Global Health Initiatives at NCSU

Marian McCord
Director of Global Health Initiatives
January 2012
Prevent
• Mosquito nets
• Barrier
• Antimicrobial
• Radiation

Heal
• Wound care
• Drug delivery
• Tissue scaffolding
• Suture
• Implant

Enhance
• Comfort
• Aesthetics
• Functionality
• Fit
• Cost
• Hygiene

Protect
• Chem/Bio
• Thermal
• Ballistic
• Cut-resistance
• Packaging (food, instrument)

TEXTILES FOR HEALTH AND WELL-BEING (THWB)
Marian G. McCord
Associate Professor, Textile Eng. and Biomedical Eng.
Director, Global Health Initiatives, NCSU
Co-director, Atmospheric Plasma Lab
Ph.D., Textiles and Polymer Science, Clemson University
M.S., Bioengineering, Clemson University
Sc.B., Biomedical Engineering, Brown University

Research Areas:
Atmospheric Plasma Modification of Textiles, Polymers, Paper, and Medical Devices
Biocidal and Insecticidal Textiles
Hemostatic Textiles and Biomaterials
Plasma and Nanofibers
Global Health

Plasma Surface Modification
Develop, characterize, and model atmospheric plasma surface modification techniques

- Enhance biocompatibility
- Create controlled release surface
- Change degradation rate/mechanism
- Sterilize surface
- Template surface for selective cell adhesion
- Graft polymer
- Reduce surface wear

Hemostatic, Antimicrobial Textiles and Biomaterials
Develop bioactive textiles and devices

Above: Blood cells on hemostatic textiles.
McCord, Fischer

Left: Antimicrobial Chitosan Grafted to Cellulose
McCord, Bourham
Insecticidal Textiles
Create safe and effective next generation textiles and bednets that prevent the spread of vector-borne diseases including Malaria

Hybrid Materials and Processes
Use atmospheric plasma to enhance the properties of electrospun materials, and develop new hybrid systems

- Determine Mechanisms for Disabling Mosquito
- Create Bite-Proof Textiles
- Add Insecticidal Features (Abrasion, Dessication, Trapping)
- Create Safe, Effective, Affordable Bednets

McCord, Roe (Entomology)

As nanofiber layer thickness increases, filtration efficiency increases, up to 0.3 mg/cm²

McCord, Bourham, Zhang
Social Entrepreneurship – Sustainable Health Enterprises (SHE)

SHE uses market-based approaches to solve social problems. SHE is addressing females’ lack of access to affordable, quality, eco-friendly, sanitary products and services for menstruation.

Medical Devices – Katharos, Inc.

Dedicated to the design, development, and licensing of patented technologies for chronic kidney disease.

- 2 Million Global Patients 2008
  - US: >320,000 patients
  - Top 4 Foreign Countries: 640,000
- Hemodialysis growth rate 3.7% to 8%/year
- 4 Million Global Patients 2025
- >320 Million Devices Per Year 2025
- 80% of these patients have hyperphosphatemia and half of those are not controlled by current therapies
  - Dialysis
  - Phosphate Binders
- Katharos, Inc. is developing a proprietary solution for hyperphosphatemia
- Co-Owners and Co-Inventors
  - Marian G. McCord
  - Melanie S. Joy

NCSU Involvement

- Faculty
  - McCord, Gorga (TECS)
  - Lucia, Jameel, Byrd (WPS)
- Students
  - Two TE senior design teams
NCSU GH Research – In the Headlines

Health-Based Approach May Help ID Groups At Risk Of Genocide

New Statistical Models to Link Climate Change, Effect of Pollution on Health – NIH Awards $1.2 M

Food safety: N.C. State gets $25M federal grant to lead norovirus research

Bedbugs sleep in your bed... and with each other
NCSU Students – Making an Impact in Global Health at Home and Abroad
NC State GH Related Student Organizations

- Helping Hand
- Amnesty International
- Anthropology Club
- Blitz for Hunger
- Bridges International
- CARE
- Circle K International
- Colleges Against Cancer
- Collegiate Entrepreneur’s Org.
- Engineering World Health
- Engineers Without Borders
- Global Brigades
- International Studies Club
- Lemonade International
- Masters of International Studies GSA
- Mi Familia
- NC Students for Cuban Humanitarian Aid
- Nourish International
- Operation Net
- Pre-Health Club
- Rotereact Club
- Stop Traffick
- Student Global AIDS Campaign
- Students Outreaching to Oppressed Nations
- Sustainability Club
- Veterinary Student Public Health Corps
Our Role

• Communicate across colleges and units to identify expertise and areas for collaboration in research, education and engagement activities related to global health; and publicize NC State’s strengths and activities.

