The Uneven Evolution of Human Know-how

Know-how

- The body of knowledge that at any time molds and supports the goal oriented practices used in a field as performed by those skilled in the art
- I will use the term “technologies” to denote those practices

Enormous Variation in Progress

- Information technologies vs housing design and construction
- Medical care vs education
- Infections diseases vs many cancers
- Managing inventories vs choosing and managing mergers
- Managing a computer system vs managing an economic system

Why the differences?

- Differences in the quantity and quality of the resources allocated to advancing know-how
- Progress is more difficult on some fronts than on others
  - Differences in the strength of underlying scientific knowledge
  - Differences in the availability of component artifacts and technologies
  - Differences in innate difficulties?

How does technology advance?

- An evolutionary process.
- Oriented by purpose, and focused and powered by understanding that in many arenas can be quite strong
- The important role of “off line” R and D
- But no substitute for learning in actual use
- A cumulative process involving many participants

What is needed for rapid advance?

- Ability to control prevailing practice and get effective reliable results. Ability to replicate if desired. Ability to get similar results in somewhat different contexts
  - Presence of a strong “core”
  - Effective “routines”
- Criteria for good and better performance must be clear and stable and relatively easy to assess
- Ability to learn from experience
- Ability to engage in and learn from controlled experiments
- Ability to learn from simple models, and through off line R and D

Role of a strong underlying science

- Identifies core
- Provides indicators of good and bad performance
- Enhances ability to learn from experience and to experiment fruitfully
- Ability to learn from models

Application oriented sciences

- Focused on practice, context, and problems
- Strong applied sciences often draw on more basic sciences. But they are sciences in their own right. Notion that they are “translational” fields misses point
- Their advance depends on ability to learn from experimenting with the technologies

Cases

- Effective paradigms with a shallow scientific base
  - Dealing with infectious diseases after Pasteur and Koch: vaccines

    Public health
  - Component technologies and LVAD
- “Technologies” with a weak core
  - Education

The general problem with important "social technologies"

- To perform effectively requires skill and dedication. And what is done and achieved will vary considerably from case to case. Maybe some opportunity for fruitful routinization and mechanization. But tight routinization often hinders good performance
- Overall progress will be quite limited. With significant progress elsewhere, costs will rise here

Current Challenges: technologies with a weak core

Medical care: dealing with ailments vs cost control

- Education: can do a lot better but limits on "progress" at frontier. Rising costs and frustration
- Better energy technologies, but problems in changing driving behaviors
- Managing the economy