

Personalized Medicine and Its Impact on the Economy

POPULATION HEALTH & DISEASE MANAGEMENT COLLOQUIUM

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Background

Personalized Medicine is becoming the new paradigm in healthcare that is transforming the way \$2.6 trillion dollars is spent in the US and \$4 trillion is spent globally

- What is “Personalized Medicine”?
 - Medicine that examines each individual's biological makeup and designs tailored strategies for maintaining and enhancing Health and Wellness and treating illness
- Personalized Medicine is estimated to be at least a \$55B market that will double within five years; the size of the closely related Health and Wellness market is estimated at \$400 to \$900B
- Most traditional healthcare companies (payers, providers, pharma, biotech) are moving aggressively into this market through R&D, JVs, acquisitions, and new product development
 - However, many of the winners in the market are likely to come from non-healthcare companies like Google, Microsoft, Cisco, Intel, Wal-Mart, and startups better able to operate in the new paradigm

"Our view is that medicine will become more data driven...that medicine can take on and have a more predictive component, that more effort can be applied to prevention as opposed to cure. That medicine can become more personalized down to...making pharmaceutical dosage really, really accurate on a personal basis. And we think it becomes more participatory, where the consumer is directly involved in both the wellness activities and the remediation activities to a degree that isn't possible today. "

*- Craig Mundie
Chief Research and Strategy Officer, Microsoft*

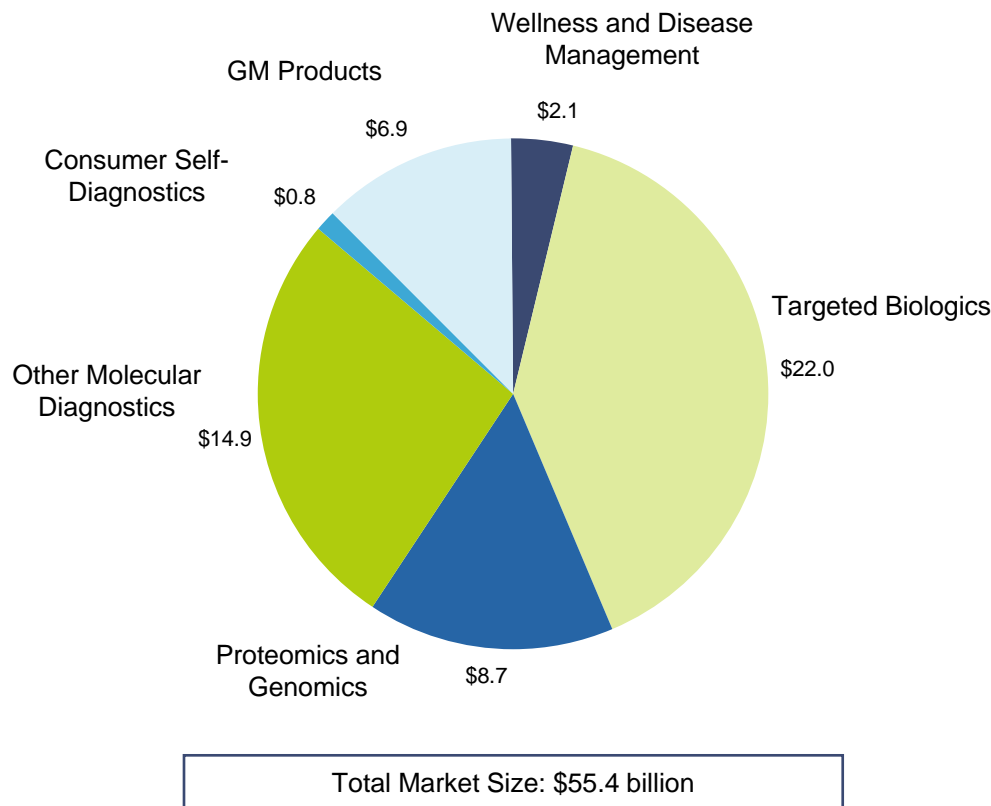
Background

We are at a tipping point in Personalized Medicine, driven by rapid technological advances as well as other changes

