Nanotechnology and the Developing World

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Greatest ethical challenge of our time
United Nations
Millennium Development Goals

- Eradicate extreme poverty and hunger
- Achieve universal primary education
- Promote gender equality and empower women
- Reduce child mortality
- Improve maternal health
- Combat HIV / AIDS, malaria, and other diseases
- Ensure environmental sustainability
- Develop a global partnership for development
The Millennium Development Goals cannot be achieved without a focused policy for science, technology and innovation.
Which nanotechnologies are most likely to benefit people in developing countries?
63 panelists in 26 countries

- United States
- Mexico
- Cuba
- Canada
- United Kingdom
- Ireland
- Germany
- France
- Spain
- Italy
- Greece
- Israel
- India
- China
- Japan
- South Korea
- Philippines
- Thailand
- Vietnam
- Turkey
- Switzerland
- Brazil
- Argentina
- South Africa
- Chile
- New Zealand

♀ 13 ♂ 50
Top 10 nanotechnologies for the developing world

1. Energy storage, production and conversion
2. Agricultural productivity enhancement
3. Water treatment and remediation
4. Disease diagnosis and screening
5. Drug delivery systems
6. Food processing and storage
7. Air pollution remediation
8. Construction
9. Health monitoring
10. Vector and pest detection and control

UHN MCMM at University of Toronto
Top 10 nanotechnologies vs. Millennium Development Goals

1. Eradicate extreme poverty and hunger
2. Reduce child mortality
3. Improve maternal health
4. Combat HIV / AIDS, malaria, and other diseases
5. Ensure environmental sustainability

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Eradicate extreme poverty and hunger
Reduce child mortality
Improve maternal health
Combat HIV / AIDS, malaria, and other diseases
Ensure environmental sustainability
Quantum dots

Dendrimers

Lab on a chip

Buckyballs
Quantum dots for malaria
Decreasing infrastructure requirement of malaria diagnostic tests saves most lives

<table>
<thead>
<tr>
<th>Test</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
<th>Adjusted lives saved SD</th>
<th>Malaria-related deaths averted SD</th>
<th>Unnecessary treatments averted SD</th>
<th>Total possible adjusted lives saved (%)</th>
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<tbody>
<tr>
<td>Moderate infrastructure&lt;sup&gt;1&lt;/sup&gt;</td>
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<td>95</td>
<td>635,993 (177,657)</td>
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<td>720,178 (164,731)</td>
<td>61,453 (19,528)</td>
<td>153,500,465 (9,157,093)</td>
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<tr>
<td>Minimal infrastructure&lt;sup&gt;1&lt;/sup&gt;</td>
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<td>80</td>
<td>1,125,343 (398,332)</td>
<td>-260,221 (71,781)</td>
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<td>1,329,135 (454,830)</td>
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<td>1,574,136 (199,153)</td>
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<td>1,431,031 (402,001)</td>
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<td>1,798,532 (557,684)</td>
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<td>1,859,670 (393,626)</td>
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<td>2,022,028 (288,721)</td>
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<td>427,162,689 (29,167,835)</td>
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<td>No infrastructure&lt;sup&gt;5&lt;/sup&gt;</td>
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<td>1,599,205 (429,882)</td>
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<td>364,781,060 (17,713,071)</td>
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<td>2,326,667 (421,037)</td>
<td>479,917 (106,694)</td>
<td>446,661,090 (30,130,053)</td>
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<td>2,488,490 (627,778)</td>
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<td>95</td>
<td>2,569,253 (584,295)</td>
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<td>487,901,105 (41,085,524)</td>
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<td>2,784,919 (432,004)</td>
<td>642,088 (96,921)</td>
<td>528,941,121 (18,279,201)</td>
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Domestic innovation needed in developing world

- Strong and sustained political will
- Individual leadership
- Close linkages, active knowledge flow
- Focused efforts in niche areas
- Temporarily permissive IP environment for initial capacity building
- Private sector development
Examples of nanotechnology innovation in the developing world

- Nanodiagnostic systems for HIV, H-B, syphilis, pregnancy (Nano Biotech Ltd.)
- Nano drug delivery systems for cancer and for local delivery to eye and skin (CISR, U. Delhi, Dabur Research Foundation, Panacea Biotec)

Polymer nanocomposites for controlled drug release, nanoscaffolds, and dental materials

- Nanomagnets as drug transporters
- Carbon nanotubes for implants, prostheses, and biosensors

Thank You

Dr. Fabio Salamanca-Buentello

Additional funding partners listed at www.geneticsethics.net