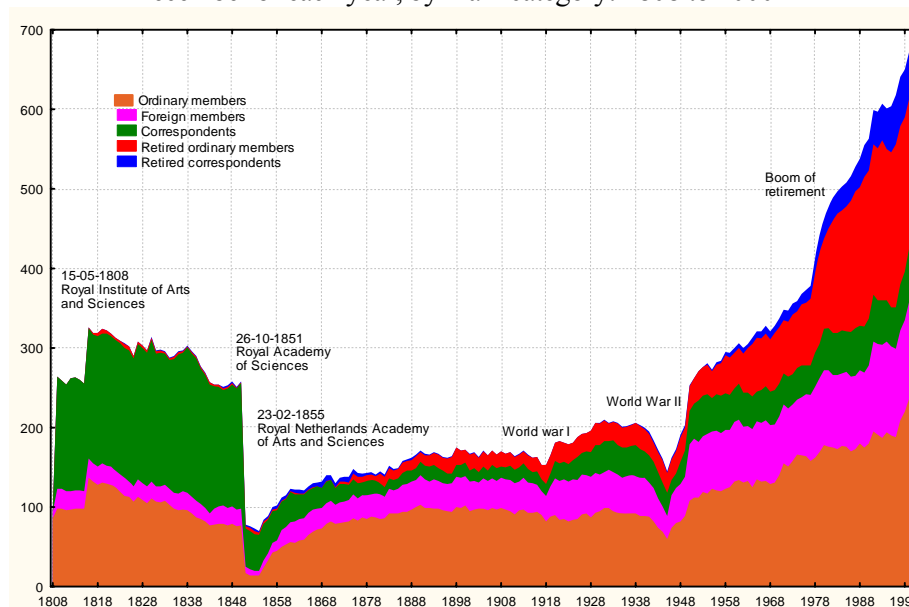
4.2 The total population to be studied

The political changes just referred to, have, understandably, found reflection in the size and composition of the membership of the society. Figure 1 gives, in silhouette, a good picture of the changes in the overall size of the membership as of 31st December of each year. The numbers declined slowly from a peak of 325 in 1816 to about 255 in early 1851. Then, on October 26, 1851, the total membership of 247 was forced to resign. As no more than 70 of the scientists were re-appointed as ordinary, extra-ordinary, or foreign members the numbers dropped suddenly to about 70 around 1855 to rise gradually thereafter. However, before the beginning of World War II the overall membership never again exceeded 200. During the period of German occupation a few members were forced to resign, while a larger number resigned voluntarily. Moreover, during global conflicts recruitment - of foreign members and correspondents in particular - is exceedingly difficult and tends to come to a halt. As a result a small decline can be observed for the period including 1914-1918 while a sizeable reduction in numbers occurred between 1940 and 1945.

Two rapid bursts of growth followed: the first after 1949, the second after 1977. During the last half century (1951 to 2000) the Academy elected nearly one thousand – 996 to be precise – new members, which is more than in the full century before (901 during 1851-1950) and also exceeds the number of scholars and scientists appointed in the period that began with the establishment of the Royal Institute and ended with its abolition in 1851 (722 appointments). Thus, in recent decades the Academy has been electing new members faster than ever before. On the 1st of January 2000, at the end of the observation period, the grand total of the membership stood at 672 members; a little less than 400 members were younger than 65, the remainder past their retirement age.

In the national context this numerical growth should, of course, be considered against the background of the tremendous expansion of the total size of the national population which grew from only 5.2 million at the turn of the 20th century, via 10 million at the end of 1949 when the first major expansion occurred, to close to 14 million when in 1977 the second major expansion was decided upon. The development of tertiary education was even more spectacular. In 1900 just 4 per 1000 of the population aged 18-25 were enrolled for university education; in 1950 this figure

Figure 1. The total size of membership of the Royal Academy as of 31st December of each year, by main category: 1808 to 2000



in the KAW as established in 1851 a total of 25 ordinary members were appointed together with 21 extra-ordinary members (here included amongst the correspondents), 5 retired members and 19 foreign members.

had risen to 23, while it exceeded 50 from 1969 on. The yearly inflow of students in universities rose from 63 per 10000 of the population aged 18-22 in 1900 to over 86 per 10000 by the early 1970s (CBS, 1975). That implies, of course, an equally impressive expansion of the teaching/research staff and, thus, of the number of university professors from which the country's ordinary members are commonly recruited.⁵

4.3 The statutory numbers of members

Changes in the statutory numbers of ordinary members, the most important category for the functioning of the Academy, give a good indication of the changes in the Academy's standing and experiences. Figures for all categories are contained in Table 2. Evidently the incorporation in the French Empire as such didn't affect numbers. But in 1816 the total number of ordinary members was increased from 90 to 140. A reduction to 98 followed in 1843 after the separation of Belgium, while the statutory number of ordinary members of the KAW was just about a quarter of that. During the KNIW-period the members were appointed in four different Classes. The distinction

⁵ A time series of the stock from which members have been elected is not so easy to define: initially it included artists, administrators, clergy, and officers. Now most new appointees are university professors. Of these, 1036 were counted at the population census of 1930; by the end of 1997 their number amounted to some 2600, more precisely 2445 full time equivalents (VSNU, 1998).

between these classes apparently was not always perfectly clear. Occasionally a member would switch from one class to another if his disciplinary orientation had been misjudged and he would feel more at home in a neighbouring class.

Figure 2 deals exclusively with ordinary members. It distinguishes between active and retired members, the latter category becoming increasingly important after the statutory reforms of 1949 and 1977. In order to demonstrate the direct relationship between policy decisions and the size and composition of the membership this figure further contains the dates of the Royal Decrees that changed the statutory numbers, with the new numbers given in brackets. Evidently, there is a stark contrast between the very gradual development between 1855 and World War II and the rather dramatic changes thereafter.

Between 1855 and the end of the 19th century the members showed remarkable restraint. While in 1855 the statutory limit of ordinary members was set at 100 that number was not reached until 1889. When in 1855 the KNAW was founded its ordinary members were distributed equally between the two divisions. The statutory regulations allowed each division to appoint 50 members. That number didn't change until 1949 when the total was raised to 135 and the Sciences Division drew ahead of the Arts Division (75–60).

Figure 2. The numbers of active and retired ordinary members as of 31st December of each year: 1808 to 2000

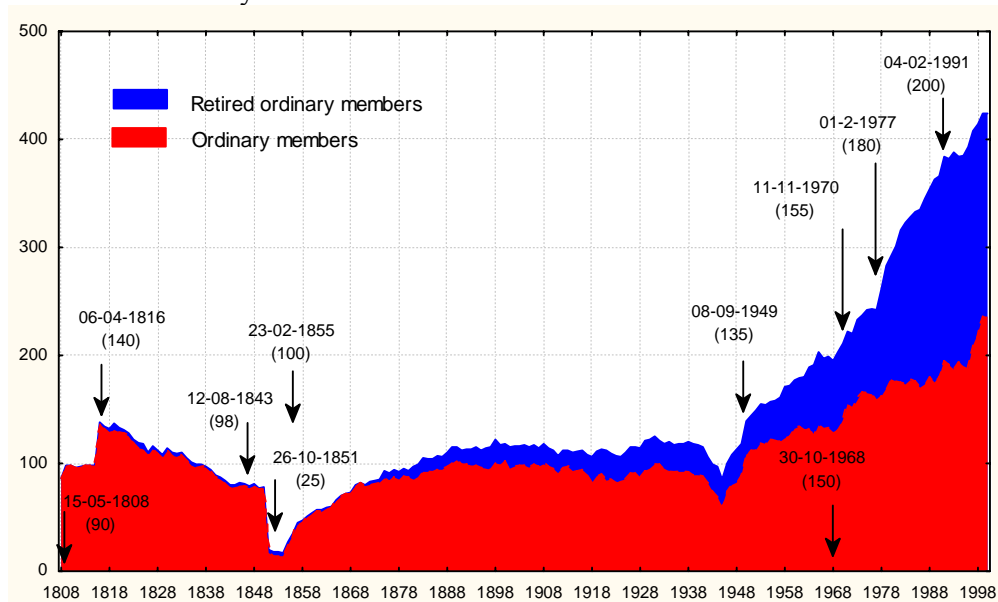


Table 2. The types of membership and the statutory numbers of members, of the Royal Academy, and of its predecessors: 1808 to 2000

Royal Netherlands Institute of Arts and Sciences (KNIW)					
Date Royal Decree	Total	Class I*	Class II*	Class III*	Class IV*
Ordinary Members					
15-05-1808	90	30	20	20	20
06-04-1816	140	45	30	30	35
12-08-1843	98	30	20	24	24
Associated Members or Foreign Members					
15-05-1808	24	8	0	8	8
06-04-1816	32	8	8	8	8
12-08-1843	32	8	8	8	8
Correspondents					
various 1809	166(146)**	60(40)**	40	30	36
06-04-1816	180	60	40	40	40
12-08-1843	130	40	30	30	30
Royal Academy of Sciences (KAW)					
Date Royal Decree, or Decision	Total	Ordinary Members	Extra-ordinary members	Associated and/or Foreign Members	
26-10-1851	69(60)***	25	25	19(10)***	
Royal Netherlands Academy of Arts and Sciences (KNAW)					
Date Royal Decree, or Decision	Total	Sciences Division		Arts Division	
Ordinary Members					
23-02-1855	100	50		50	
08-09-1949	135	75		60	
30-10-1968	150	75		75	
11-11-1970	155	80		75	
01-02-1977	180	100		80	
04-02-1991	200	110		90	
Foreign Members					
23-02-1855	40	20		20	
20-06-1918	50	25		25	
08-09-1949	80	40		40	
25-09-1975	100	50		50	
04-02-1991	120	60		60	
27-03-1995	100	50		50	
20-04-1998	140	70		70	

		Correspondents	
23-02-1855	20	10	10
20-06-1918	30	15	15
08-09-1949	40	20	20
25-09-1975	60	30	30
04-02-1991	90	50	40
27-03-1995	100	50	50
20-04-1998	70	35	35

* Class I covered the natural sciences (physics, chemistry, medicine etc) and from the outset had the largest number of ordinary members.
Class 2 had to focus particularly on the Netherlands and comprised the arts (theology, philosophy, law etc.), Class 3 covered history and antiquity, and Class 4 the fine arts (e.g. painting, sculpture, music, architecture).

** Class I was allowed 60 correspondents but in view of retaining proportionality limited itself voluntarily to 40

*** While 10 was the official number, 19 foreign members could be appointed upon the proviso that no new appointments were to be made until such time as the number would have fallen below 10.

When in 1968 a further increase in ordinary membership to 150 occurred the original balance was restored. But that arrangement was short lived. Two years later the Sciences Division gained another 5 members and 20 more were added to their number in 1977. Now the grand total of ordinary members stands at 200; 110 of these may be appointed in the Sciences Division, 90 in the Arts Division. From 1951 to the start of 2000 the Arts Division elected 275 new members, while the number of new appointments in the Sciences Division amounted to 324; roughly 50 more. These figures do, again, exceed those during the century before. Even so, while in 1900 close to 20 persons per million of the population of the Netherlands could be elected as an ordinary member this figure had dropped below 13 by 1977 and is about 12 to date.