- Advances in Personalized Medicine are driven by many forces that include:
 - Collapsing technology costs in genomics and proteomics - genomes sequenced for \$100 in an hour at any doctor's office - within 5 years.
 - Increased process speed, storage, and bandwidth capacity enabling IT therapeutic design - applying IT tools to design drugs on a virtual basis - like car design.
 - Ubiquitous connectivity allows customized solutions in both Disease Management and Health & Wellness - telehealth, homehealth, the iPhone, web applications enable personalized care outside the clinic
 - Pay-for-performance, evidence-based, consumer-directed healthcare will alter the standard of care from generic to specific - demand for outcome-based medicine that delivers value despite individual differences
 - Consumer empowerment, information, and risk management concerns have created educated and demanding consumers - scope of solutions across the Health and Wellness continuum is increasing breadth of consumer choice.

The segment of the Personalized Medicine market made up of “traditional” pharma / biotech firms, healthcare providers, and diagnostics companies and start-ups in genomics, proteomics, stem-cell and gene-therapy is estimated at about \$55 billion

Size of Personalized Medicine Market by Subsector in 2006, \$ billion



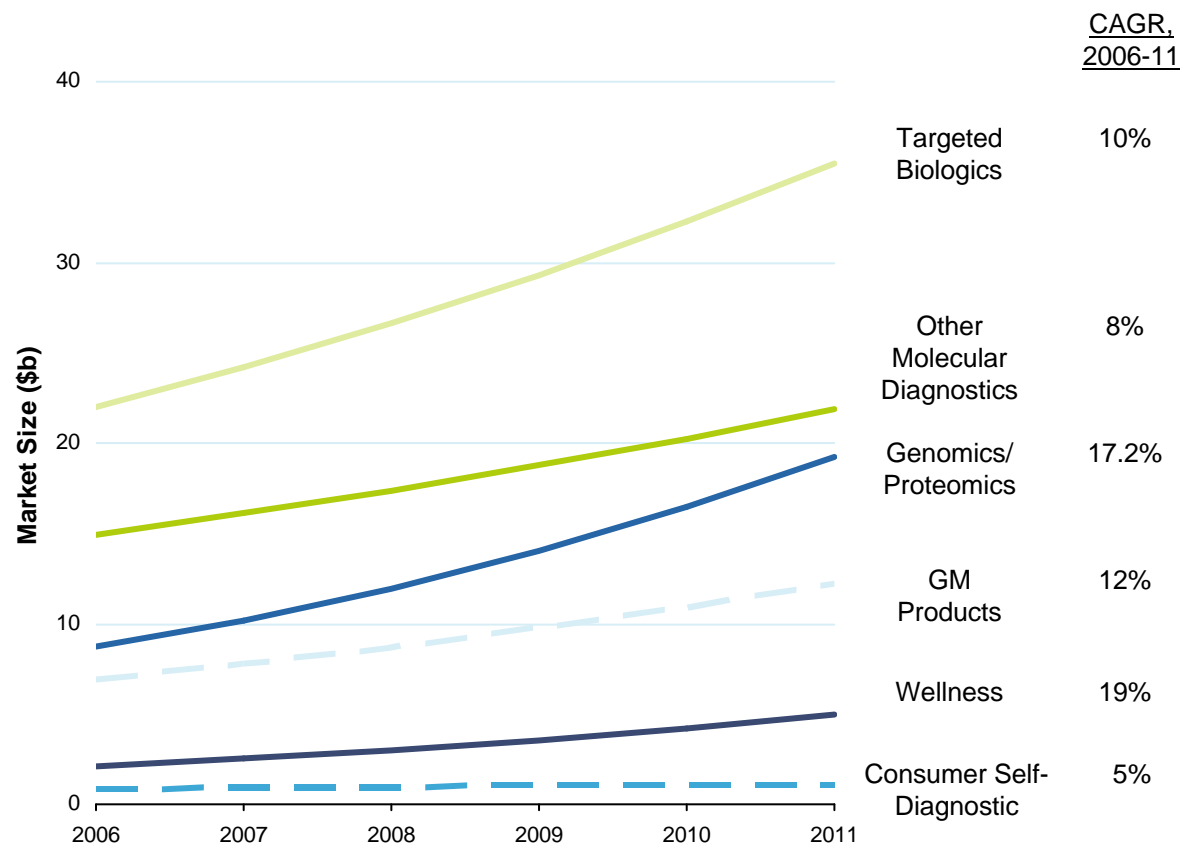
Selected Company Examples

Company	2007 Sales	Sectors Where Company Is Active
Pfizer Pharmaceutical	\$44b	Targeted biologics; proteomics, genomics and other molecular diagnostics
Siemens Healthcare	\$14b	Targeted biologics; proteomics, genomics and other molecular diagnostics
Monsanto	\$8.5b	Genetically modified products
Roche	\$8.4b	Diagnostics, including genomic, proteomic and molecular diagnostics
Inverness	\$0.8b	Wellness; consumer/home and biomarker diagnostics
Hologic	\$0.2b	Biomarker diagnostics with focus on women's health
Geron	\$6 million	Stem-cell research (revenues come primarily from collaborative agreements and licensing)

Source: HIRC, CSFB, Amersham/GE Healthcare, ISAAA, Croprosis, Inverness, Adnexus/Bristol-Myers Squibb, Kalorama, Company Information

The size of the Personalized Medicine market is projected to nearly double between 2006 and 2011, with various factors contributing to the growth of different sectors

Estimated Market Growth of PMI Subsectors, 2006-11



