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THE CARS, GADGETS, DRUGS & TV OF TOMORROW

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Inside Frank Gehry's Geek Palace at MIT

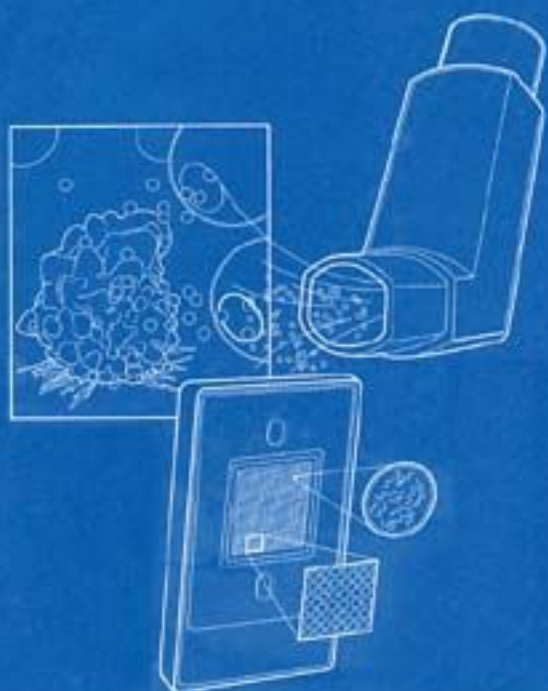
Walt Mossberg, Kingmaker



THE CURE

Nanobombs. Microbots. Vaccine pills.
A report from the medical frontier.

by Josh McHugh Illustrations by Rob Flewell



CANCER

Cause: Broken DNA, mutated either by external agents like radiation and chemical carcinogens or by hereditary factors, triggers out-of-control cell division and growth, destroying surrounding tissues and organs.

Death toll: Cancer is the third-leading killer in developed nations, accounting for one of every 12 deaths. In the US, it's second only to heart disease.

Big advance: New chip-based DNA microarrays let doctors pinpoint the genetic expression behind a mutation; gene silencing, also known as RNA interference, is a naturally occurring process that researchers are harnessing to shut down culprit genes. Scientists are testing inhalable nanoparticle "cluster bombs," which infiltrate tissues and destroy cancerous cells.

HEART DISEASE

Cause: Cardiac muscle tissue thins or dies, valves stiffen or leak, or the cells responsible for coordinating heartbeat rhythm misfire.

Death toll: Heart disease is the leading cause of death worldwide, accounting for nearly one in four fatalities in developed countries, almost one in ten in developing countries.

Big advance: Artificial hearts now in trials are expected to rival transplanted hearts for longevity. Microrobotic tools let surgeons use minimally invasive techniques for bypass grafts and valve repair, which once required open-heart surgery. Regenerative techniques like growing new cardiac muscle and blood vessels from implanted stem cells are in the pipeline.

HIV/AIDS

Cause: The AIDS virus cripples the immune system, leaving the body vulnerable to every pathogen. A shape-shifting target, HIV has subdivided into variants A (East Africa), B (North America and western Europe), and C (Asia and sub-Saharan Africa), each requiring specialized approaches.

Death toll: Number five on the developing world's cause-of-death chart, and rising fast. AIDS is ravaging sub-Saharan Africa.

Big advance: Pricy drug cocktails keep AIDS suppressed for ever-longer stretches. But a cheap, easily administered HIV vaccine is the real goal. Berna Biotech has developed a second-gen pill vaccine that contains HIV DNA encased in bacteria. Tests in Uganda and the US began this year.



ALZHEIMER'S

Cause: Protein structures called beta amyloids clump into plaque deposits in brain tissue, destroying neurons.

Death toll: With lifespan increasing, Alzheimer's has become maturity's most feared health problem. It affects 4.5 million people in the US. By 2050, that number will hit 13 million.

Big advance: Scientists are working on compounds that inhibit production of a peptide called abeta-42, the main building block of amyloid plaques. The Mayo Clinic is collaborating with biotech firm Myriad Genetics on testing the resulting Alzheimer's treatment. Eventually, researchers hope to derive a vaccine from the drug.

AGING

Cause: Tissues become brittle and begin to break down, gradually losing specialized cell maintenance and defense functions, leaving the body increasingly susceptible to both genetic mutations and outside threats.

Death toll: No one actually "dies of old age," but cell deterioration weakens the body to the point where other causes of death can do their thing.

Big advance: UC San Francisco researcher Cynthia Kenyon has spent the last decade tinkering with the aging process of *Caenorhabditis elegans*, a kind of roundworm. By disrupting hormone-based aging signals in the worms' endocrine systems, Kenyon's group caused them to live six times longer than normal. Coming soon: increasing lifespan with age-retarding compounds.

Contributing editor Josh McHugh (josh@wiredmag.com) wrote about Google in Wired 12.03.

NEXT STEPS

2007

First cheap, pill-based HIV vaccine widely available.

2008

Stanford scientists begin untying knotted proteins and finding cures for everything from Alzheimer's to Huntington's disease.

2009

Alzheimer's vaccine passes Viagra on all-time top-drugs list.

2010

Home stem cell cardiac treatment kits on sale.

2011

Number of global AIDS cases declines for first time.

2013

Artificial-heart recipient finishes NYC marathon.

2015

Cancer occurrence rate down 40 percent from 2005, cancer-death rate down 80 percent.