4.4 The types of membership through history

As is customary for academies the Royal Institute (KNIW) and the Royal Academy (KAW and KNAW) know several categories of members. In addition to the *gewone leden*, the ordinary members referred to above, two other categories are important. These are (a): the *buitenlandse leden*: the foreign members, known as *geassocieerden* (associated members) during the KNIW-period, and (b) the category of the correspondents (*correspondenten*). These three groups of members, for short called ordinary members, foreign members, and correspondents respectively, have been present during the roughly two centuries the Royal Academy has now existed. The analysis will distinguish between these three groups and will group everyone according to the category in which that member was first elected.⁶ Table 2 shows that during the brief interlude

⁶ It should be understood that while ordinary members, foreign members and correspondents apparently are permanent categories, these terms do not always cover exactly the same load. In 1808 it was stipulated that ordinary members had to live within a travelling distance of three hours from Amsterdam so that they could

between 1851 and 1855 the small academy of that period (KAW) could also appoint 25 *buitengewone leden* (extraordinary members) who acted in an advisory capacity. More significantly for them: new members were to be selected from that category. Unless they had a preceding appointment they have in the analysis been treated as correspondents. Between 1816 and 1851 some people were given the status of supernumerary associated member (*supernumerair geassocieerde*). After the Belgian Separation this title was, for example, applied to members who at one time had been appointed as living in the Netherlands but then suddenly found they were living in the new Belgium (Figure 3).

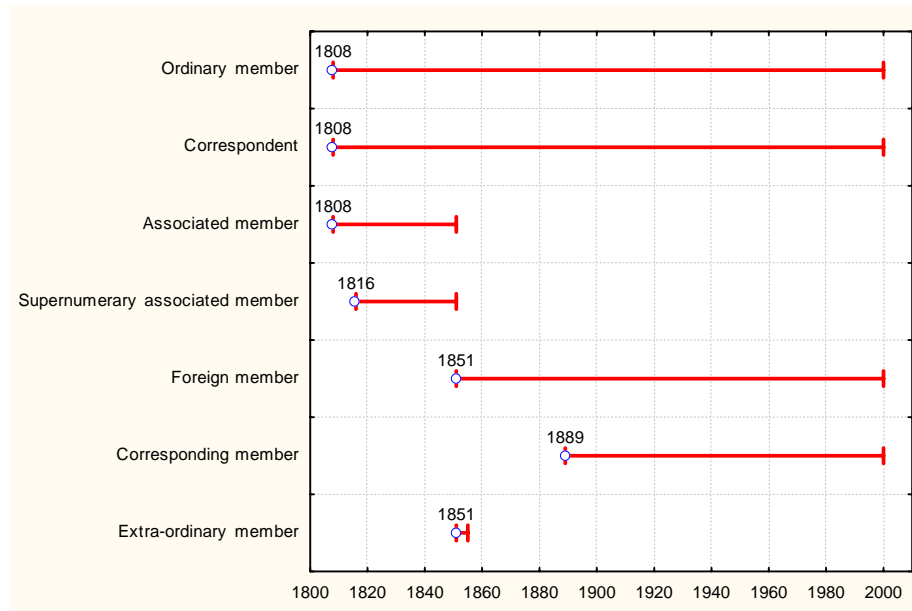
Appointments to an academy usually are for life. In demographic terms this makes death the dominant 'absorbing state' although on rare occasions an ordinary member may have resigned in a huff. A special regulation applies to correspondents as those holding citizenship of the Netherlands could easily return to the country. In the early 1920s it was specified, therefore, that correspondents taking up residence in the Netherlands were expected to resign. Most usually they would then lose all contact with the Academy unless a later appointment to ordinary membership followed, or they regained their title by once more moving abroad. This provision largely explains the lacunae in this category as reported in Table 1.

Until October 1992 the statutory numbers of ordinary members, foreign members, and correspondents were set by Royal Decree, while official letters of appointment were signed by the monarch. That made changing these numbers a somewhat complicated and difficult undertaking. In principle, that was all to the good as one of the main attractions of membership is its exclusivity.

After the change in legal position of the Academy in 1992 setting the statutory numbers became the exclusive responsibility of that organisation itself. The *Akademie Reglement* adopted in 1995 confirmed that each division of the Academy had the opportunity to elect up to 60 foreign members and 50 correspondents. Because of perpetual vacancies, in April 1998 the number of correspondents was reduced to 35 per division, as against that the numbers of foreign members that could be recruited rose to 70.

reasonably be expected to attend the obligatory bi-weekly working sessions. People living farther away could be appointed as correspondents independent as to whether they were living in the Netherlands or across the border. As against that a foreign member (associate member before 1851) had to live in a foreign country and after 1924 had to hold a foreign nationality as well. The decree of 1855 specified that correspondents had to live in one of the overseas territories of the Netherlands, at the time the Netherlands East Indies, Surinam, and the Netherlands Antilles. In 1909 that category was expanded to cover all people having the nationality of the Netherlands and living abroad, while in 1949 it was decided it sufficed to live abroad and to have obtained an academic degree from a university in the Netherlands or Indonesia. A decade later - in 1958 - it was further specified that in the latter case such an academic degree would have to have been awarded before December 21.1949. When it became more common for ordinary members to leave the country to take up teaching or research responsibilities elsewhere, or nowadays simply to retire in a more agreeable climate, it was decided to create the special category of corresponding members (*corresponderend lid*). That category was established in 1889. Starting 1924 such persons retained that new title upon their return to The Netherlands as their original place would already have been filled by someone else. From 2000 onward the Academy Yearbook simply lists them as 'ordinary members having taken up residence in a foreign country'.

Figure 3. The periods during which different categories of members existed: 1808 to 2000



4.5 The shifting age at retirement

When there is pressure on numbers an alternative to increasing these is to introduce a retirement scheme and to manipulate the age at retirement. These instruments are the more attractive in circumstances where, for whatever reason, ‘ageing’ is conceived as a problem. Table 3 gives an overview of the changes in the age at which members and correspondents were to become ‘*rustend*’, literally ‘resting’ members, respectively, correspondents. Between 1808 and 1851 the ordinary members, the foreign members or the correspondents could, presumably, retire upon their specific request but it clearly was rare. After 1851 ordinary members were due to retire at 70, a rule that from 1975 onward also applied to correspondents appointed after 1973. In the years 1977-1982 a gradual reduction to 65 years followed for both ordinary members and correspondents (Table 3). In comparison to other learned societies this retirement age is quite low. The French *Académie des Sciences*, for example, decided in 1987 that the number of full members under 80 years was the best criterion. Since 2002 the number of members below 75 years is fixed at 250 (Leridon, op.cit.: 89).

The spectacular boom in the numbers of retired members and correspondents as shown in Figure 1 is a direct effect of the changes in the rules governing retirement adopted in the mid-seventies of the last century. The number of retired ordinary members rose from 100 at the end of 1978 via a still modest 150 at the end of 1983, to exceed 200 less than 10 years later.

Table 3. The changes in the age of retirement (*rustend lidmaatschap*)

Ordinary members of KNIW, KAW and KNAW			Correspondents of the KNAW*		
Date	Decree or Decision	Age at retirement	Date	Decree or Decision	Age at retirement
1808?		Upon request	—		—
26-10-1851		70	—		—
—		—	25-09-1975		70
14-10-1977		70	idem		Idem
(1978)		70 or 69	idem		Idem
(1979)		69 or 68	idem		Idem
(1980)		68 or 67	idem		Idem
(1981)		67 or 66	idem		Idem
(1982)		66 or 65	idem		Idem
(1983)		65	idem		Idem

* applies to correspondents elected in 1973 and thereafter.

It should be noted in passing that about the same time the compulsory retirement age of university professors had also been reduced from 70 to 65 and that so far, retired members have retained most of their rights and obligations. The main effect is that they may no longer be appointed to an executive position within the Academy and that their power as ‘king-makers’ at elections has been somewhat reduced. While further on in this paper members below retirement age will be characterized as ‘active’ and those above it as ‘retired’, it would perhaps have been more appropriate to have characterized the latter category as ‘senior active members’ as they are commonly in a better position to devote time to the Academy than ‘active’ members fully engaged in teaching and research.

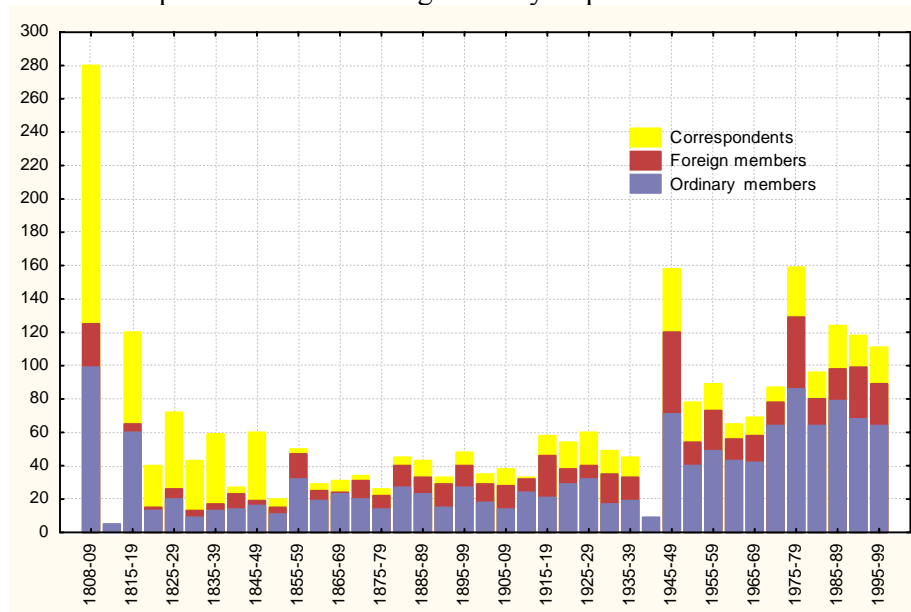
4.6 The numbers of members elected over time

As in the last 50 years or so the Academy has grown more rapidly than before, it is not surprising that 38% of all appointments have occurred in the period from 1951 to 2000. For the first half of the 20th century (1901-1950) 21% of all new appointments were recorded and during the second half of the 19th century (1851-1900) only 14% of all new members were chosen. The remainder of all individual appointments took place during the so-called Institute-period (1808-1850). As is evident from the statutory numbers, the international orientation of the KNIW was not only reflected in the appointment of associated members (only 58 new appointments during 1808-1850), but also in the international component amongst the correspondents. No fewer than 413 correspondents were elected during that same period. With that correspondents were more numerous than the ordinary members for which a grand total of 249 appointments have been documented.

It is worthwhile noting that the number of new correspondents and foreign members elected during the last 50 years, 182 and 215 respectively, come fairly close to the totals recorded for these groups during the century from 1851-1950: 185 and 251, respectively. However, even taken together they remain substantially below the numbers appointed as ordinary members. These amount to 465 during the 100 years from 1851-1950, and to 599 during 1951 to 2000. Should one conclude from such figures that during the last half century the Academy has become more engrossed in its own functioning at the national level than in its international position?

If the statutory number of members of a learned society is kept constant and ‘resignations’ are non-existent or very few, the yearly intake of new members will be limited to filling the vacancies arising from the death of members. Consequently the annual intake of new members over any given 5-year period will be well nigh stable. When statutory numbers are deliberately kept low and mortality amongst the seniors in a population is declining this inevitably results in very few vacancies per year. It is precisely the risk that as a result an increasing number of ‘obvious’ candidates will miss out altogether and the organisation may become a gerontocracy largely irrelevant in the eyes of others, which eventually drives boards to change the rules.

