Humanizing not Mechanizing

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www.fhti.org
“By analogy to the successful effort to put man on the moon, we should aim at chromallocyte landing on the liver by 2039 which would commemorate 70th anniversary of man landing on the Moon. We should have a dream with a deadline of 2039.”

Future of Health Technology: Humanizing not Mechanizing

**INSPIRATION**
- Inspiration from space to achieve impossible for the “benefit of the mankind”:
  - Fight for Chromalloye and Space Elevator

**INCUBATION**
- Importance of setting goals
- Strategy equations and mega-trends
- Public-Private Health Revolution:
  - Empowering consumers and especially women
  - Examples: sociometers, $2 eye exam, 100-fold cost reduction in Malaria /HIV testing, caring agents; autonomous learning robots; cellular-camera; mosquitoes fighting malaria
- Electricity generation through ...dancing

**INSIGHT - WHA resolution 60.29**
- Improved access, quality and use of medical devices
From Space Elevator to Cancer Treatment

- Carbon Nanotubes have been classified by FDA as medical devices
- Soluble in water
- Thermal conductivity linear with concentration and temperature
- Can be targeted towards specific cancers

- Cancer therapeutics – market worth $35B in 2003 and projected to be $60B in 2010 (Pharmaceutical Business Review)
Future of Health Technology Institute since 1996
Brings Together Creative Minds for Annual
Future of Health Technology Summit™ to:

- Stop disease before it even begins
- Stop suffering before tears occur
- Stop symptoms before they hurt
- Stop medical errors and aging before they kill
- Stop Cyborgs before….they control us…. 

Future of Health Technology Institute tries to achieve this by:

- Addressing health crisis as an international emergency
- Thinking about long-term global future on an on-going bases
- Giving power to the consumer
- Managing randomness in technology creation & adoption process
- Designing healthcare with caring machines

Third nanotech-made diamond eye to see the future, wings to be inspired...

Reduce suffering, save lives, extend human potential with technology
Future = CONVERGENCE
Life Science + Computer Science
Medical Devices + Communications Technologies/IT

IT + MD + Medicine = ITicine
Power to the Consumer

Mathematics
Mechanical Engineering
Material Science
Electrical Engineering
Chemistry
Biology
Computer Science
Physics
Genomics
Proteomics
Nanotechnology
Genetic Engineering
Architecture
The following 32 diseases related to genes on chromosome 11:
- autism (neurexin 1) [1]
- aniridia
- acute intermittent porphyria
- ataxia-telangiectasia
- beta-ketothiolase deficiency
- beta thalassemia
- bladder cancer
- breast cancer
- carnitine palmitoyltransferase I deficiency
- Charcot-Marie-Tooth disease
- Charcot-Marie-Tooth disease, type 4
- Denys-Drash syndrome
- familial Mediterranean fever
- Hereditary angioedema [2]
- Jacobsen syndrome
- Jervell and Lange-Nielsen syndrome
- Meckel syndrome
- methemoglobinemia, beta-globin type
- multiple endocrine neoplasia type 1
- Hereditary Multiple Exostoses
- Niemann-Pick disease
- nonsyndromic deafness
- nonsyndromic deafness, autosomal dominant
- nonsyndromic deafness, autosomal recessive
- porphyria
- Romano-Ward syndrome
- sickle cell anemia
- Smith-Lemli-Opitz syndrome
- tetrahydrobiopterin deficiency
- Usher syndrome
- Usher syndrome type I
- WAGR syndrome

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Smart computers

$1,000 OF COMPUTING BUYS

© 1999, R. Kurzweil, The Age of Spiritual Machine

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Future of Health Technology- Move to Wellness Model
Power to the consumer: Personal HIS

Track the social signals exchanged in telephone conversations – Attitudes, Interest, Distress

Shared decision making

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Crowd Farms would make use of the endless human movements harnessing this power source to create electricity

“The Land of Giants”

“idea from an ingenious little device by Thomas Edison. When visitors came to his house, they passed through a turnstile that pumped water into his holding tank.”

“MIT student T. Jusczyk’s stool exploits the passive act of sitting to generate power. The weight of the body on the seat causes a flywheel to spin, which powers a dynamo that, in turn, lights four LEDs”
$2 Health Technology to Save your Sight
153 million do not know they need glasses – 87% of them in developing countries

2 billion people have refractive errors

Research by Vitor Pamplona, Ankit Mohan, Manuel Oliveira, Ramesh Raskar

Paper Accepted for ACM SIGGRAPH 2010
Lab on the cell phone: 100 times reduction in cost of Malaria and HIV testing

CD4-count machines, which determine the suitability of HIV-positive patients for antiretroviral treatment, cost too much around $20,000.

**LUCAS:** Lens-less, ultra-wide-field cell-monitoring array platform based on shadow imaging - UCLA professor Aydogan Ozcan.

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Smart Relational Agents Technology

© 2010, Northwestern University, Relational Agents Group, Professor Tim Bickmore

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Intelligent Caring Agents – empowering women

Personal HIS
Personal Status Monitoring
AI/NLP
Access to Global DBs
Robotic and nano-surgery: towards autonomous medical devices


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- 20 times tougher than steel
- 17 times as tough as bullet-proof vest
- 4 times tougher than spider silk

Portable Light Project, a non-profit global initiative to develop portable energy harvesting technology in a textile form that can be adapted by local people.
Depression meter
By 2020 depression will be the highest ranking cause of disease.
Goal: ongoing monitoring of mental health status
Revolution in Public Health
“Using Reality Mining to Improve Public Health and Medicine”
by Alex Pentland …
in Strategy for the Future of Health, R. Bushko IOS 2009

Instead of this:

You can use this:

So: we can `x-ray’ entire organizations and regions with Reality Mining

Massive behavioral real-time monitoring – mobility, speech patterns, socialization patterns – diagnostic of depression, diabetes…immediate action possible
Mosquitoes totally resistant to malaria – new way to fight the disease...