- The market for Personalized Medicine products is expected to grow 11% per year, reaching about \$95B in 2011
- Different sectors have different growth drivers, though all are driven in large part by scientific advances and consolidation
 - Wellness, the fastest-growing market at a projected 19% CAGR, is driven by a need for companies to control health costs by implementing programs to improve employees' health
 - Ageing baby boomers also add to Wellness' growth, by increasing the numbers of chronically ill disease management clients
 - Worldwide food shortages contribute to the 12% growth of GM products
 - Genomics, proteomics and areas like stem-cell and gene therapy research are boosted by technological advances and the potential of therapies coming to market

Source: Kalorama, ISAAA, Amersham/GE Healthcare, HIRC, CSFB

The Personalized Medicine market is also driving the growth of the Wellness market

- In 2005, Business Week estimated that “Wellness“ was poised to grow from a \$400 billion to a \$1 trillion industry by 2020
- The Wellness market may be even larger:
 - “It's clear that the current debate over cost, quality, and access to care is necessary but completely inadequate to achieve the health gains we need and deserve. Health is produced mostly outside of healthcare....We hear many people talking about the \$2 trillion [plus] we are spending on healthcare but very few are talking about what we think may be \$800-\$900 billion consumers are paying out-of-pocket for wellness activities and products. This demand is largely ignored by most of us in the formal health and healthcare sector.”
 - > Dr. Brad Perkins, Chief Strategy and Innovation Officer at the CDC
- The Health and Wellness market is also attracting major players.
 - Steve Case, co-founder of America Online, who was recently named the most powerful person in healthcare by Modern Healthcare magazine, is the Founder, Chairman and Chief Executive Officer of Revolution Health Group, which aims to offer information and advice to consumers regarding healthcare choices (Note: Eric Schmidt, chairman and CEO of Google, and Bill Gates, chairman of Microsoft Corp., Ranked No. 2 and No. 3)

Recent years have seen tens of billions of dollars in M&A activity by companies active in Personalized Medicine as consolidation shapes the industry and new players emerge - Sectors like stem-cell research and proteomics see millions in venture capital funding each quarter