Figure 4. The numbers of ordinary members, foreign members, and correspondents elected during each 5- year period: 1808 to 2000



As far as the Royal Academy is concerned it is quite clear that changes in the statutory numbers and in the rules governing retirement have had a direct influence on the numbers of members that could be elected. This can be further illustrated by measuring the totals elected during each 5-year period between 1808 and 2000. Figure 4 illustrates that after the initial selection and expansion a century of very limited annual intakes followed. During most 5-year periods between 1820 and 1945 fewer than 50 members in all categories together could be elected. Even amongst ordinary

members, by far the largest category, not many more than 25 new members could be appointed during each 5-year period in a time span of one and a quarter centuries. The post-World War II situation is substantially different: nearly 160 members were recruited in the first 5-year period. Thereafter the annual intake of ordinary members doubled from not more than 4 or 5 before the war to 10 or more. The new rules governing retirement applied from 1975 onward allowed the intake of a particularly large cohort in the period 1975-1979. During the last 15 years more than a hundred new members were recruited during every 5-year period. Understandably, given the nature of the changes in the rules, most new appointees were ordinary members.

5. Age characteristics

5.1 Setting an example: the initial selection of members

When one has the possibility of appointing or selecting the first members of a new learned society one is, at least in principle, entirely free to decide on its initial age structure and in doing so to establish a tradition and to set a precedent. Consequently it is relevant to consider the characteristics of the very first groups of scholars and scientists appointed by Louis Napoleon. The age range amongst the cohort appointed in 1808 as ordinary member was tremendous: from 27.6 to 74.5 years, the mean being 50.2 (standard deviation: 3.5). The oldest of the initial group of correspondents was the botanist N.J. Jacquin (1727-1817) of Vienna, who had reached the age of 82 years when elected; the youngest foreign member was the French portraitist of Joséphine de Beauharnais and painter of Napoléon's battle of Austerlitz, Baron F.P.S. Gérard (1770-1839), who had not yet reached 39 when appointed. However, a pattern that becomes immediately established is that the mean age at election of foreign members exceeds that of ordinary members, correspondents being markedly younger than both categories. Table 4 displays these characteristics and shows that when a further distinction is made between what may be called the 'foreign' and 'national' correspondents of the institute respectively, the latter group is the youngest. An easily understood generality appears to be that when proposing new members for election, ordinary members take into consideration foreigners with a reputation and age at least equal to their own, while for (national) correspondents they focus their attention on people not quite their peers.

Table 4. The mean age at election in the founding period

Category of membership	Number	Mean age	S.D.
Ordinary members appointed before December 1808	89	50.2	3.5
Foreign members appointed before April 1816	23	56.7	2.9
'Foreign' correspondents appointed before April 1816	77	52.0	2.8
'National' correspondents appointed before April 1816	82	47.8	2.5

It should be noted, further, that all appointees were men; there was not a single woman amongst them. In part this, no doubt, reflected the small number of women active in prestigious academic positions and (inter)national networks. Thus, for quite a long time the election of a woman would remain an exception; *Madame* M.S. Curie-Sklodowska (1867-1934), who was elected as a foreign member in 1913, certainly is the most prominent amongst these appointees. It is only from the late 1990s that deliberate attempts to increase the number of female members began. During the period considered in this paper their number remained too small to warrant separate analysis: all members whether male or female have been included in the appropriate category of first appointment.

5.2 Changes in the age at election

An interesting question is whether changes in the yearly numbers elected and, thus, whether changes in statutory size or regulations aimed to achieve a degree of rejuvenation, do indeed affect the ages at election.

Figure 5. The mean age at election of ordinary members, foreign members and correspondents, by 5-year periods of election: 1808 to 2000

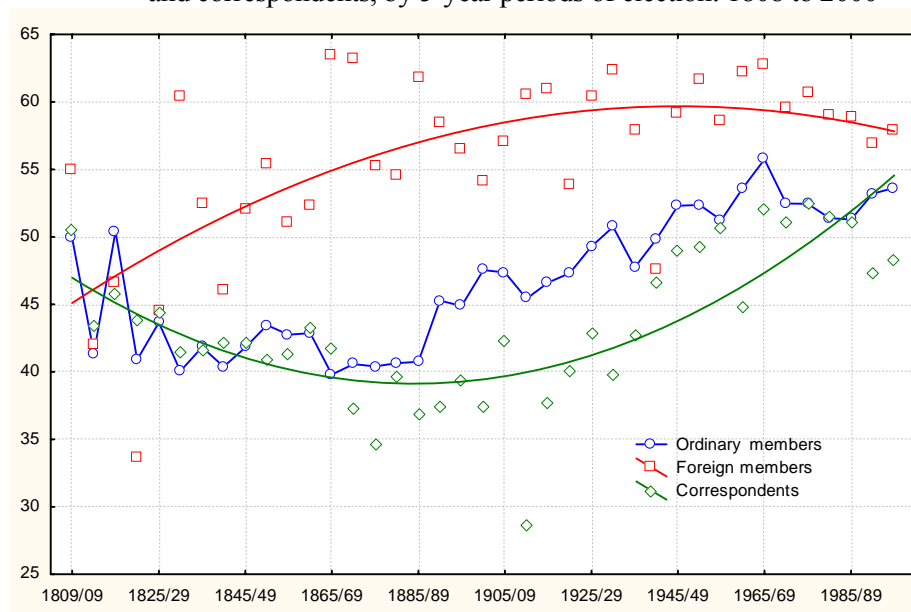


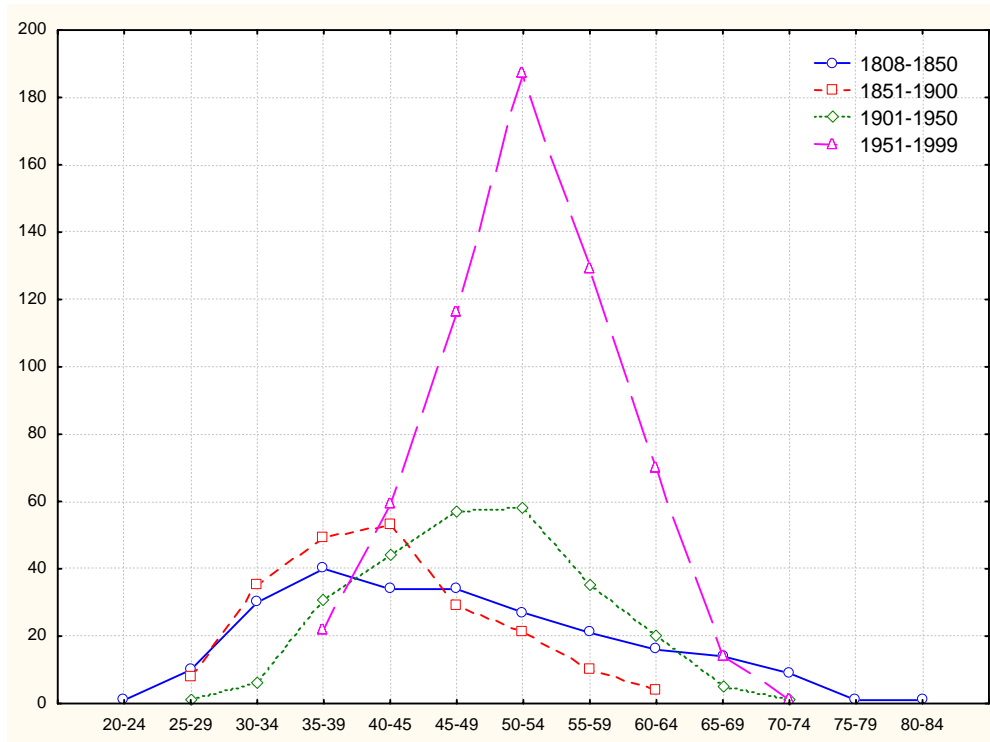
Figure 5 demonstrates that following the initial intake the average age of ordinary members at election declined and then leveled off at between 40 and 45 years. From just after the middle of the 19th century to the 1970s a rather substantial increase in the age at election took place. The mean age rose by more than 15 years: from 39.8 for 1865/1869 to a peak of 55.7 in 1965/1969. The brief period of decline after 1950 may, at least in part, have been the effect of the quite marked expansion in statutory numbers in 1949, just as the decline in the means after the mid -1970s will,

at least in part, be a consequence of the changes in the rules of retirement adopted in 1977 and the further expansion of the Academy.

It should be noted that these declines are far from spectacular and do not last long. The averages never fall below 51 years, which is well above the pre-war standard. In the face of a rapidly expanding system of higher education it is, apparently, not so easy to manipulate the mean age at entry into the Academy through changes in formal rules and statutory numbers. But, while the mean may not have changed much, the distribution around the mean certainly was affected by efforts to reduce the ages at election.

Figure 6 shows that in the post-war period age became an increasingly important consideration in the selection process. In the last half century the distribution by age at election narrowed: extremely young or quite senior scholars and scientists were no longer elected. The typical age at election became 50-54 with the adjacent age groups 55-59 and 45-49 taking 2nd and 3rd place respectively. Now that the retirement age has been set at 65, pressure from the Board of the Academy makes being elected at an age over 60 an exception.

Figure 6. The age distribution of ordinary members at election, by broad periods: 1808 to 2000



5.3 Direct impact of attempts at rejuvenation through the age at election

In order to see whether the efforts to rejuvenate the organisation found immediate reflection in the ages of the members elected, Figures 7a and 7b seek to make a comparison of the age distribution of the newly elected members in the 5-year period before and after the important statutory changes of 1949 and 1977 respectively. The results are puzzling. The highest fraction elected below age 45 occurs in the 5-year period before 1950! It would seem that in 1978-1982 the most common age group at election was 55-59, and instead of being lower than that of the previous 5-year period it was higher! However, the numbers elected below the ages of 50, 45, and 40 exceeded those of 1973-1977 substantially. The distributions by age both before and after 1949 would appear to be flatter; perhaps age had not become quite as important as in recent years. Perhaps then also an element of post-war recuperation was involved as foreign members and correspondents could not be reached during the war. This could possibly explain the bi-modality observed for the period 1950-1954.

While during the period immediately following the retirement reforms of 1977 more people were elected from the age groups up to age 45, the peak election age has, contrary to the intentions, clearly shifted to higher age groups, most notably the age groups between 50 and 60. Apparently, and not surprisingly, there is commonly a passage of time before scholars or scientists are considered to have qualified themselves as members of a learned society.

