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) corpuscularean 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

b. And he devoted a great deal of effort to optics, in which he has claim to being a co-founder (with Huygens) of the (longitudinal) wave theory of light, among other things

5. The emphasis on experimentation, the bi-weekly experiments before an intensely critical audience, and Hooke's own genius in developing experiments raised the standards of experimentation in England to a much higher level, generating a series of experimental "paradigms"
   a. One example is the series of experiments on ballistic pendula performed in the late 1660's, using knowledge of pendular motion to investigate the effects of impact
   b. Experiments were criticized, refined, and once perfected then exploited, in other investigations
   c. The upshot was an experimental tradition that has ever since remained part of English science
6. {Mariotte and Huygens were similarly raising experimental standards in the Academy, though with less immediate dissemination}

F. Post-Cartesian Efforts in Celestial Physics

1. Whether because of Descartes' vortex theory or because the books by Streete, Wing, and Ward openly discussed celestial physics, serious interest in the physical mechanisms underlying celestial phenomena, especially planetary motion, developed again
   a. Streete suggests in passing that Moon held in orbit around Earth by quasi-magnetic gravity (see Appendix)
   b. After years of pushing Kepler's physics off to one side, and running only geometrical and phenomena-saving arguments, the idea that many questions were going to be settled only through an underlying physics finally took hold
   c. And, at least in England, this meant a physics solidly founded on experiments
2. Wilkins (1614-1672), one of the central figures in London in the years leading up to the Royal Society, had kept the tradition of the "magnetical philosophy" of Gilbert going in England
   a. Christopher Wren -- then a professor of astronomy -- and Hooke, both protegés of Wilkins at Gresham College in London, began looking at a 'magnetic' gravitation to account for planetary motion in the late 1650's
   b. Wren lectured on Keplerian astronomy in the late 1650's, expressing the view that "the perfection of ... the Elliptical Astronomy" was most worthy of inquiry
   c. (Wren’s shift to architecture occurred during the 1660s, following the London fire of 1666 and his winning the job of designing and building the new St. Paul’s)
3. Starting in early 1660's Hooke began trying experiments to reveal how gravity varies with radial distance from the center of the Earth, an issue that had become prominent in some circles years earlier
   a. Huygens had established that the acceleration of gravity could be measured via pendular motion to high accuracy by 1660
   b. Tales of reduced gravity in deep mine shafts led Hooke to use pendulums to measure the acceleration of gravity in mines