The War on Cancer: 41 Years After Nixon’s Declaration

Dr. Mark Clanton
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The War on Cancer: 41 years after Nixon’s Declaration

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Fighting Cancer: Time to Translation

Discovery → Translation → FDA → Translation to Practice → Wide Acceptance

Time Line: Greater than 17 to 20 years
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US Cancer Death Rate

Risk Factors/Causes of Cancer in the US

- Smoking: 33% attributable
- Obesity/Poor Nutrition/Inactivity: 30% attributable
- Unknown: 15% attributable
- Occupational Exposure: 5% attributable
- Viruses: 5% attributable
- Family History/Genetics: 5% attributable
- Alcohol: 3% attributable
- UV and Ionizing Radiation: 3% attributable
- Prescription Drugs: 2% attributable

Percent Attributable to Cause
Cigarette Smoking by Adults 18 and Older in U.S.

Source: National Health Interview Survey, 1965 – 2010
Where and How will Science Battle Cancer in the Future?
Where will the War on Cancer be Waged in the Future?

- Understanding Personal and Population Risk for Cancer
- Precision Screening and Diagnosis
- Changing Science Policy
Gene-Environment Interaction: Public Health and Personal Risk

or

Where DNA Meets the World
If smoking is the most common cause of lung cancer, why do only 10 to 20\% of heavy smokers develop the disease?
Why are rates of breast cancer high in the United States compared to other parts of the world... 

...though, even in the US, most women do not develop the disease?
Comprehensive answers will be found when we understand what happens when DNA meets the world.
DNA
- Single gene mutation
- Multiple gene mutations
- Gene-environment interactions

Individual
- Single gene cancer
- Multiple gene mutations and cancer
- Gene-environment changes resulting in loss of tumor suppressor

Population
- Public health and gene-environment interactions studies
- Nurses health study
- Cancer prevention studies

Environment
- Diet
- Exercise
- Environmental exposure
DNA
- Single gene mutations
- Nucleotide polymorphisms
- Gene-gene interactions
- Gene-environment interactions

Environment
- Environmental Exposures
- Diet
- Exercise
Is Obesity a Genetic or Environmental Cause of Cancer?
Obesity in the United States 1970 and 2008

Percent of Population

- American Adults, Age 21 and above:
  - 1970: 15%
  - 2008: 35%

- American Children, Aged 6 to 11:
  - 1970: 4%
  - 2008: 20%
The Impact of Gene-environment Interactions

Assuring Conditions for Population Health

Government and Public Health Infrastructure

Community

Health Care Delivery System

Academia

Employers and Business

The Media
RECENTLY ENROLLING: CPS-3

- UT Medical School could play a role here
- Need more than 300,000 enrollees
- Enrollments occurring in Missouri, Oklahoma, and Texas
- Long term commitment
- Diverse population
Can we find Cancer Cells before they become a Cancer Diagnosis?

- Circulating Tumor Cells
Circulating Tumor Cells: Shed from tumors, and in the bloodstream

- Progress in Prostate Cancer?
- What is Our Detection Limit Capability?
The Liquid Biopsy
Screening for Cancer in Blood

Drawing Blood
Finding Cancer in Blood
Prostate Cancer and CTC

- Draw blood
- Find the cancer
- Test for whether it is deadly (genetic profile)
- Inform prognosis
Number of Circulating Cancer Cells Can Predict Survival and Guide Treatment in Hormone Resistant Prostate Cancer

(After Miller et al., 2010)
Precision Screening Cancer: Colorectal Screening

The Present as an Example
Colon Cancer Screening Today

- Card based test such as Hemoccult and SDNA
- Sigmoidoscopy
- Virtual Colonoscopy
- Double Contrast Barium Enema
- Colonoscopy
Colon Cancer Screening Tomorrow
How Early can Cancer be Diagnosed?: Nanoscale Devices

http://nano.cancer.gov/learn/understanding/
Can nanostructures help us see cancer?

Quantum dots:

• Tiny quantum dots are made from semiconductor crystals as small as one nanometer (one-billionth of a meter).

• They can zero in with pinpoint accuracy on human prostate cancer.

In ultraviolet light, each dot radiates a brilliant color.
Advances in Colorectal Screening and Diagnosis: Gold Nanoparticles

- Identification and removal of non-invasive high grade neoplasia
- Flat/ulcerative colorectal neoplasms more dangerous
- Flat lesion more difficult to find
- Gold nanoparticles may offer more precise diagnosis of GI cancers.

Scanning electronmicrograph of gold nanoparticles created by the National Cancer Institute and the National Institute of Standards and Technology. Credit: NIST (2008)
Can Research be changed to speed its impact on Humans?
Time to Translation

- Discovery
- Translation
- FDA
- Translation to Practice
- Wide Acceptance

Time Line: Greater than 17 to 20 years
Time to Translation

- Discovery
- ACCELERATE
- Translation
- Translation to Practice

Time Line: Less than 10 years
“The highest and best purpose of biomedical science is realized when the knowledge derived from research is used to improve the human condition.”

Mark Clanton, MD, MPH - NIH
QUESTIONS?
Health Policy and Medical Practice Issues

- Understanding more about the mechanisms of disease will undoubtedly lead to new treatments.
- The more scientists identify and fine-tune the genetic factors behind disease or drug response, the more doctors will want to screen individuals for gene variants in order to tailor medical care.
- Such personalized medicine may well lead to higher health care costs and thus may create a policy quandary.
If not communicated well, the findings from gene-environment research could even backfire.

If you found a set of genes that made people highly resistant to the effect of smoking on lung cancer - and again, that’s a hypothetical - it’s unlikely that those same genes would make people resistant to the other bad effects of smoking like heart disease.
Dr. Mark Clanton

Dr. Mark Clanton is the chief medical officer of the High Plains Division of the American Cancer Society and was the deputy director of the United States National Cancer Institute at the National Institutes of Health. Prior to Federal service, he served as the chief medical officer of Blue Cross Blue Shield of Texas and the vice president of a 1 million member drug card program.

In both 2005 and 2006, Dr. Clanton was honored with the Secretary of Health and Human Service Distinguished Service Award as well as the National Institute of Health directors Award of Merit. An accomplished scientific researcher, Dr. Clanton is currently a voting member of the Food and Drug Administration’s Tobacco Products Scientific Committee; and a member of the Washington University in St. Louis National Council for the Institute of Public Health, where he advises the Institute on the development of a full time school of public health.

In 2011 Dr. Clanton was named to the Washington University Transdisciplinary Research in Energetics and Cancer Center (TREC) external advisory board. The TREC grants represent a 45 million dollar, multi-site consortium whose purpose is to understand the causes of obesity and its relationship to cancer.