Figure 7a. The age at election: comparing all members elected in the period 1945-1949 with those elected during 1950-1954

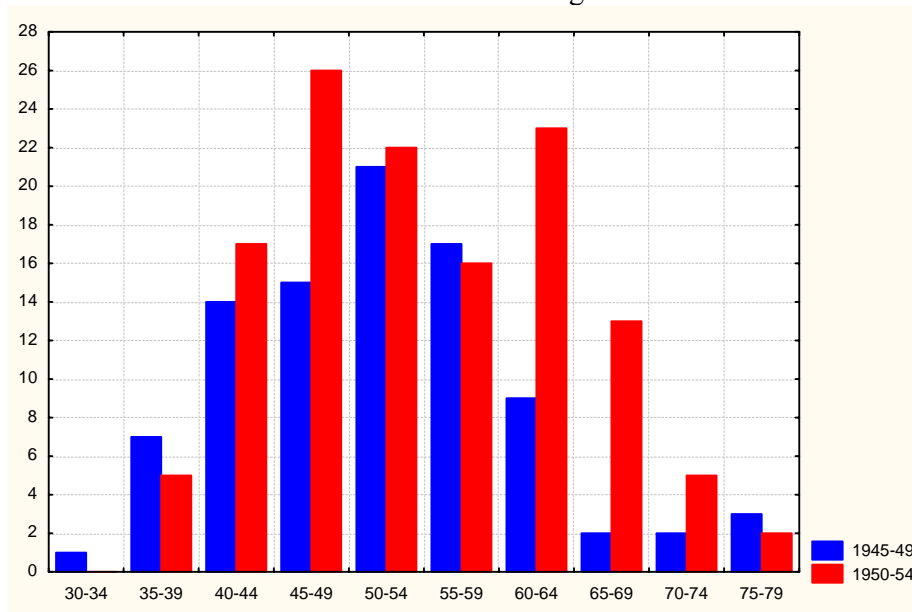
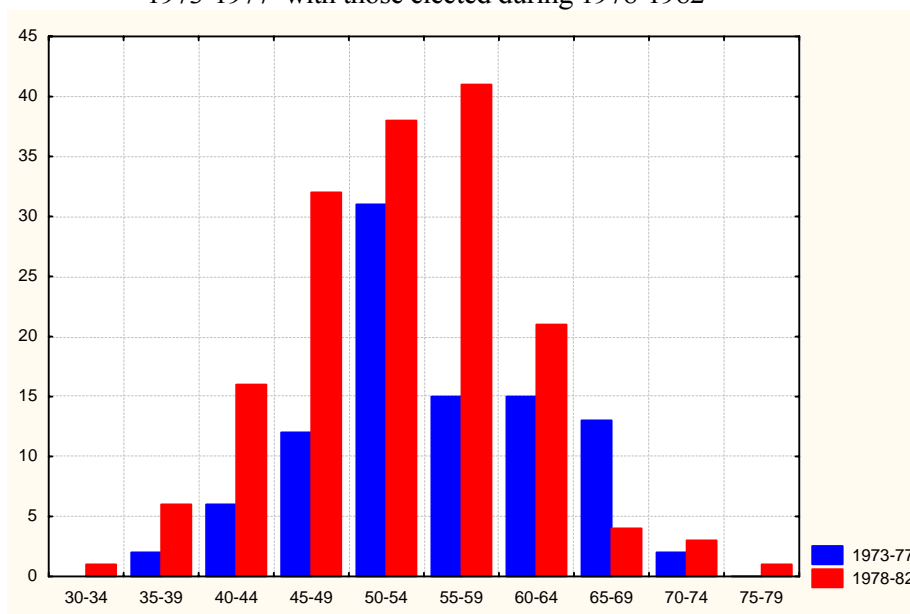


Figure 7b. The age at election: comparing all members elected in the period 1973-1977 with those elected during 1978-1982

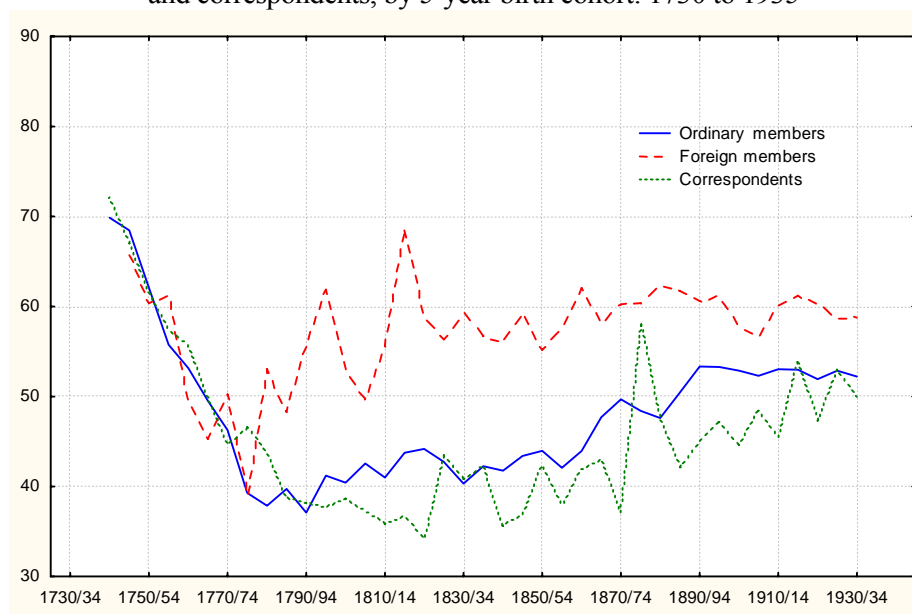


5.4 Contrasting the different categories at their election

If for foreign members and correspondents polynomials are fitted through the widely scattered averages calculated for each 5-year period of election, a strong contrast emerges between the two groups (see Figure 5). Obviously, correspondents tended to be junior to ordinary members. Particularly after the middle of the 19th century to after World War II, when correspondents could only be resident in the overseas territories, they were elected at comparatively young ages. With a single exception the means remained below 40 for the whole period from 1870/1874 to 1920/1924, which makes one assume that many candidates may have been former students of the members selecting them. After all, it is quite natural for ordinary members to take particular pride in the academic achievements of young scholars and scientists they guided through a Ph.D. These, in turn, may have made it a point to stay in contact after having begun their adventure in the colonies. After the war there may still have been a stock of potential candidates abroad that grew older as time went by, so that in 1975/1979 the average age at election reached 52. Thereafter, the effect of increasing internationalisation of science and scholarship, which encouraged many young people to go abroad, must have made itself felt. A shortage of eligible candidates in the last decades presumably helped to make the age at recruitment decline to 47 and 48 years.

Foreign members when appointed are almost invariably older than the ordinary members electing them. No doubt this reflects the fact that building up an international reputation takes many years of scientific effort, while members putting forward the name of a potential candidate will make sure it is someone bringing lustre to the Academy. During 12 out of 39 five-year periods of election

Figure 8. The mean age at election of ordinary members, foreign members, and correspondents, by 5-year birth cohort: 1730 to 1935



the average age amounted to more than 60 years. That no obligatory age of retirement has been established for foreign members may, further, have made it easier to keep the names of senior international scholars and scientists on the list of candidates. In recent decades the ages at election of the different categories drew somewhat closer together. Is this the outcome of increasingly rapid international dissemination of research findings, the impact of easier communication through international electronic networks, or of increased active participation in joint international projects?

When members are grouped by category and birth cohort the resulting graph (Fig. 8) confirms the same pattern of age differences at election between the ordinary and foreign members, and the correspondents. Ordinary and other members of the birth cohorts born before the 1750s were, of course, quite old when first appointed, just as those born after the mid-1930s are bound to have been relatively young upon election. A striking feature of the graphs is the steady rise in mean age of election amongst the cohorts of correspondents and ordinary members born in the period from the late 18th century to the beginning of the 19th century, i.e. from 40 years or less to 50 years or more. The age at entry of foreign members over the same period was more stable but at quite a high level, frequently above 60 years.

5.5 The age distribution of the membership

An organisation recruiting its members at ages well over 45 cannot expect to be a young organisation. For a learned society being young is rather irrelevant, but being seen as irrelevant because the members are too old, not dynamic enough and no longer well-informed, is. Hence the

repeated efforts of boards or councils to reduce the average ages by creating more vacancies, by creating vacancies more rapidly, and by filling these vacancies with ‘young’ candidates.

Calculation of the average age of the various categories of members at the end of December of each year shows that the Academy was indeed ageing gradually. Amongst all active ordinary members a peak of 57 years was reached in the years from 1967 to 1971. If over the whole period since its founding the average age of members younger than 65 is established, as shown in figure 9, the average age appears to creep up from about 50 to an average again remarkably close to 57. Amongst ‘retired’ ordinary members, here considered to be all those aged 65 and over even though before the reform of 1977 the age at retirement was 70, the mean age is 75. It is quite remarkable that the reduction in age of compulsory retirement has, obviously, not helped to reduce the average age amongst active members to any degree, not even temporarily.

Figure 9. The mean age of members as of 31st December of each year: 1808-1999

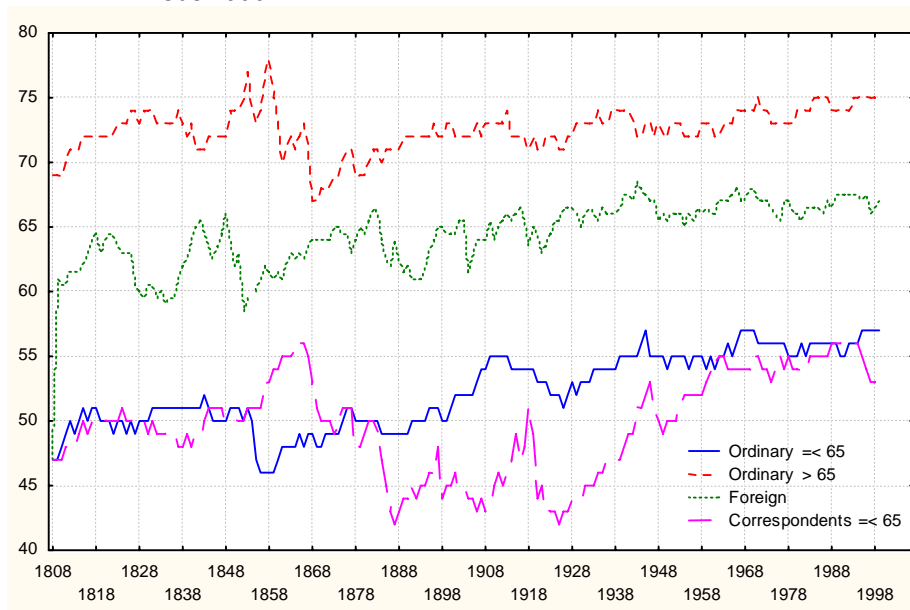
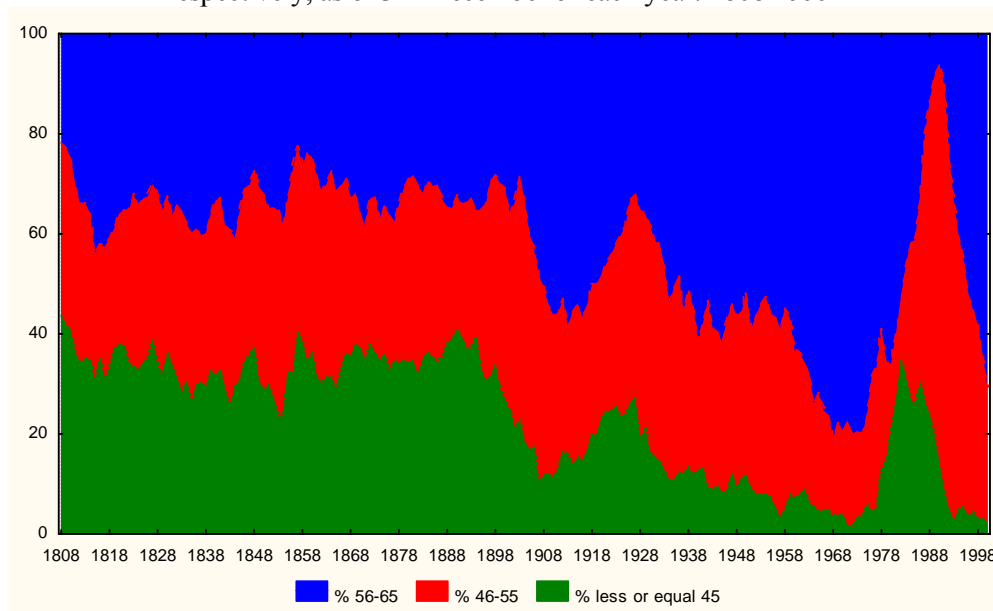


Figure 10 displays changes in age structure over time by showing the proportions of ordinary, active members below selected ages at the end of December of each year. This graph amply demonstrates the unsettling effect upon the age composition of the active membership of the sudden intake of sizeable numbers of members at younger ages and the forced reduction in retirement age over a brief period of time. As the newly elected younger members age, they move on to older age groups. And, as large numbers of members rapidly move over the boundary established by the declining retirement age, the proportion of members aged 56-65 starts dominating the active membership.

