

Q&A: The Dawn of Molecular Medicine

What is molecular medicine? How will it transform healthcare—and what are the consequences for investors? We put these and other questions to Amy Raskin, who leads our Global Growth Equities Research team and heads our Research on Strategic Change (RSC) effort; and Eli Casdin, an analyst on the RSC team who has been spearheading extensive research on the subject.

Portfolios in Perspective: Eli, recognizing that not many of our readers have a PhD in biology, could you explain what molecular medicine is and why it's important?

Eli Casdin: Think about your own experience of visiting the doctor's office. Traditionally, doctors have tended to view disease as a collection of symptoms or as a breakdown in a particular biological function. Treatments are often more focused on symptoms than causes. Finding the "right" drug for you is not always straightforward.

Molecular medicine offers an alternative perspective: It views illness as a dysfunction in the interactions of molecules such as DNA (deoxyribonucleic acid) and various types of biological mechanisms. Having knowledge of an individual's molecular makeup and the molecular characteristics of disease better enables physicians to assess susceptibility to disease and tailor treatments. We expect this molecular perspective to revolutionize the practice of medicine and transform the global healthcare industry. This is just the kind of secular shift that the Research on Strategic Change team seeks to identify and analyze. We want to understand "the next big thing," identify the companies poised to benefit from it, and incorporate these emerging opportunities into our investment portfolios.

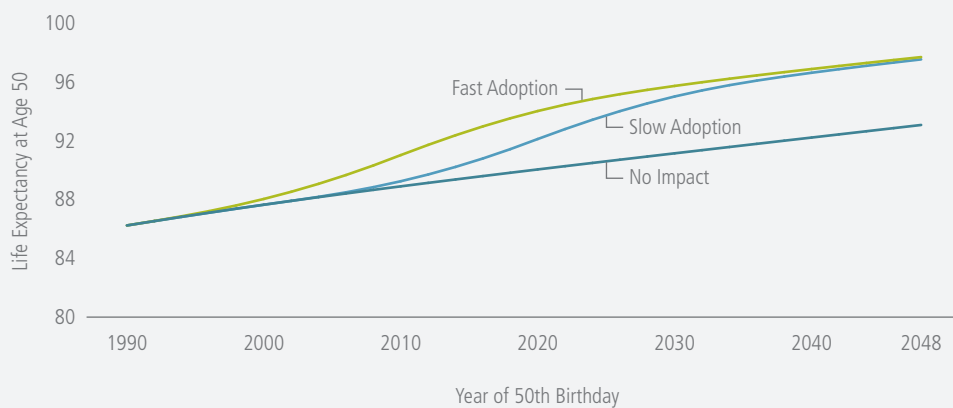
PiP: Are there any historical precedents for the kind of dramatic change you foresee?

Amy Raskin: Sure. The germ theory of disease held that microbes cause many diseases. This simple insight a couple of centuries ago led to new standards of hygiene, vaccination and the discovery of antibiotics. By the 1900s, physicians were applying this knowledge to halt the course of certain diseases. Deaths from infectious disease became less common in developed countries, and life expectancy increased.

Eli: We expect that the adoption of molecular medicine over coming decades will also lead to longer and healthier lives, as diseases that are most lethal or debilitating today become chronic and livable. There's no question that this science will help people live longer. The only question is how quickly the adoption occurs (*Display 1*).

Display 1: Different paths to a longer life

Life Expectancy of a 50-Year-Old (Different Molecular Medicine Adoption Scenarios)



As of December 31, 2010
For illustrative purposes only.

Fast Adoption: Benefit from molecular medicine begins in 2020. Full benefit occurs by 2040, after which improvement in life expectancy tapers off over a 20-year period due to the impact of diseases of older age; no improvement after age 80.

Slow Adoption: Benefit from molecular medicine begins in 2030. Full benefit occurs by 2050, after which improvement in life expectancy tapers off over a 20-year period due to the impact of diseases of older age; no improvement after age 80.

No Impact: No improvement in life expectancy from molecular medicine.

Source: AllianceBernstein

PiP: What role does technology play in the disruption you foresee in the healthcare industry?

Eli: Technology is pivotal. Complex instruments called DNA sequencers read the “code” embedded in DNA—essentially the instructions regarding biological structure and processes. This means that DNA is the blueprint and production line for life...and disease, too. Researchers are now able to probe deeper and ask specific questions about the role of molecular processes in disease. Sequencers are generating huge amounts of molecular data, which researchers are using to better understand disease at the molecular level. Meanwhile, sequencers are becoming more efficient and cheaper, which has attracted more users.

We expect the coming adoption of molecular medicine will lead to longer and healthier lives, as diseases that are lethal or debilitating today become chronic and livable.

PiP: That sounds reminiscent of the start of the digital information era, when rising processor speeds and falling costs led to a proliferation of computers and applications of computing technology.

Amy: Precisely. In that instance, advances in semiconductor technology drove down the cost of computing. Processing speeds doubled every two years and applications for computing exploded, enabling more users, more knowledge and, ultimately, more uses for information technology. In the case of DNA sequencing, technology improvements are occurring even faster, doubling every six months. We project the sequencing market will generate \$1.5 billion in annual revenue in 2010 and will reach nearly \$4 billion by 2015 (*Display 2*)—far more than most market participants expect.



PiP: Let's focus on medical innovation. How will healthcare be different in the future?

Amy: Today, diseases are regularly misdiagnosed or undiagnosed, resulting in ineffective treatment and considerable suffering. A sea change is under way in patient diagnosis and treatment and in drug research and development. Molecular tools should make diagnosis much more objective and accurate. Treatment outcomes will improve if physicians can identify diseases based on their molecular components and match them with treatments for the specific molecular dysfunction. The more specifically a disease can be defined, the more likely that interventions and treatments will succeed.

PIP: What are the implications for companies in the diagnostic subsector?

Eli: We believe molecular information and technology will create significant revaluation and disruption in the diagnostic industry. Eventually, large, new user markets and test categories will emerge. We project that molecular diagnostics will generate \$20 billion in revenue by 2020—just under a third of the total for the diagnostic industry.

PIP: And what about the implications for the drug subsector, both in terms of how new drugs are developed and the markets that they address?

Eli: Less than 25% of drugs in development are ultimately marketed, and development time hovers at around 10 years. The capitalized cost of developing a single drug (including the cost of failed attempts) typically exceeds \$1 billion, often more than the drug's future profits warrant. Innovative drug companies will use molecular information to reduce costs and expand their drug pipeline. Companies may also be able to use this technology to identify new applications for previously failed drugs. In our view, smaller, more nimble biotechnology companies will lead the adoption of molecular technologies in drug research and development.

Amy: The economics of individual drug markets will change in the near term as drugs increasingly address smaller subsegments of disease and, in some cases, are used for greater lengths of time. In the longer term, regenerative medicine that restores broken biological "machinery" (including vital organs) will not only disrupt currently large drug markets, but create new ones.

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