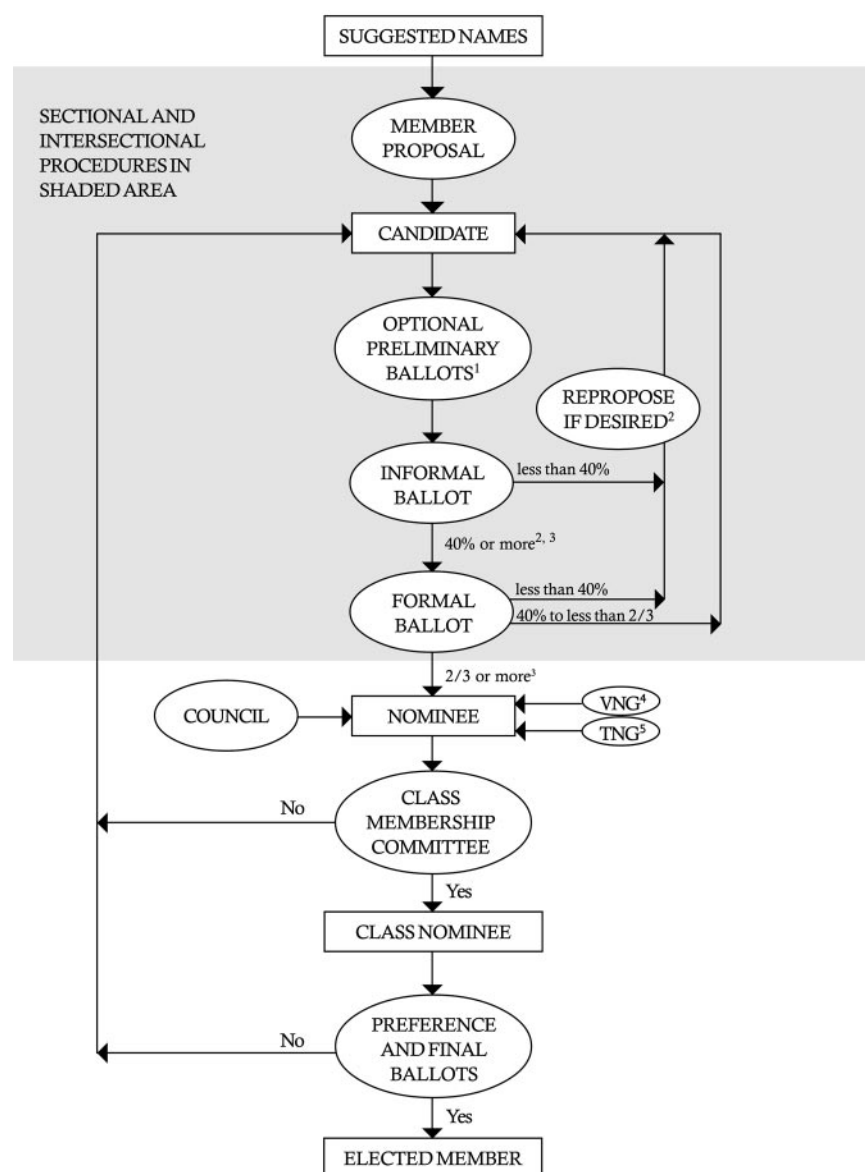


# Election to the National Academy of Sciences: Pathways to membership

Every spring, in late April or early May, the National Academy of Sciences (NAS) elects new members. Membership in the NAS is a widely recognized sign of excellence in scientific research, but most scientists are not familiar with the process by which members are elected. This lack of information is certainly not intentional; no one gains when the elections are shrouded in mystery. However, the election's successive ballots have become more complicated over time, in part reflecting the rapid expansion of scientific fields. The complexity reflects a consensus process designed to ensure that an individual, or small group of individuals, cannot have an undue influence on the election. In this editorial, we attempt to shed some light on this poorly understood process. In addition, we describe recent efforts to make it more welcoming, especially to women and to younger scientists.

Consideration of a candidate begins with his or her nomination. Although many names are suggested informally, a formal nomination can be submitted only by an Academy member. Each nomination includes a brief curriculum vitae plus a 250-word statement of the nominee's scientific accomplishments—the basis for election—and a list of not more than 12 publications. The latter limit helps to focus on the quality of a nominee's work, rather than the number of publications. Once a nomination has been prepared, it is sent to the chair of one of the Academy's 31 discipline-based Sections, e.g., chemistry, cellular and developmental biology, or mathematics (for a complete list, see [www.nas.edu/sections](http://www.nas.edu/sections)).