Figure 10. The proportion of active ordinary members at or below ages 45 and 55 respectively, as of 31st December of each year: 1808-1999



Changes in rules such as decided upon in 1977 tend to create the typical effect of a sizeable prey passing through the belly of a snake. While in the year 1971 little more than 1% of active ordinary members were younger than 45 years, this proportion rose sharply to peak at nearly 35% in 1982. However, thereafter it declined almost as fast to be back at 2% at the start of 2000. As against that the proportion of members aged 56-65 rose from a mere 6% in 1990 to 70% by the 1st of January 2000, when it was almost 3 times as large as the number of active members aged 46-55. The latter proportion had, understandably, peaked ten years earlier, in 1991, with 82%.

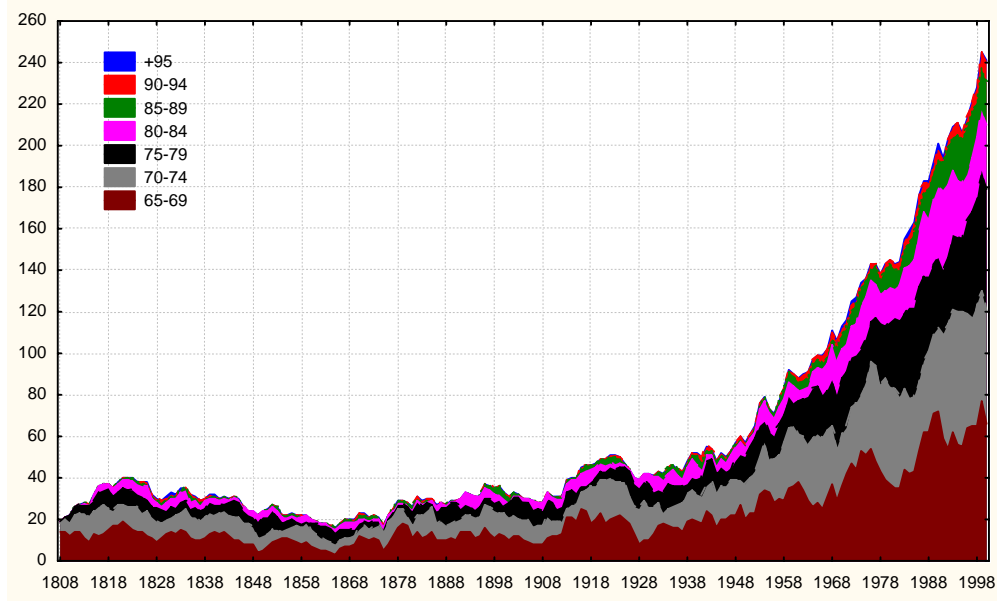
The graph also demonstrates that the situation during the first century of the Academy's existence has been much more stable than thereafter. Quasi-stability will always result if one refrains from changing policies and numbers. However, the ageing process that began in earnest from the late 19th century onward has a momentum of its own since everyone will necessarily age as a person as time goes by. The effect of rejuvenation policies will, therefore, always be short-lived.

5.6 The impact of reducing the retirement age

As will be easily understood a reduction in retirement age has the immediate effect of increasing the numbers of retirees. In 1941 they numbered 50 to a man, roughly half of the total ordinary membership at the time. By 1967 their number had just about doubled; from 1993 onward it began to exceed the number of active members and just before 2000 peaked with 247. The latter figure is, of course, quite a bit larger than the number of active ordinary members.

It is an interesting exercise to establish at what date the number of retired members in a specific age group reached 10 without ever falling below that round number thereafter. For the age group 70-74 that year is 1935; for the age group 75-79 it is 1949; for the next higher age group 1966, then 1984, while the number of retired ordinary members aged 90-94 passed a total of 10 in 1999.

Figure 11. The number of retired (65+) ordinary members by 5-year age group as of 31st December of each year: 1808-1999



The next figure, Figure 11, illustrates the tremendous boom in retired members in considerable detail. From the 1930s onward the growth in numbers is really exponential. At the end of the observation period the total number of retired ordinary members was very nearly 5.5 times larger than in 1934! Members over 75 years old then were almost as numerous as those aged between 65 and 75.

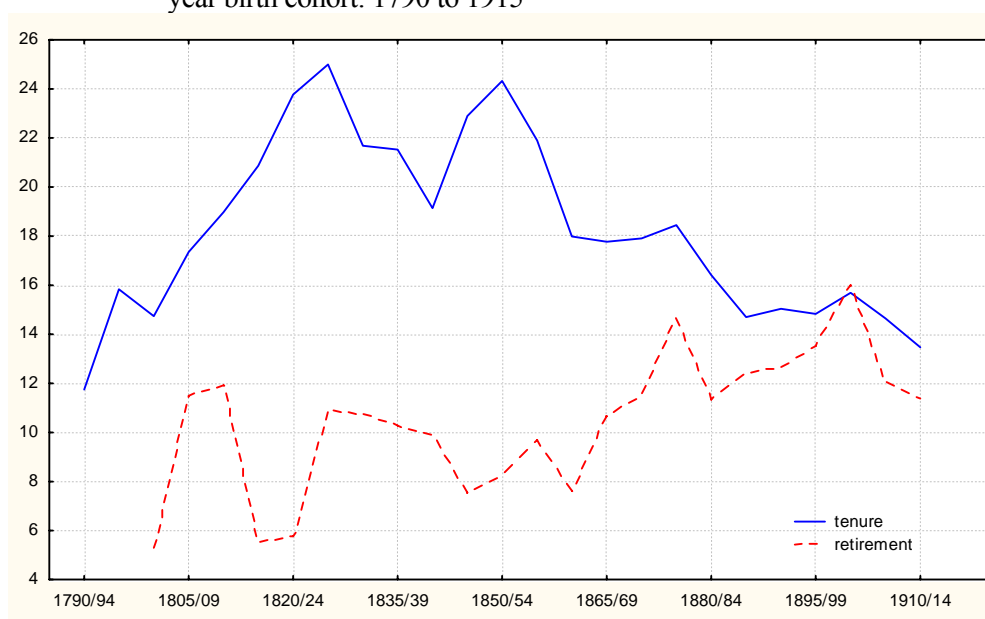
6. Assessing the duration of tenure

6.1 Continuity and prestige

Amongst national academies a certain prestige is commonly attached to age and traditions; the older the more prestigious is the rule. And indeed, one of the most important tasks of an academy's board is to ensure continuity. Continuity is essential in achieving and maintaining the highest possible standing in the scientific community of a country. Rather than bending to the winds of the season, the best traditions of scientific and scholarly research have to be protected unwaveringly. If

a learned society has been able to survive for centuries by serving science and scholarship it deserves respect and has earned respect. An element of continuity amongst the membership may be an asset in that regard; while for members it is highly attractive to have been elected to an influential organisation rich in traditions: the older the better! It is, thus, of interest to try to ascertain what effect changes in statutory numbers, age at retirement, and age at death have had on the duration of membership in the academy of the various categories of members.

Figure 12. The mean duration of tenure and retirement of ordinary members elected after the introduction of compulsory retirement in 1851, by 5-year birth cohort: 1790 to 1915

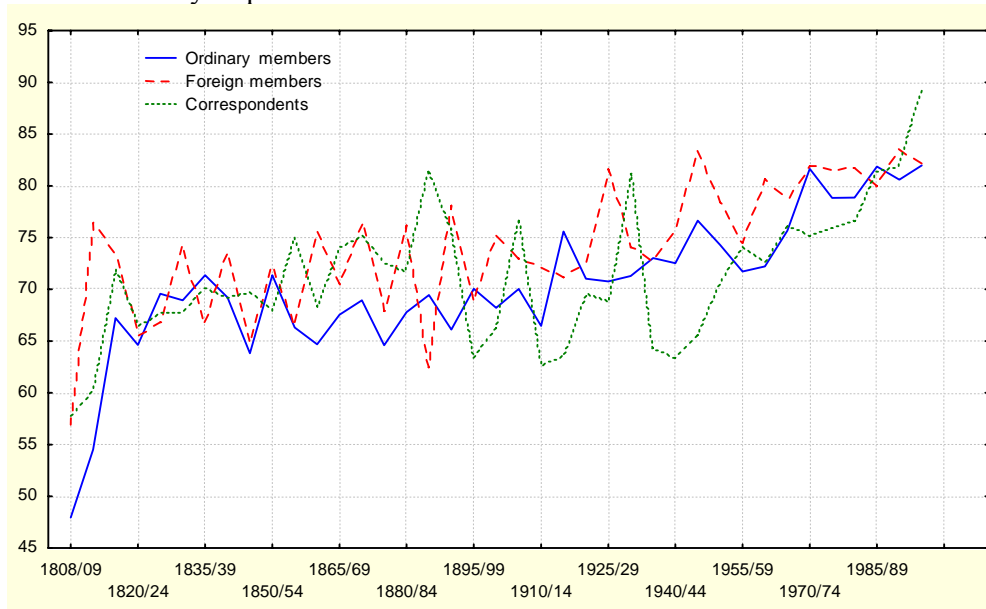


If size of the membership of a learned society is kept constant, a new member can only be elected once another member has died. Consequently, the average annual number of entrants will be determined by the average duration of tenure, which is obtained as the difference between the average age at election and the average age at death. When death is not the sole 'absorbing state', the concept of compulsory retirement is introduced, and the size of the membership is increased repeatedly, the situation is more complex. The relationship does not, for example, hold in the case of repatriating correspondents losing their status within the academy. However, for birth cohorts that have completed their lives the average duration of membership can even in the current circumstances be judged by subtracting the mean age at election from the mean age at death. From Figure 12 it can be established that ordinary members born from the early 19th century to well past the mid-1860s spent from 18 to nearly 25 years on average as active members. At the same time the period of retirement gradually reached its maximum of 16 years for members of the cohort 1900/1904. The academy career of all members born after 1915 will, of course, continue to be influenced by the retirement arrangements that came into effect from 1977 onwards.

6.2 Role of age at death

The length of life of members will, of course, have an immediate effect on the duration of their membership and period of retirement. Figure 13 shows that the average age at death of all categories of members has crept up slowly but steadily. Before World War I it rarely exceeded 70 years; after the mid 1980s the average age at death is 81 or 82. It is quite evident that the mean age at death of the ordinary members did not change very much between the first decennia of the 19th century and about 1915. If anything there is more evidence for decline than of increase in the average age at death during that long period. And, the values obtained for foreign members and correspondents tend to be higher than for the ordinary members of the Academy. That may seem unexpected but need not be if it is acknowledged that in the first period of the Academy's existence universities were predominantly located in the western, urbanized part of the country. It may be recalled here that for quite a while living within 3 hours travel from Amsterdam was a prerequisite for ordinary membership.

