Lecture 28
Agriculture, Technology, and the Scientific Revolution

- Our existence as a civilization depends on a series of technologies that provides us with sustenance and surplus.
- The basic technology is associated with Agriculture which directs the flow of energy from the sun to the supper table.
- The origin of Agricultural Information derives from two traditions:
  - Empirical (trial and error)
  - Experimental

- Roots of Empiricism stem from efforts of Neolithic farmers, Hellenic roots diggers, medieval peasants, gardeners everywhere to obtain practical solutions to problems of crop and livestock production.
- Accumulated information on successes and failures passed orally from parent to child, artisan to apprentice and have become embedded in human consciousness via legend, craft secrets and folk wisdom.
- This information is now stored in tales, almanacs, herbals, and histories, and has become part of our common culture.

- In addition improved germplasm was selected and preserved via seed and graft, from harvest to harvest, and generation to generation.
- The sum total of these technologies makes up the traditional lore of agriculture and horticulture.
- It represents a monumental achievement of our forebears—largely unknown and unsung.

Neolithic Technology

- Enormous plant lore, familiar with literally hundreds of species.
- Knew how to clear vegetation with fire, sow seed, plant tubers, protect plants.
- Spun fibers, wove cloth, made string, cord, baskets, canoes, shields, spears, bows and arrows and a variety of household utensils.

- Painted pictures, carved masks, and ritual objects, recited poetry, played musical instruments, sang chants, performed dances and memorized legends
- Harvested grasses, threshed, winnowed, and ground seed into flour
- Dug roots and tubers
- Detoxified poisonous plants for food and extracted poison to stun fish or kill game
- Familiar with a number of drugs and medicinals
- Understood the life cycles of plants

Horticultural Achievements

- Basic propagation technology: seed handling, grafting, layerage, and cuttage.
- Planting and cultivation technology involving plowing, seed bed preparation, planting.
- Irrigation technology including water storage in dams and ponds, channeling of water above and below ground, water lifting technology including shaduf, Archimedes screw, sakieh (chain of pots).

- Basic technology of storing agricultural products: granaries, underground storage, cave storage
- Fertilization and crop rotations
- Selection and clonal propagation
- Basic development of food technology: fermentation (bread and wine), drying, pickling
- Beginnings of protected culture (*specularia*).
- Development of parks and gardens

Scientific Tradition

- Not as old as empirical techniques but also ancient
- Beginnings derived from systematic attempts to discover rational explanations for nature
- Science, derived from the Greek "to know," is in reality a method for accumulation of new information about our universe
  The driving imperative is the desire to understand
- *If necessity is the mother of invention, then curiosity is the mother of science*

Scientific Method

- Experimentation
- Systematic rationality
- Inductive reasoning
- Constant reformulation of hypothesis to incorporate new facts
- When new explanations of natural phenomena are accepted, they must be considered not as dogma but as tentative approaches to the truth and subject to change
- The process is cumulative and science is alive only when it grows
- When any society claims to know the complete truth such that further question is heresy, science dies

- Curiously, isolated pieces of information, even if of no immediate relevance or consequence, may have potential value
- Thus the recording of experiments to produce a growing body of knowledge, known as the scientific literature, is a prerequisite for the scientific process
- But the accumulation of information without experimentation leads to dry scholasticism
- The great advances in agriculture originally derived from the accumulation of empirical technology but now derive principally from scientific investigations
- In many cases it has been hard to separate the two approaches because they are now intertwined

Scientific Revolutions

- Dates back to antiquity with astronomy and mathematics
- Greek influence of rationality
- Systematic research is a consequence of the Renaissance
- Scientific societies, preservation of scientific literature
- Scientific revolution now has an enormous effect on agriculture