Each Section has its own procedures for identifying potential candidates and for winnowing the list through successive ballots of Section members. Some of these procedures are simple and straightforward; others are lengthy and complex, involving screening panels, caucus ballots, and other mechanisms. And variations occur when candidates are nominated by two (or more) Sections. But, as illustrated in Fig. 1, all Section procedures culminate in two mandatory ballots—named, for reasons lost in history, the “Informal” and “Formal” ballots. Successful candidates then go forward as nominees for consideration by increasingly broad segments of the membership, beginning with the



**Fig. 1.** Flow chart of the member nomination and election process. 1, Optional, as specified by Sectional procedures; 2, subject to modification by Sectional procedures; 3, an intersectional candidate must receive at least 25% on each Section's Informal Ballot to advance to Formal Ballot and at least 50% of total Formal Ballot vote to become a Nominee; 4, Voluntary Nominating Group (VNG); 5, Temporary Nominating Group (TNG), which conducts informal and formal ballots subject to the same rules as Sections.

six discipline-based Classes into which Sections are grouped.

Candidates can also be nominated by a group of members by petition (a Voluntary Nominating Group or VNG) or by a special group appointed by the NAS Council to search for candidates in a specific field or set of fields (a Temporary Nominating Group or TNG). In 2003, on the recommendation of the

ad hoc Committee on Nomination and Election in the 21st Century, the Council appointed six of these TNGs—one for each of the six Classes: Physical and Mathematical Sciences; Biological Sciences; Engineering and Applied Sciences; Biomedical Sciences; Behavioral and Social Sciences; and Applied Bio-

logical, Agricultural, and Environmental Sciences. These TNGs were charged with identifying and nominating younger candidates, both men and women; the work of the TNGs also has stimulated the nomination of women and younger members among the Sections.

The Academy's bylaws specify the maximum number of members who can be elected annually (currently 72), and each year the NAS Council determines the number of members that can be elected from each Class. In allocating these Class quotas, the Council takes into account the current size of the Academy and the areas in which it might grow.

In early February, six Class Membership Committees—each of which is composed of representatives of all Sections in that Class—meet to discuss the relative merits of all of the nominees who have survived voting in the Sections. As illustrated in Fig. 1, the nominees of VNGs and TNGs are also placed in the mix.

The end product from each Class Membership Committee is a rank-ordered list of nominees, composed of 150% of the total number of members that the Class is permitted to elect. Nominees who cannot be placed on the list because of this upper limit will be automatically considered again by the appropriate Section for the next year's election.

The rank-ordered lists of nominees for the six Classes comprise a "Preference Ballot," which is sent to all Academy members in early March, along with each nominee's biographical material and information about his or her standing on the Formal Ballot. Members are required to vote for a minimum number of candidates in all six Classes—not just their own—for their ballot to be

valid. The results are tabulated for presentation during the business session at the Academy's annual meeting in late April. Members attending the annual meeting vote on the "Final Ballot," which contains the names of the 72 nominees who received the highest number of votes on the preference ballot, up to the maximum number permitted in each Class. The remaining nominees appear on a second list and—like those not ranked by the membership committees earlier in the process—are automatically reconsidered the following year by their nominating sections.

Although the final list is voted on as a group, any member at the meeting may request that a name be removed for discussion and a subsequent separate vote. Such "challenges" are very rare.

The new members elected each year are introduced and welcomed to the Academy by their colleagues at the annual meeting the following April. For the past 2 years, newly elected members have been 56 years old, on average. A list of the members elected this year can be found in the supporting information, which is published on the PNAS web site.

One might ask whether the end result of this election process is worth the large amount of time and effort that is devoted to it. Why does it matter that the 2,000 members of the Academy are so carefully chosen? There are at least two answers to this important question. First, in principle, each member should serve as a role model for defining excellence in science for the next generation of scientists in his or her field. Second, it is this Academy—along with its sister organizations, the National Academy of Engineering and the Institute of Medicine—that supports the enormous public service efforts of the National Research

Council, our "operating arm." Known as the National Academies, this four-part organization is chartered to provide extensive policy advice to our national and state governments. The issues addressed cover a vast range—from stem cell research and the status of postdoctoral fellows and young investigators in the biological sciences to the dangers of arsenic in drinking water and of future climate change. By producing an average of more than one report every working day, the National Academies have greatly increased the wisdom of public policymaking.

Election to the NAS confers editorial responsibilities for this, the Academy's official journal, established in 1914 as a journal for members to publish their own important work and the work of others. In 1995, PNAS introduced direct manuscript submission, whereby any author—member or nonmember—can submit his or her work directly to the journal. All papers published in PNAS are evaluated and approved by an NAS member; the PNAS editorial office secures the appropriate editor for direct submissions.

To honor newly elected members, the journal publishes brief biographies that accompany a research report in the journal, thus providing examples of role models of excellence in science. The journal has an open archive policy, with all articles made freely available to everyone on the web 6 months after publication. The PNAS web site receives nearly 2 million hits per week and conveys groundbreaking research to the scientific community and the lay public.

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