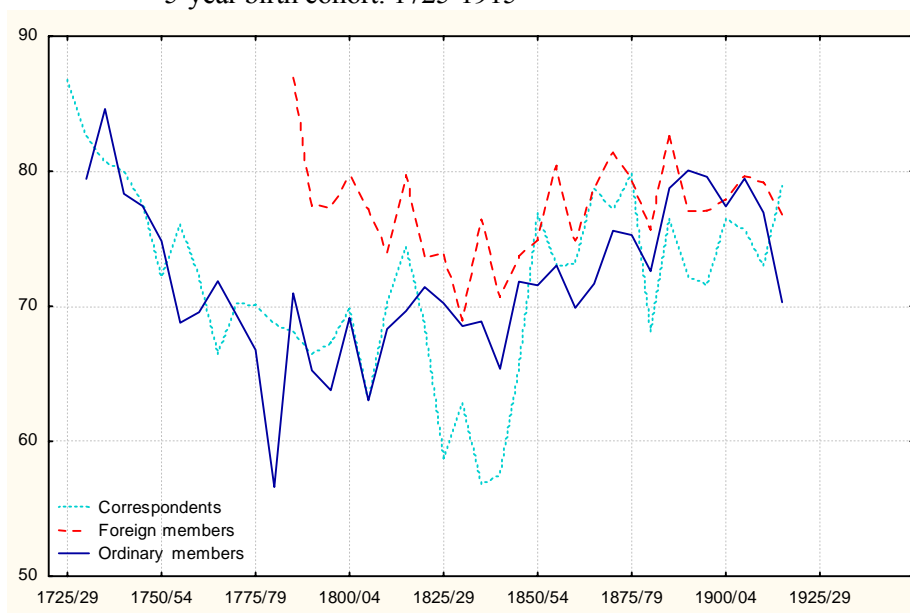
Figure 13. The mean age at death amongst the various categories of members, by 5-year period of death: 1808 to 2000



It is well known that at the time mortality risks in rural areas were much lower than in the urbanized western provinces of the country. As Van Poppel (2005:14) recently reported, around 1830 and during the period 1840-50 the average duration of life in the provinces of *Gelderland* and *Brabant* probably exceeded that in *Zuid-Holland* and *Zeeland* by some 15 to 20 years. After World War I, the average age at death of ordinary members increased rapidly to a value in excess of 80 years by the end of the observation period. Internationally, it is in particular after about 1970 that the chances of survival of older persons improved quite rapidly. While until that time a life

expectancy at birth of between 70 and 75 years was assumed to be the natural limit, now values over 80 are reached while in most countries further improvements in mortality are expected. It goes without saying that once a retirement age has been decided upon further increases in longevity will not affect the duration of active membership and the number of places falling vacant. However, they will lengthen the average duration of the period of retirement and of overall membership.

Figure 14. The mean age at death of the various categories of members, by 5-year birth cohort: 1725-1915



When deaths are arranged by birth cohort, as in Figure 14, the position of ordinary members improves to some extent. The rise in the average length of life of cohorts born before the end of 18th century to those born around the year 1910 is unmistakable. Very many correspondents must have spent a substantial part of their lives in the colonies in the tropics which may explain their fairly early demise in several periods during the late 19th and the first half of the 20th centuries. Infectious diseases and malaria must have played an important role in their mortality pattern. When studying the graph it should be kept in mind that the numbers dying in any particular birth cohort are small so that chance fluctuations are likely to have influenced the fate of one generation more than that of another.

Given the history of the Academy's concern with 'over-ageing' and its repeated attempts at 'rejuvenation' the changes in the duration of active membership of ordinary members are of special interest. Has the period of membership from election until retirement declined? From Figure 15 it can be seen that where death occurred before retirement the duration of active ordinary membership has steadily declined. It should be remembered here that an official retirement age was not established until 1851, while the reduction from 70 to 65 years only came into full effect in 1982. As Figure 15 demonstrates the duration of active membership of members dying before they

reached retirement age has markedly declined; from over 20 years for members elected between 1870 and 1880, say, to well below 10 years for the more recently elected ordinary members. The graph understandably also shows a so-called truncation effect: death amongst recently appointed members can only have occurred not very long after their election. At the same time the number of members befalling the fate of a relatively early death was small. The trend line depicting the mean duration of tenure before retirement also shows a steep decline. While it used to be well over 25 years for members elected up to 1900 it is obvious that, on logical grounds, those elected at ages over their mid-fifties cannot expect to serve as an active member for any extended period of time. Whether that is a sensible arrangement is a moot point.

Figure 15. The mean duration of tenure upon retirement, or death before retirement, of ordinary members, by 5-year period of election: 1855 to 2000

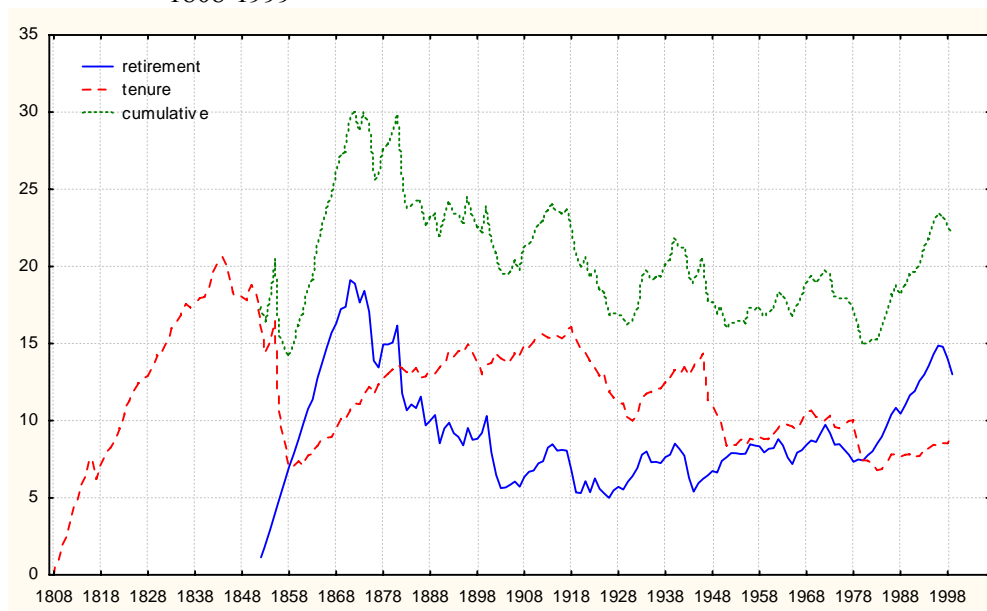


If one considers the mean duration of tenure as an ordinary member from the date of election to the date of death another pattern emerges. This pattern is not shown in a graph as it is strongly influenced by the dismissal of all members in 1851. So far, the longest average tenure as members of the Academy has been recorded for the ordinary members elected between 1865 and 1885, namely 26 years.

Figure 16, finally, considers the situation as of 31st December of each year between 1808 and 2000. Once again two trend lines are provided. For all members still alive and active at the end of each year the mean duration of tenure as an active member has been calculated while, starting with 1851, for all those retired but still alive and a member the average duration of retirement to the end of each year is given for all years between 1851 and 2000. The cumulative effect of these two trends is also shown. In a nutshell these graphs illustrate the joint experience of the members on

which the board of the Academy could call at the end of each year. Evidently the repeated increases in statutory numbers, the changes in the age at compulsory retirement, and the increase in longevity, have had a rather profound impact. The average experience as an active member has declined from over 15 to less than 10. In contrast the average duration of retirement of all retired ordinary members is creeping up as time goes by. While it was 5 years in the 1920s it had climbed to 15 by January 1, 2000. The cumulative experience of members present at the end of the years in the 1880s was, with 30 years, the highest recorded so far.

Figure 16. Mean total duration of active tenure and mean total duration of retirement of ordinary members present at 31st December of each year: 1808-1999



7. Assessing longevity

7.1 Life expectancy at age 50 and beyond

The data base makes it possible, at least in principle, to study the longevity of members of the Royal Academy. However, the small size of the population poses severe limits on that sort of exploration.

For example, 5-year age intervals will have to be used instead of single ages, and fairly long periods of observation instead of single years. Moreover, members enter the population at a different age. Sometimes the observation of the life of a member, of a correspondent returning

home and losing his status in the Academy, for example, has come to an end before he/she died. And even though it is virtually certain that this member was no longer alive in the year 2000, the date of death may not be known. Of members still alive at the end of 1999 the observation period is, obviously, truncated (censored); they may well live for many years to come. This situation makes it imperative to use all information collected as efficiently as possible by calculating for each individual the number of person years of observation in each 5-year age interval, including the age interval during which that person is known to have died. For a well-defined part of the total population all person years of observation in a specific age group during a specific observation period can then be added and can be related to the deaths recorded at the same age during the same period.

Table 5. Extract from the abridged life table of ordinary members of the Royal Academy: period 1970 to 2000

x	${}_n\mathbf{P}_x$	${}_n\mathbf{D}_x$	a	${}_n\mathbf{M}_x$	${}_n\mathbf{q}_x$	l_x	T_x	e_x	-95	+95
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
35	22.3	0				100000	4852250	48.52	47.39	49.66
40	142.3	0				100000	4352250	43.52	42.39	44.66
45	466.4	0				100000	3852250	38.52	37.39	39.66
50	1071.1	2	0.57	.00187	.0093	100000	3352250	33.52	32.39	34.66
55	1497.7	6	0.52	.00401	.0198	99070	2854575	28.81	27.74	29.89
60	1716.1	6	0.47	.00350	.0173	97105	2364138	24.35	23.34	25.35
65	1565.1	14	0.52	.00895	.0438	95423	1882820	19.73	18.75	20.71
70	1313.3	23	0.49	.01751	.0839	91244	1416153	15.52	14.59	18.45
75	1044.1	37	0.54	.03454	.1639	83593	979059	11.71	10.83	12.59
80	675.9	46	0.49	.06806	.2902	69893	595344	8.52	7.67	9.37
85	355.1	46	0.43	.12953	.4734	49607	296594	5.98	5.14	6.82
90	97.83	24	0.34	.24532	.6788	26123	107267	4.11	3.19	5.02
95	28.17	7	0.52	.24849	.7778	8392	20979	2.50	1.85	3.15

The technique used to calculate the number of years spent in each age interval during a specific period is known as ‘episode splitting’, while ‘fraction calculation’ is required to establish the fraction of the years lived in the last interval of life (Chiang, 1984). In his excellent study on the mortality amongst nuns and monks living in Bavarian cloisters during the period 1910-1985, Marc Luy (2002) has provided a detailed description of these techniques and of the SPSS Windows Syntax Programmes he developed for it. Table 5 demonstrates, by way of example, the results that can be obtained in this way by presenting the abridged life table for ordinary members of the Academy during the period 1970 to 2000.

In this table x stands for age, n for the number of years in the age interval, in this case 5 years. Column 2 (${}_n\mathbf{P}_x$) gives the total number of years lived by ordinary members, and thus the years at risk, observed in each age interval n to $n+5$ during the period 1970 to 2000; column 3 (${}_n\mathbf{D}_x$) the observed number of deaths amongst ordinary members during the same period and column 4 the fraction of the years lived in the last age interval of their lives by the persons who died between

ages x to $x+5$. The resulting age specific mortality rates are given in column 5 (${}_nM_x$), and the probabilities of death derived from these rates in column 6 (${}_nq_x$). The columns 7, 8 and 9 are classical life table columns. They show the number of survivors out of an initial group, here set at 100000, at exact age x (l_x) and, as column 8 (T_x) the total number of years that all these survivors at exact age x together will still live before all have died. From that total number of years the life expectancy at each age x (e_x) is, finally, calculated.

