GREEN NANOTECHNOLOGY IN DUAL MEDICAL and NATIONAL DEFENSE APPLICATIONS
Global Perspectives On Formal Training and Education

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Globally Recognized Efforts In Nanomedicine

- Chancellor Brady Deaton (2008)
- Raghuraman Kannan
- Kattesh V. Katti
- Handy Williamson
- Ann Deaton
- Kavita Katti

- Dean Robert Churchill (2010)
- Kattesh V. Katti
- Raghuraman Kannan
- Robert Duncan (May 2011)
- Annette Sobel (May 2011)

Signed MOU’s with five academic and two industrial corporations

- Research
- Education
- Product Development
Formal Training On The Scientific and Technological Aspects of Gold/Silver Nanoparticles

- Development of Antibacterial and Antimicrobial Agents
- Catalysis in Hydrogen Production for an Alternative Energy Source
- Sensors in Defense Applications
- Sensors in Automotive Industry
- Cancer Imaging & Therapy
- Drug Delivery
- Immunodiagnostics
- Gene delivery & Antisense therapy
Green Nanotechnology: In Medicine and Stealth Sensor Design

Technology Development

Graduate and Undergraduate Level Courses

Defense

Medical
Training in Biomedical and Global Defense ↔ Nanotechnology

- Medicine
- Green Nanotechnology
- Environmental Restoration
- Alternative Energy
- Agriculture Productivity
Nontoxic Nanotech Uses Cinnamon

By Alyssa Dangelsi | Thu Dec 2, 2010 05:09 PM ET

A dash of spice makes everything nice, including nanotechnology. Scientists at the University of Missouri have a way to make gold nanoparticles using cinnamon instead of toxic chemicals.

Nanotech has all kinds of potential, including as a tool to fight cancer. Small particles -- ones that are much, much smaller than a human cell -- can do what chemicals can't. Gold, in combination with active chemicals, turns out to be ideal for targeted cancer treatment and detection. The problem is that making gold nanoparticles involves toxic chemicals.

A University of Missouri team led by radiology and physics professor Krittesh Katti developed a greener alternative. The researchers took cinnamon, mixed it with gold salts in water and successfully produced gold nanoparticles. Sounds kind of like alchemy at first glance, but the scientists found that cinnamon and other kinds of plants contain naturally occurring chemical compounds called phytochemicals.
Green Nanoparticles in Civilian and Defense Use

- **Telecommunications**
- **Automotive Industry**
- **Medicines**

Gold Salts in water

Phytochemicals

Green Nanoparticles

Phytochemicals in Tea, Soy, Cinnamon...
MU’s Nanodrug from Tea
EGCG-AuNPs Cellular Internalization

PC-3 Cells with EGCG-AuNP (T24h)

EGCG-AuNPs in PC-3 cells: Photo acoustic studies

Experimental setup
EGCG-AuNPs Treated PC-3 cells: Photo acoustic profile

10 Au tagged PC-3 cells in 5 ml PB

Time (μs)

Volts

5:24min

6:00min
Targeting receptors... one example

High Affinity towards prostate tumor receptors

Bombesin (BBN)

Tumor overexpressed with GRP receptors


Targeted Nanoparticle

Cancer cell

GRP Receptor binding region

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NBI-MU’s STEALTH NANOTECHNOLOGICAL PROCESSES FOR DEFENSE APPLICATIONS

- Nanolithography that avoids enemy detection
- Nanoimprinting under stealth conditions
- Nanoconstruct synthesis leaves no chemical/detectable trail after assembly
- Ideal for Sensor and Weapons assembly and Tracking under 100% ‘Stealth’ conditions
- Education and Formal Training
MU and NBIs Antibacterial Nanoconstructs In Defense Applications

- Non toxic nanoconstructs are effective in 100% destruction of S. epidermis, E. coli, S. aureus, C. albicans and various gram + and gram – bacteria
- Non toxic antibacterial/antimicrobial liquids available in bulk for defense deployment/applications
- NEW!!! NBI’s Nanoconstruct product is effective in complete destruction of toxins used in biological warfare (details available in confidential discussions with NBI personnel)
Circulating Tumor Cells

Early Tumor Cells

Via Lymph node

Via Blood

Lymph Node Metastasis

Distant Metastasis
Normal cell Vs Tumor cell

RECEPTOR: 1
GASTRIN RELEASING RECEPTOR
RECEPTORS: 200,000

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Pancreas express GRP receptors

Katti et al PNAS 2010 ; Nano Letters 2010
Targeting receptors... one example

TUMOR BEARING MICE

AUnPBBN-3

% ID/g

100

80

60

40

20

0

Organ

Pancreas

Tumor

Liver

Spleen

Kidney

Nanoparticle Biochem, Inc.

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Targeting receptors...one example

TUMOR BEARING MICE

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