• Identify funding agencies and potential partners to pursue strategic initiatives that align with university goals and mission, and facilitate proposal development.

• Coordinate meetings between university units and external partners.

• Expand opportunities for students, faculty and staff in education, research, training and engagement activities in global health.

• Represent interests of NC State University with external agencies e.g. Triangle Global Health Consortium.
Our Major Initiatives

- Faculty Engagement
  - GH Survey
  - Proposal Development
- Student Engagement
  - GH Challenge
  - GH Student Council
- Collaborations
  - TGHC
  - Local and Global Partnerships
- Visibility
  - Website
  - Special Events
- Education and Training
  - GH Courses
  - GH Design Projects
FACULTY ENGAGEMENT
Faculty Survey (Spring 2011)

- Targeted Pool of Faculty
  - Selected by searching RADAR for proposals submitted in GH focus areas
- 55 NCSU faculty participants representing 10 Colleges
- Expertise in a broad range of GH research areas

### Top Global Health Research Areas

- Agricultural Development: 13%
- Agricultural/Industrial Chemicals: 11%
- Animal Health and Global Zoonotic Diseases: 11%
- Environmental Contaminants/Toxins: 13%
- Health Science and Technology: 9%
- Natural Resources: 10%
- Biology: 9%
- Environmental Health: 9%
- Water: 8%
- Soil/Water Contamination: 7%
Gates Grant Collaboration Event, Oct. 2010

- Initiated by NCSU GHI, co-sponsored by the Triangle Global Health Consortium (TGHC)
- 104 people representing 53 organizations/businesses in North Carolina attended the event, spanning the academic, not-for-profit, for-profit and government sectors
- 28 NCSU participants
- Since this event, the number of Gates Grand Challenge Explorations proposals has increased by 120%, and funding has increased by 200%
Cross-disciplinary GH Collaborations - Research

• 30 faculty members in 8 Colleges collaborated on a USAID proposal on Global Community Development

• Developing multidisciplinary research and development cluster around “Healthy and Sustainable Communities”

• NCSU awarded IIE 2012 Fulbright Global Food Security Summit
  – October 17 – 21
  – 80 international scholars will come to NCSU to attend seminars and participate in workshops

• NCSU awarded NSF Nanotechnology Engineering Research Center (NERC) to develop nanotechnology for Global Health Monitoring ($18.5M for five years)
A multidisciplinary coalition of universities, industry, schools, and non-profits.
ASSIST Vision: Using Nano to Improve Global Health

• Enable correlation between personal health and personal environment.

• Empower patients and doctors to manage wellness, lowering health costs and improving global health.

• Engage industry, medical practitioners, scientists, and engineers for transformational impact.
NAE Grand Challenge: Advanced Health Informatics

- 75% of All Health Costs Related to Chronic Diseases (cdc.gov)

- Sources: CDC and World Health Organization

- 2010 US Health Costs = $2.6 Trillion
- Heart disease is the leading global killer
- Over 300 million asthmatics

Sources: CDC and World Health Organization
Why Personal Environmental Monitoring?

Our location and behaviors significantly affect our exposure and risk.

- Lives near busy highway
- School has poor air quality
- Diesel generator outside house
- Has relatives who smoke
- Unpredictable asthma attacks

Our location and behaviors significantly affect our exposure and risk.

Simultaneous health and environment monitoring can enable direct correlation and rapid response.
Health Monitoring for Prevention

- Improved quality of life for a large percentage of the vulnerable population.
- **Hassle-free, comfortable and medically relevant** health monitoring systems needed.
- Huge emerging market space for wearable devices.

*Source: IBM Global*
ASSIST Mission

To transform global health by creating self-powered wearable systems for personal environmental and health monitoring, enabled by nanotechnologies.
What is ASSIST?

A hassle-free, wearable system for personal health and environmental monitoring over long periods of time during normal activities of daily life.
Transformative Impact of ASSIST

With ASSIST’s hassle-free monitoring systems, we will:

• **Significantly reduce health care costs** by empowering doctors/patients with information leading to rapid diagnosis, effective treatments, post-treatment decisions, reduce hospital stays and improve quality of life.