As the life table shows, not a single death below age 50 of an ordinary member was recorded between 1970 and 2000; this should, of course, be appreciated against the background of the quite small number of person years at risk below that age. In turn this reflects the high average age at which members are customarily elected. The column of recorded deaths is not smooth, as one would prefer, which results in irregularities in other columns, most notably that of the probabilities of dying. The highest absolute numbers of deaths were observed for the age groups 80-84 and 85-89. The best summary measure of a life table is the life expectancy at each specific age. Under the mortality conditions observed during 1970 to 2000 members aged 50 could, on average, expect to live another 33.5 years. At the official retirement age of 65 nearly 20 more years would await them, whereas an average of just over 8.5 years would await those members reaching exact age 80. Such expectations are, of course, conditional upon circumstances remaining as they were during 1970 to 2000. This is, however, highly unlikely. Experiences from the past have shown continuous improvements in life expectancy with time (Van Poppel, 2005). Consequently these life expectancy values probably underestimate what the coming years will bring. It can even be assumed that within the observation period of 30 years that elapsed between 1970 and 2000 a certain improvement has taken place so that the probabilities of dying at the end of the period were lower than at the beginning.

As the values presented in Table 5 are based on a very small number of observations they are subject to considerable standard errors (SE). These have been calculated for the same sub-population of ordinary members and observation period as given in Table 5 using the programme available on a UK Government site.⁷ The results show that with 95% certainty the true value of the life expectancy at age 50 lies between a lower limit of 32.4 years and an upper limit of 34.7 years. These confidence limits are contained in columns 10 and 11 of Table 5 respectively.

7.2 Assessing differentials in life expectancy

The materials collected allow the calculation of life tables for various periods, categories, and sub-groups of members.

These can, at least in principle, give an answer to questions such as to whether correspondents live longer than foreign members; whether ordinary members live longer than the other categories, or whether survival amongst members of the Arts Division exceeds that of the members of the Sciences Division.

⁷ <http://www.statistics.gov.uk/STATBASE/ssdataset.asp?vlnk=6949a>

Table 6. The life expectancy at age 50 of different categories of members during broad, partly overlapping, periods: 1808 to 2000

Period	1808-1854	1855-1939	1940-1999	1940-1969	1970-1999
Correspondents					
No. of deaths	241	46	130	78	52
e_{50}	21.0	23.1	29.5	25.8	36.2
95% Conf. Interval	19.6- 22.4	20.0- 26.3	27.8- 31.2	23.5- 28.1	33.6- 38.9
Foreign members					
No. of deaths	37*	153	187	87	100
e_{50}	--	21.9	29.5	26.3	33.3
95% Conf. Interval	--	19.7- 24.1	27.6- 31.4	23.1- 29.4	31.6- 34.9
Ordinary members					
No. of deaths	175	262	364	153	211
e_{50}	20.7	21.0	30.7	27.0	33.5
95% Conf. Interval	19.1- 22.4	20.7- 23.2	29.8- 31.6	25.3- 28.7	32.4- 34.7

* Associated members of the institute (KNIW).

As the number of recorded deaths is small and the categories are numerous there are limitations to the comparisons over time that can be made. This applies particularly to the correspondents: over the entire period from 1808 to 2000 only 417 deaths have been observed and of these 241 relate to the period 1808-1854 when a considerable proportion of the correspondents lived within the Netherlands. Table 6 compares the life expectancy at age 50 for correspondents, foreign members, and ordinary members for a number of, partly overlapping, broad periods. Statistically significant differences in life expectancy at age 50 between the three different categories of members cannot be established. Moreover, while in some cases the correspondents register the highest life expectancy, in others it is the foreign or ordinary members who score best. However, over time, and especially from 1940 onward, a significant rise in life expectancy has, evidently, occurred amongst all categories of members.

Although the size of the membership barely allows it, it is also worthwhile to investigate whether any substantial difference is found between the life expectancy of members of the Arts and Sciences divisions. Stereotypical, scientists are supposed to show their talents at a very young age and to spend most of their time twirling the knobs of microscopes and even more complicated instruments, while scholars are thought to spend most of their days poring over old documents and manuscripts, rare books, and micro-films in their pipe smoke-filled studies.

Table 7 presents an overview of the findings as regards foreign members and ordinary members, while results are also shown for correspondents, foreign members, and ordinary members taken together. The life expectancy data presented in Table 7 are for life expectancies at age 65. This age was chosen in order to establish the number of years members may, on average, expect to live upon reaching retirement age. That the different categories of members of the Sciences Division have a higher life expectancy than the members of the Arts Division cannot be established beyond reasonable doubt. However, in most cases they appear to live longer and this rather systematic difference between scientists and scholars may well be indicative of the situation as it really was,

and perhaps still is. It would seem, further, that the gap between the two groups is narrowing. The differences in life style may have become less obvious than the old stereotypes would have it.

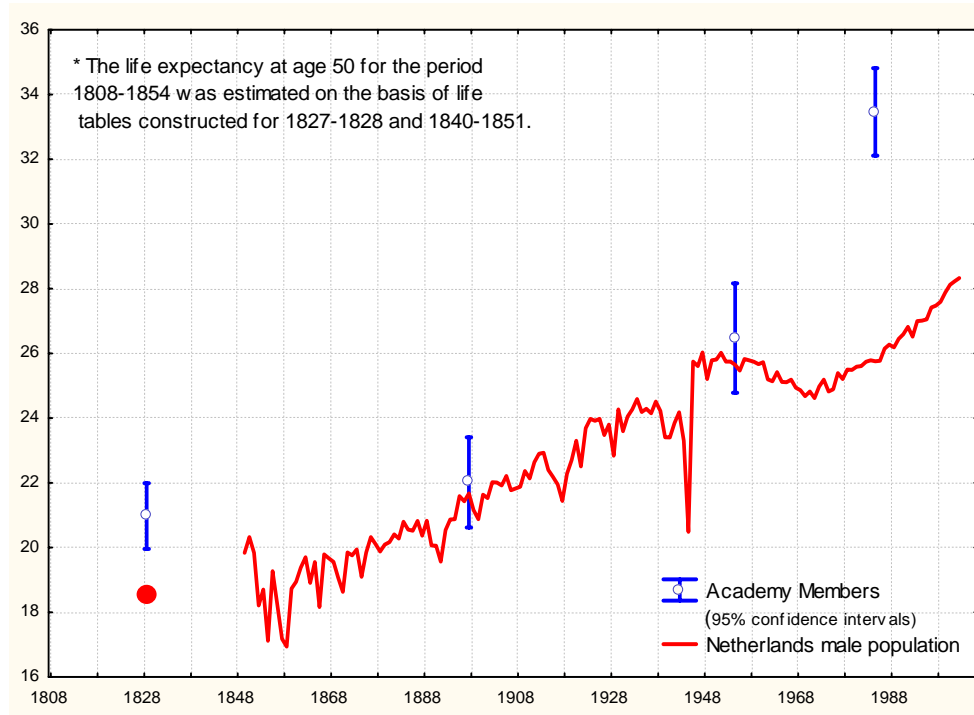
Table 7. The life expectancy at age 65 for the members of the Arts and Sciences Divisions during broad, partly overlapping, periods: 1855 to 2000

Arts Division	1855-1939	1940-1999	1970-1999
Foreign members			
No. of deaths	72	95	50
e_{65}	11.9	17.7	18.7
95% Conf. Interval	10.1- 13.7	16.3- 19.2	17.0- 20.4
Sciences Division			
No. of deaths	81	92	52
e_{65}	12.1	17.6	17.6
95% Conf. Interval	10.4- 13.9	15.7- 19.5	15.6- 19.6
Ordinary members			
Arts Division			
No. of deaths	148	178	103
e_{65}	11.3	17.8	19.7
95% Conf. Interval	10.0- 12.5	16.7-18.9	18.4- 21.0
Sciences Division			
No. of deaths	114	186	113
e_{65}	12.6	18.6	19.2
95% Conf. Interval	11.0- 14.3	17.4- 19.7	18.0- 20.4
All categories combined (correspondents included)			
Arts Division			
No of deaths	247	337	180
e_{65}	11.5	17.8	19.3
95% Conf. Interval	10.5- 12.5	17.0- 18.7	18.4- 20.3
Sciences Division			
No. of deaths	214	344	191
e_{65}	12.9	19.0	19.6
95% Conf. Interval	11.7- 14.0	18.0- 19.9	18.6- 20.5

7.3 Comparing members with the national population

The life expectancy at birth for the population of The Netherlands as a whole can only be calculated from the year 1850 onward. But, for two periods before that date, i.e. for the years 1827-1828 and 1840-1851, fairly good estimates have been prepared.

Figure 17. The life expectancy at age 50 of members of the Academy, all categories combined, in comparison with that of the male population of the Netherlands*



During the first period males could expect to live about 36.6 years, during the second roughly half a year shorter (Van Poppel, 2005:14). On that basis one may estimate the average life expectancy at age 50 over the period 1808-1854 to have been just over 19 years. It should be understood, however, that during the first half of the 19th century epidemics of cholera and other contagious diseases still were rife and that yearly fluctuations in life expectancy were quite considerable. In Figure 17 the estimate for 1808-1854 is represented by a dot, while a line connects the life table values available for each of the years 1850 to 2000. As the level of mortality has been found not to differ significantly between the different categories of members of the Academy all categories have been combined to calculate the life expectancies at age 50 for four broad periods: 1808-1854, 1855-1939, 1940-1969 and 1970-1999. These are also shown in Figure 17 together with their 95% confidence intervals.

The most striking feature of this graph is that during the early part of the history of the Academy the life expectancy of its members did not differ much from that of the average male. At first sight that characteristic may appear unexpected. At the time members of the intelligentsia in the Netherlands were almost exclusively recruited from the upper classes of the society. Quite a number came from noble families, belonged to families that for many generations had served the public cause or the church, and had, in any case, been wealthy enough to allow the children to receive a good education. Many of the initial candidates had, in fact, already served with such distinction that they had been knighted themselves.

One would, moreover, have expected to see the effects of the principle of 'healthy selection' reflected in the expectation of life. Members elected to a learned society have demonstrated an above average vitality and will at the time of their election on the whole have been in better health than the average person of their generation. One would not usually want to appoint a candidate known to be seriously ill, sickly even. Why does not that show more strongly during the first century? The probable explanation is that during the period concerned infectious diseases still were an important cause of death and these have little regard for status and level of education. In 1846/1847 a cholera epidemic occurred while in 1859 the combination of smallpox and cholera drove the life expectancy of males down to under 30 (Van Poppel, *op. cit.* 15).

The well-to-do frequently had a number of maids and man-servants living in, or had them living in close proximity, so that their exposure to infection probably didn't differ much from that of the population as a whole. Van Poppel does, in fact, report that for generations born up to 1860 the higher social classes in the Netherlands had a lower expectation of life than the remainder of the population. That the early ordinary members of the Academy had to be living within three hours travelling distance of Amsterdam may not have helped either. Urban settings were particularly risky, and that is where universities and similar bodies were commonly located. It is only after the end of the 19th century that a greater physical separation of the social classes became established and the advantage of 'living in the country side' begins to show up in the life expectancy at age 50 of Academy members.

