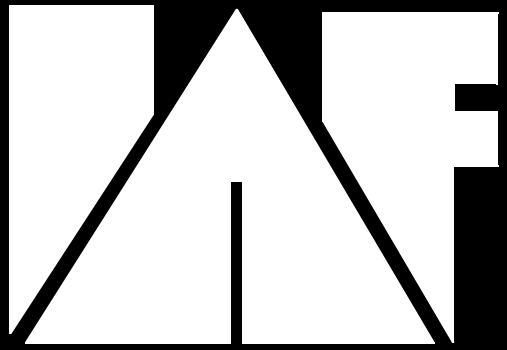


Institute for Alternative Futures

Internet & Genomics

Two Revolutions At The Crossroads:

Presentation to The eHealth Colloquium

by

Jonathan C. Peck

August 21, 2000

Overview

- Internet + Genomics = New Knowledge + New Economy + New Healthcare System
- Premise: Change in Future Means Forecasts Are Now More Valuable Than Descriptions of Current Reality

Optical Internet Coming

"Fiber optics is leaving Moore's Law in the dust…Now, the amount of information that can be transmitted over a strand of glass is doubling every nine to twelve months. Advances in fiber-optics stand to replace advances in chip speed as the new pace-setter in computing…. The pace of their innovation suggests an era of ever-cheaper pipelines for data, video programming and almost any other digital-information product…."

Wall Street Journal

HOW MANY PEOPLE WILL BE ONLINE IN THE YEAR 2005?

Who Will Be Online?

The Computer Industry Almanac estimated that at the end of 1998, about 52 percent of the world's 147.8 million regular Internet users lived in the U.S. But by the end of 2005, the Almanac predicts, the U.S. share of Internet users will have dropped to 29 percent. Much of that growth is likely to be concentrated in Europe and the Asia-Pacific region.

Who Will Be Online?

"The precise impact of the Internet is still hard to quantify. One reason is the sheer rate of growth: Every second, another seven people around the globe tap in for the first time."

The Washington Post

June 20, 1999

Scale of eEconomy

A comprehensive study showed that the Internet generated about $301 billion in U.S. revenue in 1998--closing in on the automobile industry. Annual growth between 1995-1998 was 174 percent.

Internet's E-economy Gets Real

The Washington Post, June 20, 1999

Scope of eEconomy

“Coming online soon are easy to use electronic wallets that will send intelligent agents out on the Net to find the lowest prices or even facilitate auctions in which merchants will bid to be the lowest-cost supplier for the products a consumer wants.” –

The Wall Street Journal Reports,July 12, 1999.

New Rules for eEconomy

- **Moore's Law** (Gordon Moore)
  Processor power doubles every 18 Months for decades

- **Metcalfe's Law** (Bob Metcalf)
  The value of a network is proportional to the square of its number of users

- **Coase's Corollary** (Ronald Coase)
  Companies can do away with $4.5 trillion of transaction costs by handling info better

eEconomy Pharma Strategies

- Products to Knowledge
  - Evolve from Pharma to Health Co's
- Form Global Networks
  - Bet on Disintermediataries
  - Lead in Health Creation

E-Pharma Marketing

"The e-environment will revolutionize the market intelligence process by providing the means with which to "talk" and interact with consumers directly. It will enable a company to establish a one-to-one and two-way dialogue with individual patient-consumers and thus know more about its end users than it has ever known before."

Pharma 2005—Marketing to the Individual
PricewaterhouseCoopers

E-health Forecast

E-health will emerge first as an important peripheral development for health care and e-commerce over the next 5 years. By 2005 pilot projects which offer broadband into homes will have shown that e-health provides high value and generates revenue. Clinical trials will generate revenue through reduced costs, increased speed and better quality results. Data from monitoring devices will be a key component of home-based clinical trials.

E-Health

Venture capitalists pumped $728 million into e-health startups in 1999, and the combined market capitalization of all public e-health companies, most of them created in just the two years, is now $30 billion. Estimates show business-to-consumer ecommerce could grow from $400 million today to $2 billion by 2003, and that business-to-business ecommerce would leap from $1.5 billion to $44 billion in the same time frame.

