

- a. He gave a good deal of nominal, but not much financial support, leading them to abandon the idea of a separate college, and instead institutionalize the discussion group -- a forum for the discussion of scientific problems of all sorts
- b. Meeting bi-weekly in London except during the summer, with a fully scheduled program for each meeting
- c. A list of the most scientifically prominent initial (1663) Fellows, including Huygens as the sole foreigner, and some of those they elected in the following years can be found in the Appendix
- 4. Published *Philosophical Transactions of the Royal Society* monthly, beginning in 1666, leading to rapid publication of papers and notes, thus disseminating the substance of the presentations and discussions at the meetings
 - a. Save for one brief hiatus at end of 1670s, continued publication down to today (see JSTOR)
 - b. By the mid-1660's over 150 Fellows, representing all those either actively involved in or interested in empirical research in England
 - c. Reaching across all of the sciences -- medicine as well as physics (the first blood transfusion, for example)
- 5. Henry Oldenburg, the Secretary of the Society from 1662 until his death in 1677, was exceptional in getting people to present their work and engage in critical discussion without long term animosity
 - a. Great openness of discussion as well as rapid dissemination and critical-response -- a tradition continued by Oldenburg's successor, Hooke, as best he could
 - b. Bi-weekly discussion and monthly publication could not help but have an enormous impact on the quality of empirical research and theoretical thinking going on in England, if only through the reduction in the time for ideas to become refined or discarded in favor of better ones
- D. The Royal Academy of the Sciences (1666)
 - 1. A tradition of regular meetings of discussion groups in Paris extended back into the 1630's, originally organized by Mersenne, but continued after his death in 1648 by Gassendi and Rohault
 - a. Gassendi the central figure until his death in 1655, after which Huygens was the primary star
 - b. Huygens initially presented his discoveries, e.g. regarding Saturn, to this group at its regular meetings
 - c. This group included some brilliant women (subsequently satirized by Molière)
 - 2. After the Royal Society was established in London, Louis XIV was successfully prevailed upon by Colbert to form the Académie Royale des Sciences in Paris in 1666
 - a. Unlike Charles, however, he supplied generous funding, allowing the Academy to become much more than a discussion group
 - b. Money to support individuals full time (16 academicians) as well as for superior equipment and for special projects and expeditions
 - c. Housed in the Royal Library

3. The Academy brought in the top people from throughout the Continent to join the French
 - a. Huygens accepted a charter appointment in 1666, and with it became the intellectual leader of the Academy, along with the physicist and astronomer Auzout, the outstanding French observational astronomer, Picard, and the experimentalist, Mariotte
 - b. Cassini joined in 1669, at Huygens's urging, and Roemer two years later, at Picard's urging
 - c. Like the Royal Society, not restricted to physics, though its greatest successes in the early years were in astronomy and experimental physics, with Mariotte the chief experimenter
4. In conjunction with the Academy, the Royal Observatory was established, in the garden of the Royal Library, in the late 1660's
 - a. Cassini became the Royal Astronomer in 1669 -- starting a family tradition of Cassini's as Royal Astronomers of France
 - b. He brought with him the finest Campani telescopes, giving the Academy the best equipment in the world -- e.g. a 17 ft and a 34 ft telescope with Campani lenses
 - c. In effect, the first fully functioning observatory since the death of Tycho, with a group of the very top people in observational astronomy working closely together -- Huygens, Picard, Cassini, Richer, Roemer, la Hire -- and discussing details with one another all the time
5. The *Journal des Sçavans* ended up providing the vehicle for rapid publication for those associated with the Academy in much the way that *Philosophical Transactions* did so for the Royal Society
 - a. Close communication between the leading Fellows of the latter and the Academicians, in part because Huygens was a member of both
 - b. Both journals read on both sides of the Channel, and the most important articles were often translated to appear in the other journal -- e.g. Cassini's second and third satellites of Saturn
 - c. {*Mémoires* started in 1690s}
6. Thus, in both England and France, science breaks off from the rest of philosophy with the emergence of professional organizations in the 1660's, out of the reach of university politics
 - a. Free to set their own standards, define their own problems, and isolate themselves from the sorts of concerns that Galileo's trial had given rise to
 - b. More important than even this, having two such organizations in supportive competition with one another, yet with open communication, produced an international scientific community
 - c. Not just the loosely connected community of a single academic discipline spread over many universities, in the manner of astronomy from well before Copernicus, but a tightly integrated community, with great communication and fast turn-around time on ideas and criticisms
 - d. Thus, sociologically as well as in content, science starting to look distinctly more like it is today
7. Until early in the 18th century, when the Basel school emerges, science largely a "tale of two cities"
 - a. Some drop-off in Italy when early death of Torricelli left the Galilean experimental institute weakened, not to mention effects of trial of Galileo and departure of Cassini to Paris

- b. In rest of Europe, scientists spread out among universities, working too much in isolation, versus what was happening in England and France
- E. New Standards in Experimentation: Hooke
 1. The Royal Society was outspokenly committed to the so-called "experimental philosophy" -- i.e. the idea that questions should be settled via experiment and observation
 - a. Two of the well-springs for the Society were the influence of Bacon's philosophy in certain circles and the (neo-Epicurean) corpuscularian school of the mechanical philosophy inherited from Gassendi, in part through the writings of Charleton, and pushed by Boyle
 - b. The distinction between theory and experiment was drawn sharply and, at times, the prevailing attitude seemed to be that virtually all new knowledge came out of experiments
 2. The only full-time employee of the Society was called the Curator of Experiments -- for forty years, Robert Hooke
 - a. His job was to further experimentation, by developing experiments, by reviewing and criticizing experiments being done by others in and outside the Society, and by developing equipment and techniques that could be used
 - b. In addition to being expected to report on experiments, he was obligated to have an experiment actually presented at each bi-weekly meeting, if need be by devising one himself
 3. This put Hooke in a pivotal spot in the development of science in England for the forty years from 1660 to 1700, involving him in a huge number of projects
 - a. Hooke is the second major figure in this course -- Kepler is the other -- who was not financially secure and hence had to survive off his scientific work
 - b. He is often referred to as a mechanical genius because of his great cleverness in designing experiments and equipment; yet he was also given to a good deal of theorizing, though his mathematical skills were not up to those of many of the others
 - c. Probably because of the incredible demands on his time, he often did not perfect experiments or equipment to the extent he might have, and when others did, leading to new results or advances, he tended to claim priority
 - d. Indeed, Hooke was constantly involved in priority disputes, perhaps in part because of his personality, but also because he really did have at least some early thoughts about virtually every major scientific discovery of the time
 4. At the time Hooke became most widely known from his *Micrographia* (1665), a compendium of observations made with the microscope, in which he added the word 'cell' to the lexicon of science (the microscope served him well in meeting his bi-weekly obligation -- see figures in Appendix)
 - a. But he also worked on the equipment used in Boyle's experiments in pneumatics, built a (not terribly successful) mural arc for Greenwich, and built one of the first reflecting telescopes, based on Newton's ideas, that was used in astronomical research