It is, more specifically, after 1940 that the survival of members of the Academy increasingly diverges from that of the population as a whole. For the period 1940-1969 a statistically significant difference of about 3 years can be established between an arithmetic average calculated for the average male in the Netherlands and the members of the Academy. However, the effect of World War II may have made itself felt more strongly amongst the population at large than amongst Academy members and the figures for the average male in the late 1950s are not significantly different from the figure obtained for Academy members over the whole period from 1940 to 1970. But after the early 1960s the difference between males in the population at large and Academy members appears to have grown dramatically. While in the male population as a whole the life expectancy at age 50 clearly declined for a while, it may have continued to increase amongst the members. It is likely that the more infectious diseases became replaced by diseases directly related to life style and individual behaviour, the balance tilted more to the well-informed and the better educated population groups. Over the three decades from 1970 to 2000 the Academy members averaged a life expectancy at age 50 of 33.5 years. As against that life expectancy at age 50 amongst the male population in the Netherlands increased from 24.7 years in 1970 to 27.6 in 1999. This leads to the conclusion that members of the Academy live anywhere from 6 to 8 years longer than their less gifted counter-parts! Huge differences between selected groups and a total population have earlier been established elsewhere in the world. The famous Alameda County study in the US found that using a longitudinal research design men following a healthy life style lived 24 years longer than the average American male (Manton et al., 1991).

An interesting feature of the graph emerges when the life expectancy at age 50 for the population as a whole during 1808-1854 is compared with the figures at age 65 as calculated for various groups during 1970 to 2000. Evidently the life expectancy at age 50 at about the time the Academy

was founded is just about equal to the life expectancy members currently have when they are obliged to retire.

8. Simulating the effect of selection variables

Micro-simulation is an attractive means to explore the future and to assess the effect of changes in the value of certain variables. This technique will here be employed to assess the long-term effect of differences in the average age at election and levels of mortality on the recruitment of ordinary members and the mean ages of the members present in 2050 and 2100. Starting point of the micro-simulation carried out is the population of ordinary members arranged by age as of January 1st 2000. Each individual is then followed from year to year until the time of death. Everyone will be one year older on January 1st 2001 unless death occurs before that date. In order to establish the probability of death at each single age the 5-year probabilities of death presented for the different age groups in the life table contained in Table 5 had to be transformed to single year probabilities of death. This was achieved using a straightforward interpolation procedure by means of a second degree polynomial fit. If, given these probabilities, random selection determines that a particular member has died in a given year he/she, obviously, no longer forms part of the population at the beginning of the next year. As soon as a member reaches age 65, or was found to have died before reaching that age, a vacancy can be filled. In the simulation this is done without delay, the age at election of each separate appointee being established by a random procedure and on the basis of a certain distribution of ages around a given mean age. As candidates for ordinary membership can no longer be elected once they have reached retirement age, a truncated normal distribution was selected with a standard deviation of 10% around the mean.

For the purposes of assessing their impact, three different mean ages at election were chosen for the micro-simulation: 40 years, 50 years and 60 years. From the moment of their election new members were exposed to the same probabilities of death as the members present.

Over a long period of time the life expectancy at birth in human populations has continuously increased. This process will almost certainly also influence mortality conditions in the next half century. How large that increase will be is almost impossible to tell. Observations from the past suggest that for national populations it could be around 0.25 of a year in each year that passes. Since the members of the Academy are such a special group and since illustration of effects rather than prognosis was the purpose of the simulation exercise, levels of life expectancy somewhat below and above the one presented in Table 5 were chosen. The single year probabilities of death applied to the initial population represent life expectancies at age 50 of 32.5, 35, and 37.5 years respectively. The results of the simulation exercise are presented in Table 8.

The results show that the influence of changes in life expectancy on the numbers of new members that, in the absence of any further expansion, could be elected in the next half century is very limited. It, similarly, does not affect the mean age of active and retired members to any great extent. The crucial determinant is mean age at election.

Table 8. The influence of the mean age at election of ordinary members assessed by micro-simulation

Mean age at election	Life expectancy at age 50	Total number elected (2000 to 2100)	Mean age of active members 2050	Mean age of retired members 2050	Number of retired members 2050	Mean age of active members 2100	Mean age of retired members 2100	Number of retired members 2100
40	32.5	984	54	78	110	52	77	124
40	35	984	54	80	132	52	76	135
40	37.5	987	54	80	163	52	78	176
50	32.5	1408	57	76	207	57	76	200
50	35	1420	57	77	242	57	77	258
50	37.5	1419	57	77	269	57	78	275
60	32.5	3337	61	76	556	61	76	578
60	35	3324	61	77	670	61	77	644
60	37.5	3245	61	78	731	61	78	734

The higher the average age of newly elected members, the higher will be the number of persons reaching retirement age soon after election. As that basically determines the number of vacancies it also determines the number of new members that can be elected each year. Selecting members much younger than is currently the case, at mean age 40 for example, results in very few vacancies. At the same time it tends to increase the average age of retired members as the inflow of new entrants in that category will, necessarily, also be relative small. It would, however, bring down the mean age of active members to about 54. If new members are on average 50 years old upon election, the average age of active members would be 57, very close to the level currently observed.

With an average age at election of 40 years the Academy could welcome no more than 450 to 500 members in the 50 years to come. This figure would rise to close to 700 when the mean age would be 50 years and to over 1650 if the mean age would rise to 60. The micro-simulation demonstrates that if the Academy seeks to cover more sub-disciplines than would currently appear possible, increasing the average age at election is an alternative to increasing statutory numbers. Doing both could, quite obviously, also provide a solution. The simulation also suggests that the current situation may not be as undesirable as is sometimes argued. It, finally, drives home, that some sort of stable situation becomes established fairly soon after keeping the rules governing the entrance of new members constant. In fact, Table 8 shows that continuation of the simulation for another 50 years, to the start of the next century, has negligible effects on average ages and numbers of retired members.

It should be understood that a micro-simulation as just presented is subject to random variation. If the exercise were to be done once again the results would be slightly different. However, if it were repeated 100 times or so, chance fluctuations would subside. The average outcome would become increasingly stable and closer to the 'true' values the alternative approaches would yield.

It should be emphasized that for the purposes of the simulation possible increases in statutory numbers of ordinary members have not been taken into account. One would, of course, have to do that in any exercise aimed at projecting the Academy population over a specific period of time.

9. By way of conclusion

1. Nearly 192 years have elapsed between the founding of the first predecessor of the Royal Academy by degree of May 4, 1808 and the beginning of the 21st century. Over that long period a grand total of 2619 scientists and scholars received the news that they had been elected to the membership of this learned society. Of these just about half (1313) were ordinary members, 525 can be classified as foreign members, and 781 as correspondents.
2. The average yearly number of persons elected has been very close to 11. Due to repeated increases in statutory numbers and a reduction in the age of compulsory retirement the distribution of the totals elected over time has been very uneven. In the last half century the numbers elected have exploded. The total number of appointees then amounted to 996; substantially larger than in the whole century before. At the same time the numbers elected tilted more heavily towards ordinary members. It would seem that the Academy has become more inward looking and has become less concerned with positioning itself internationally through the election of foreign members.
3. Upon election foreign members are on average older than ordinary members; correspondents invariably are younger. From the end of the 19th century to the 1970s the mean age at election of ordinary members rose by some 15 years to a peak of 57.7 years during 1965-1969. Foreign members commonly are around 60 years old when elected.
4. A learned society can not reasonably be expected to be a young organisation. With the passage of time the average ages of members have increased. This applies to those younger than the - by the standard of academies exceptionally young - retirement age of 65 established in 1977, as well as those aged 65 and older. Repeated efforts at rejuvenation notwithstanding, the average age of ordinary members younger than 65 now stands at 57 years. Retired ordinary members are on average 75 years old, a phenomenon that should be appreciated in the light of improved mortality conditions.
5. Over time the age of candidates appears to have become more of an issue than, as of late, their sex. Currently the dominant age group at election is 50-54 years.
6. The mean age at death of members whose death was reported in the late 1990s was about 82 and had been over 80 for some time. In their average age at death the different categories of members are drawing closer together.
7. The lowering of the age at compulsory retirement, obviously, had a profound influence on the average experience within the Academy of ordinary members present at the end of each year. The average duration of tenure as an active member has declined to 8 years, while the mean duration in retired membership has risen to 15. During several long periods in the Academy's history the average total duration of the period of tenure of active and retired ordinary members present at the end of any one year has been about 23 years, just as it is now.
8. At age 50 ordinary members of the Royal Academy now (1970-1999) have a life expectancy of 33.5 years. As such they can expect to live, on average, 6 to 8 years longer than men in the

population of the Netherlands as a whole. By all standards that difference is substantial. In all likelihood 'healthy selection' is involved.

9. The life expectancy at age 65 now is at roughly the same level as that of members at age 50 a century and a half ago. At the time of their compulsory retirement ordinary members can expect to live on average another 19.5 years
10. The life expectancy at age 50 of ordinary members, foreign members, and correspondents does not differ significantly. It is rather striking that during the 19th century academy members did not have a substantially higher life expectancy than the male population of the Netherlands. Presumably they were exposed to the same infectious diseases and living in urban areas still was unhealthy at the time.
11. The results of a micro-simulation on the basis of the analysis of the painstakingly collected data, have underscored that age at election is the most crucial element in determining the number of vacancies and, consequently, the number of new members that can be elected in any one period. If the mean age at election is 60, that is to say 5 years from the now compulsory retirement age, the number of new ordinary members that could be elected during 2000 to 2100 amounts to some 3300. If the average age at election is 40 that number drops to a little below 1000. Changes in life expectancy do not influence these figures substantially.
12. Clearly there is a trade off between the age at election, the number of vacancies, and the average tenure as active member newly elected ordinary members can expect to serve. The rule is simple: the higher the average age of members elected, the more can be selected, but the shorter the period they can function as an active member. Consequently, allowing each ordinary member to serve actively for a specific period of time, 10 years say, is a more equitable, and may, therefore, be a better solution than forcing everyone to take early retirement.
13. However, this aspect has not been researched and its drawbacks may be considerable. There would also be obvious advantages. By adjusting the duration one could determine the turnover time of the membership quite precisely. It would make those having served their term resemble 'senior active members' rather than 'retirees' and that would satisfactorily fit the demographically unavoidable tendency in society to remain on the labour force beyond the normal age of retirement. It would, further, prevent the accentuation of the differences between 'active' and 'retired' members currently observed. It would, finally, have the advantage of no longer making age such a predominant criterion in the selection process.

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Learned societies have a series of demographic concerns in common. These relate, for example, to the age of members at election, their longevity, and the ageing of the membership.

This Working Paper addresses a variety of such issues with regard to the Royal Netherlands Academy of Arts and Sciences (KNAW). It traces that Academy's demographic history over the period of more than 190 years that have elapsed since its establishment in 1808 and the end of the 20th century. During that period a grand total of 2619 scholars and scientists received the happy news that they had been elected to the Academy. Upon their election the foreign members were on average older than the ordinary members, while the correspondents invariably were the youngest group. The mean age at election of ordinary members rose to a peak of 57.7 years during 1965-1969. Now the dominant age group at election is 50-54. The mean age of members younger than 65 is 57 years, while those older than that official retirement age are on average 75 years old. The mean age at death of members whose death was reported in the late 1990s was about 82 years. At that time ordinary members of the Academy had a life expectancy at age 50 of 33.5 years. This implies that they could expect to live, on average, 6 to 8 years longer than men in the population of the Netherlands as a whole. Micro-simulation underscores that age at election is the most crucial element in determining the number of vacancies in the Academy and, consequently, the numbers of members who can be elected in any one period. Clearly there is a trade off between the mean age at election, the numbers that can be elected, and the mean age of the membership.

The Netherlands Interdisciplinary Demographic Institute (NIDI) is an institute for the scientific study of population. NIDI research aims to contribute to the description, analysis and explanation of demographic trends in the past, present and future, both on a national and an international scale. The determinants and social consequences of these trends are also studied.

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