• **Empower users** with individual health data on wellness

• **Enable direct correlation** between personal health and personal environment

• **Inform** sound environmental policy.

• Excite a **new and diverse generation of globally aware engineers** ready to address society’s grand challenges.

• **Have a positive economic impact** on existing new markets.
Cross-Disciplinary GH Collaboration – Academic Programs

- Global Health Program Faculty
  - Representation from every NCSU College as well as CSLEPS, HealthPack
  - Courses
    - GPH 201
    - Global Health Seminar
- In planning stages:
  - UG GH Minor
    - Multiple tracks, likely Technology, Science, and Policy
  - Masters in International Studies Concentration in GH
  - Professional Science Masters in GH
STUDENT ENGAGEMENT
Triangle Global Health Case Challenge

- Held in collaboration with UNC, Duke, and TGHC
- Seventeen teams from five Universities competed
- Over 150 NCSU students from seven Colleges have participated

Team Desipak wins $500 for Second Place
The (GHSC) is the umbrella organization for all of the NCSU student organizations with interest in Global Health. Working closely with the Director of Global Health Initiatives, one of our main objectives is to create a unified presence for Global Health activities on campus, though the following activities:

- Planning, hosting, and executing campus-wide Global Health Events (e.g., a Global Health Week)
- Appropriating funds (as available) to student organizations each year
- Making sure that the University is aware that students care about Global Health
- Disseminating Global Health information efficiently
  - Courses available
  - Internships
  - Events
  - Scholarships
  - Resources
OUTREACH
Triangle Global Health Consortium

Fred Gould - Can Genetically Engineered Mosquitoes Suppress Malaria and Dengue? – TGHC
Breakfast Feb. 24, 2011
NC One Health Collaborative

ONE WORLD, ONE MEDICINE, ONE HEALTH

One Health Intellectual Exchange Weekly Discussion Series / Course

Philosophy to Practical Integration of Human, Animal and Environmental Health

Spring Semester 2012
Duke (GLHLTH 371), NCSU (CBS 886/VMP 986) and UNC (PUBH 690 sect 008)
Special Event - Dr. Bashir Yusuf Abubakar Visit and Seminar – March 2011

Dr. Marian McCord and Dr. Abubakar

Dr. Abubakar and Dr. William Welsh
On October 26th, Elizabeth Scharpf, CEO of Sustainable Health Enterprises (SHE), visited NC State’s campus to discuss her “she28” initiative and her use of market-based approaches to address social problems in developing countries.

She28 helps women start their own businesses, distribute and eventually manufacture affordable, eco-friendly sanitary pads by sourcing local, inexpensive, raw materials (e.g., banana fibers).

Elizabeth also shared the ways in which she has worked with University students and faculty to co-develop solutions.
EDUCATION AND TRAINING
Education and Training

GPH 201 Fundamentals of Global Public Health
Dr. Deborah Threadgill, Asst. Prof. Dept. of Microbiology

Fall 2009 - 20 students enrolled
Fall 2010 - 24 students
Fall 2011 - 41 students!

Students showed substantial interest in additional Global Health classes as well as an established minor. Four GPH 201 students participated in UNC-CH’s Summer Public Health Academy (summer 2010).

GPH 201 students organized for World AIDS day on the Brickyard Dec. 1, 2011
Global Health Engineering Senior Design and Entrepreneurship Alternative Spring Break Initiative

**Motivation**

- The urgent and enormous unmet need for medical technology, products and services for the 4 Billion people living on under $4 per day
- NCSU's commitment to growth of strategic and sustainable collaborations with international partners, particularly in Global Health Initiatives
- College of Engineering focus on NAE Grand Challenges

**Strategy**

- Team with Center for Student Leadership, Ethics and Public Service (CSLEPS), Engineering Entrepreneurship Initiative, Biomedical Engineering and NCSU Global Health Initiatives
- Assist student teams in engaging with community partners in low-resource settings in the developing world
- Facilitate problem identification and solution co-development amongst student teams and community partners
- Create opportunities for teams of students and faculty to travel to partner location during winter or spring break for prototype evaluation and solution refinement

**Impact**

- Enhanced student global competency and awareness of the needs of the health needs of emerging markets
- Spinoff social and business ventures that offer appropriate healthcare solutions for low-resource settings
- Increased NCSU international global health and engineering visibility and collaborations in developing world
- Greater continuity in the engineering design process through ongoing partnership and collaboration with a partner community