2007's Largest Deals Involving Companies Active in the PM Space

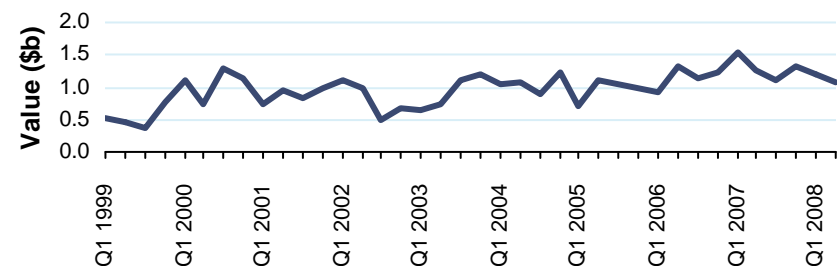
Target	Acquirer	Value	Description of Target
Dade Behring Diagnostics	Siemens	\$7b	Develops variety of diagnostics tools, including gene and protein-based
Cytc Corporation	Hologic	\$6.2b	Uses genomics for tests for breast cancer detection
Ventana	Roche	\$3b	Creates cancer therapies based on patient's DNA
Ameripath	Quest Diagnostics	\$2b	DNA-based diagnostics and other diagnostics tools
BioSite	Inverness	\$1.7b	Proteomics tests for heart, infectious and thromboembolic diseases
Digene	Qiagen	\$1.6b	DNA and RNA tests for detection of disease
BioVeris	Roche	\$0.6b	Immunochemistry-based diagnostics tools
Adeza Biomedical	Cytc	\$0.5b	Proteomics-based women's and prenatal diagnostics
Adnexus Therapeutics	Bristol-Myers Squibb	\$0.4b	Targeted biologics therapies to treat disease via proteins
Morphotek	Eisai	\$0.3b	Tests for biomarkers used to diagnose and treat cancer

Largest VC investments in PM companies in 2Q2008

Company	Investor	Size of Investment	Description of Company
Five Prime Therapeutics	ATV, Domain, Kleiner Perkins, et al.	\$40M	Develops therapeutic proteins
BiPar Sciences	Domain	\$17.5M	Makes genomics-based tumor drugs
Riley Genomics	Kleiner Perkins, Mohr Davidow	\$15M	Specialty diagnostics
Fate Therapeutics	Domain	\$12.9M	Develops stem-cell therapies
Osprey Pharmaceutical	Burrill, BDC, GeneChem	\$11M	Produces therapeutic proteins

VC investments in the biotech space have risen at a rate of 2% per quarter since 1999

VC Investments in Biotechnology by Quarter, 1999-2008



Source: The Walden Group, PwC Money Tree, Company Information

From a financial perspective, the overriding goal of Personalized Medicine is not necessarily to reduce costs (though this is expected to be a benefit) but to increase value

- The true promise of Personalized Medicine is to maximize health value, that is, to maximize the outcomes for every dollar spent on healthcare
 - The best way to deliver value via the healthcare system is to promote better health to avoid disease altogether and to adopt earlier, more precise interventions when disease occurs - Personalized Medicine is already enabling both of these approaches
- As the number of entrants into the market increases, competition will drive the creation of increasing value delivered in new, ever more innovative ways

Personalized Medicine is expected to have a significant impact on the economy as well as on costs, with the impact on costs differing in the short-term versus long-term.

- Personalized Medicine is a disruptive innovation that will upend traditional business models; create new economic models and funds flow; and reallocate healthcare resources away from disease treatment and towards wellness and prevention
- In the short-term, Personalized Medicine may increase the costs of healthcare because of:
 - The learning curve associated with the development and use of new diagnostics tools, that is, creating tests that are predictive and applying the right test(s) to the right patient(s)
 - The increased demand for diagnostic testing, even by those at low risk for disease
 - The likely continuation of the practice of validating positive diagnostic tests using other tests, for example, expensive imaging procedures

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- In the long-term, Personalized Medicine will likely decrease the costs of healthcare because of:
 - The emphasis on prevention, which will reduce the incidence of disease and related costs
 - The development of improved diagnostics, which will eliminate the costs associated with:
 - > Validating positive diagnostic tests (e.g., through expensive imaging procedures)
 - > Implementing treatments that produce no benefits and may even cause harm
 - A focus on early detection and ongoing monitoring, which will eliminate the need for the expensive procedures, devices, and drugs required by current health interventions, many of which target late stage disease
 - In addition, gains can be expected due to the increased productivity and reduced absenteeism resulting from the improved overall health of the workforce

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