Impacts on Health Care

- Smart Homes, Agents & Markets
- Direct-to-Consumer Changes to Permission Marketing
- Pharmaceutical Research Gets Driven By Consumers

Home Health Technologies

- **"Magic Medicine Cabinet"**
  - smart labels, face recognition, health monitoring devices, flat panel displays and the web
- "Health Buddy"
  - 1,000 Patients Nationwide Monitored by Doctors Via Web

What Will They Do Online?

"Americans are consuming medical information as if it were candy….the Medline Web site now receives 1 million visits a day….consumers 'are really drilling down into clinical articles that, three years ago, only a physician would have read."

N.Y. Times (1999)

Networked Patient Power

"Community people now sit on scientific core committees…. I host 50 interactive Internet discussions. I conduct 'N=1 experiments' and share the results with others doing the same. The discussions are all monitored by pharma companies."

AIDS Activist

Do Genomics Online?

THE WALL STREET JOURNAL.

FRIDAY, APRIL 16,

MARKETPLACE

Online: *AOL to unveil a screen phone for e-mail, Web access* Pa

Health: *Two studies on cancer could confuse chemotherapy patients* Pa

SCIENCE

New Era of Personalized Medicine

Targeting Drugs For Each Unique Genetic Profile

By Robert Langreth And Michael Waldholz
Staff Reporters of The Wall Street Journal

THE PHARMACEUTICAL industry makes billions of dollars a year selling one-size-fits-all medicines. But now the race is on to come up with tailor-made drugs that will treat people based on their individual genetic makeup.

Drug companies hope to create a map of genetic landmarks that will become a potent new tool for uncovering the minute inborn differences that make some individuals particularly susceptible to certain diseases. With that knowledge, the drug makers hope to develop safer, more potent drugs that can more precisely target the variety of biological quirks that underlie each major disease. Their goal: a cornucopia of personalized medicines that will produce huge profits into the next century.

DNA, which carries the instructions that allow cells to make proteins, is found in the chromosomes located in the nucleus of a cell.

in prostate cancer. But so far the company has declined to identify the genes so that other cancer researchers can begin working to understand the genes' role and develop treatments.

The mapping project is separate from the Human Genome Project sponsored by the federal government that expects to produce a complete sequence of the entire three billion subunits, or nucleotide letters, that constitute human DNA. But the sequencing project and the new mapping plan are expected to make it possible for both groups to complete their tasks more quickly.

The map will be made up of so-called SNPs (pronounced "snips"), which are minute genetic alterations sprinkled in millions of locations across human DNA. Essentially, they are places in the genetic code where DNA differs from one person to the next by a single letter. Scientists now believe these SNPs, short for single nucleotide polymorphisms, are the ever-so-slight genetic variations between human beings that predispose some people to disease and explain why some respond better to certain drugs. The new project will draw up a map of at least 150,000 SNPs distributed evenly throughout the DNA, much like mile markers along a long

LAW

Intel's Bold S
To Thwart F
In Patent Ca

By Dean Takahashi
Staff Reporter of The Wall Street

Intel Corp. has used many
protect its patents. But the chip
cently countered a rival patent cl
maneuver unusual enough to
Texas bankruptcy judge and surp
experts in legal ethics.

The giant semiconductor
cretly used a shell company in the
Islands to argue on its behalf in t
bankruptcy case of Internatio
Systems Inc., a tiny El Segund
computer-chip-design company,
the Chapter 11 proceedings,
way in Austin, the Cayman comp
bought IMS's sole last year of a p
Northbrook, Ill., law firm cal
Search LLC. The law firm is
patent as the basis of a separate
fringement suit against Intel, now
in federal court in San Francisco.

Initially, Intel didn't disclos
volvement in International Met
ruptcy case. But after it admitte
ership of the Cayman company
Judge Frank R. Monroe, who is
the proceedings, concluded that
the Cayman company had portray
selves as trying to help the bankru
when they were in fact really ou

Genomic Forecast

In 1 to 5 years clinical studies will use genetic information that will help pharma companies make clearer and faster clinical decisions based on genetically stratified populations.