Scientists created a gene that kills the disease inside the mosquitoes themselves. DNA injected to mosquito eggs. According to Michael Riehle from University of Arizona US, genes kill 100 percent of the malaria inside the engineered mosquitoes.

At the dawn of the 21st century, malaria kills at least 1 million people a year while roughly 2 million children die from diarrheal diseases annually.
Massive low-cost Immuno-signaturing
Neal Woodbury
ASU

Porous silicon sensors which color changes as a function of what's in the pores - a molecule from a disease-causing organism. Can be incorporated into bandages

New type of silicon sensor able to detect *single viruses* - only 4/1000ths of a millimeter across

© 2010 Benjamin Miller
The way forward to ensure improved access, quality and use of medical devices (WHA resolution 60.29):

**Form nonprofit medical device companies** just like Dr. Hale’s nonprofit pharma company, to work on most pressing problems not addressed by established industry and involve local communities – create jobs.

After five years, Hale’s company will bring to market its first affordable drug: a cure for *Kala Azar*, a parasitic disease that kills two hundred thousand people a year; **Next goal: secretory diarrhea**, a deadly disease that kills more than 1.6 million children in the developing world each year is the

**Massive hiring of mathematicians** to work on complexity and reliability theory and implementation both in current manufacturing process and in the use of devices in medicine.

**Massive consumer education campaign in use of PERSONAL Medical devices** to prepare for SELF-CARE era.
Digital Medical Training and Clinical Trials with Quantum Computers

Actual

Simulation

© Peter Haddawy
Nano-sensing: Diamond cellular-camera  
Professor Ron Walsworth – Harvard University Department of Physics

Scanning the magnetic activity of billions of individual nuclei.

The new diamond-based magnetic sensor could enable novel forms of imaging, marrying NMR’s noninvasive nature with atomic-scale spatial resolution.

© Marco/Harvard, diamond from Apollo Diamond, Cooperative work between Harvard and Apollo Diamond.
Evidence from several countries shows that tremendous improvement in healthcare outcomes at costs dramatically less than US or similar healthcare systems is achievable by proactively delivering healthcare through a system of young women who visit every family in the country several times per year. Such young women in desperate need of jobs already can collect health information, deliver context-dependent advice, and perhaps most importantly serve as front-line triage for the rest of the healthcare system. The successes demonstrated by such `three tier' systems - proactive home visit, health clinic, and hospital - can be further augmented by using the world's first ubiquitous sensor technology: cell phones.

Today's phones track mobility, speech patterns, and socialization patterns - information proven to be diagnostic of many of the world's most important diseases of (diabetes, depression, etc)...and collect images suitable for telemedicine. By managing and analyzing the information collected by these ubiquitous sensors - a process called `reality mining'- we can dramatically improve disease detection and track treatment efficacy.” Professor Alex (Sandy) Pentland

That process is also called personal health informatics, self-analytics, or self-monitoring. Some consumers will be able to do reality mining themselves while others will subscribe to RM services and will relay on caring machines and automated triggers.

Self-reflection may also lead to more self-realization and increased sense of purpose that will significantly decrease depression rates due to overwhelming feeling of insignificance. Caring for each other in a new way may give jobs and sense of purpose to millions.
Dream with a Deadline: Broad use of Chromallocytes on 100th Anniversary of Man Landing on the Moon in 2069

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<thead>
<tr>
<th>Year</th>
<th>Event</th>
<th>Description</th>
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<tbody>
<tr>
<td>2003</td>
<td>50th anniversary of DNA discovery</td>
<td>First mechanosynthesis – key manufacturing technology to build chromallocyte [8]</td>
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<td>2009</td>
<td>40th Anniversary of Man landing on the Moon</td>
<td>Nanofactory Collaboration active: coordinate a combine experimental and theoretical R&amp;D program to design and construct the first working diamondoid nanofactory [10]</td>
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<tr>
<td>2019</td>
<td>50th Anniversary of Man landing on the Moon</td>
<td>Demonstrating diamond mechanosynthesis in practice</td>
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<td>2022</td>
<td></td>
<td>Building Nanofactory</td>
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<tr>
<td>2027</td>
<td></td>
<td>Building Prototypes of simple nanorobots (eg. Respirocyte)</td>
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<tr>
<td>2029</td>
<td>60th Anniversary of Man landing on the Moon</td>
<td>Manufacturing of diamondoid medical nanorobots for life extension</td>
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<tr>
<td>2039</td>
<td>70th Anniversary of Man landing on the Moon</td>
<td>Building chromallocyte (extremely sophisticated and complex nanorobot) and landing on a human liver – First in vivo liver chromosome replacement.</td>
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<tr>
<td>2069</td>
<td>100th Anniversary of Man landing on the Moon</td>
<td>Broad use of chromallocytes: Our biological age restored once a year to a more or less constant physiological age that we select.</td>
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