(1998 Survey by Michael Silber, Ph.D.)

“The ability to see a single genetic error in a set is going to be helped as we get to compare 20-year olds and 60-year olds. This will help us predict changes in the health of populations and lead to a very big preventive market.”

Professor Mark Richmond

University College

Genomics Forecast

- MHSS 2020 Focused Study on Biotechnology & Nanotechnology

Forecast 3:

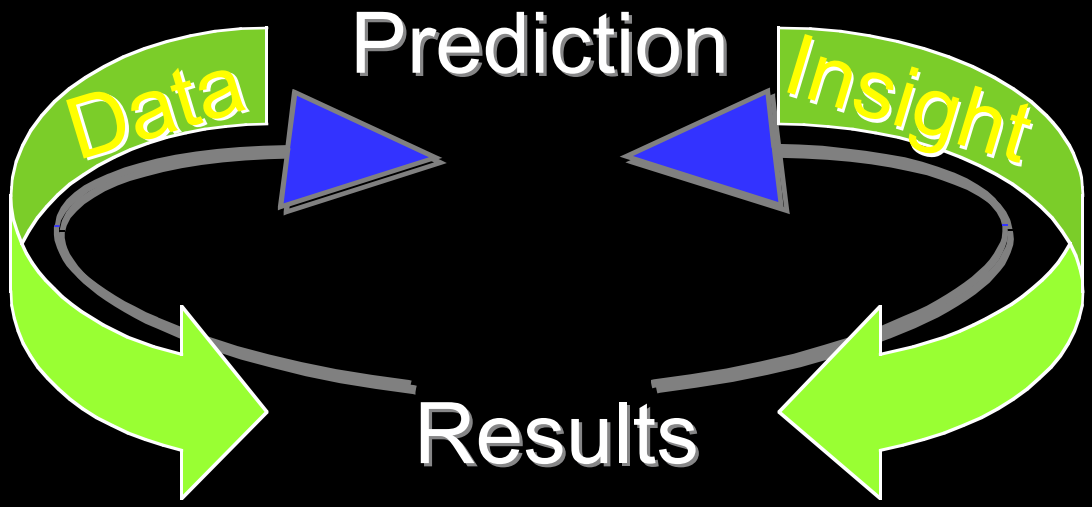
Gene chips for analyzing the distinctive pattern of genes active in different diseases will sweep aside traditional disease categories

Bioinformatics Forecast

Virtual organs will provide “in-silico” models that embed our understanding of human physiology that can be used to test new medicines…. In the 2020s individuals may have personalized virtual selves with their organs modeled for continuous updating and testing.

Computer Simulations

New Paradigm for Human Clinical Trials



Simulations Will Mean...

- Genomics + Computers = Fast Growing Need For Patient Data
- New Frontiers Open For Pharma
  - Chronopharmacology
  - Diagnostics & Monitoring
- Need For Speed + Endurance

MEMS Forecast

MEMS “are going to be everywhere” … MEMS are enablers. They’ll be all over, like plastic…having an impact on society to rival that of integrated circuits…. The ideas pipeline is surging, with an estimated 10,000 scientists and engineers working on MEMS devices to see, hear, feel and taste as well as transmit observations. *(Science, 10/16/98)*

Next Generation Technologies

- Laboratories on chips
- Data storage technologies
- Cell manipulating tools
- Propulsion for microsatellites
- Smart dust

Conclusion

The Coming Technological Revolutions Mean Forecasts Are More Valuable Than Experience. The Most Valuable Forecasts Are Visions Describing What We Want Our Technology To Do For Us.

No modern nation has enough money to pay for the amount of disease it is generating!

Our medical care system attempts to intervene too far downstream to be effective.

Rather than trying to treat all of our diseases, we should attempt to design them out of our population.

Eliminate poverty
Change to healthy lifestyles
Engineer genetic disease out of human gene pool

Leland Kaiser

Conclusion

The 21st Century Offers Potential To Be The Healthiest Century In Human History If We Use Technology and Knowledge Wisely.