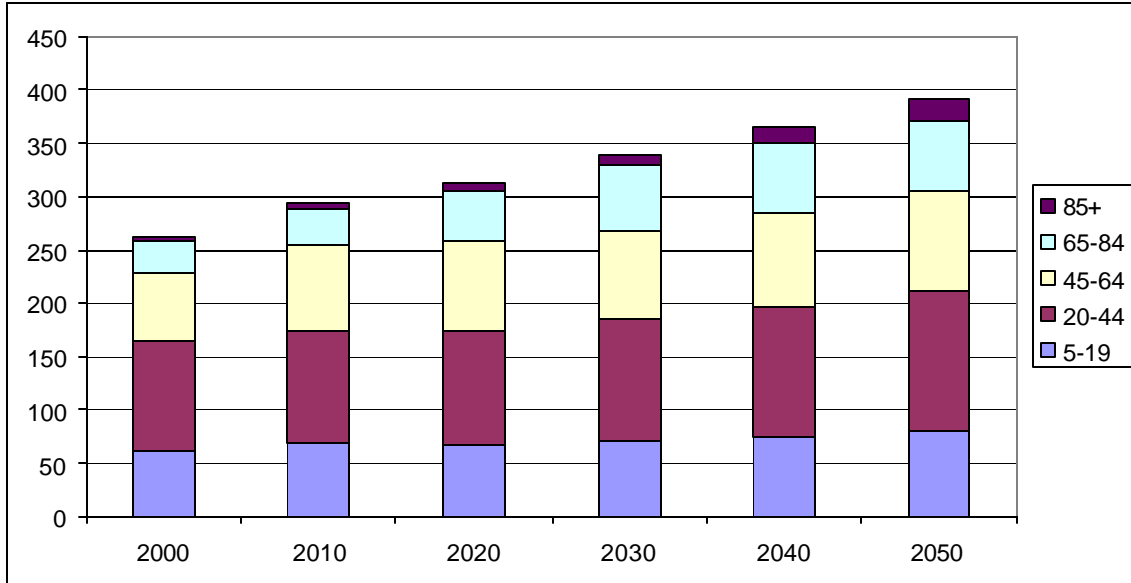




ATP-Funded Technologies for the Aging

The fastest growing age group in the U.S. is adults 65 and older which is projected to grow from the present 35 million to 85 million by 2050.¹ The second fastest growing age group is adults 45-64 born during the early years of the baby boom (1946 through 1950) fueled by a 55% increase in the 50-54 age range.² The chart below demonstrates the rise in the aging population over the period between 2000 and 2050.³



An aging population poses challenges for society while presenting opportunities for scientists to explore technologies that will improve the well-being of senior citizens. ATP, working in conjunction with private industry, has funded the development of high risk and innovative technologies that have the potential to improve the lives of senior citizens as well as the lives of people of all age groups.

ATP funds high-risk and innovative technologies through partnerships with the private sector. The purpose of ATP is to strengthen the nation's technological foundation, which has long since been determined necessary for sustained U.S. economic growth. ATP accomplishes its mission by providing federal funds to support R&D projects that would either not have been undertaken at all, or in a timely fashion, due to the high technical

¹ "Baby Boom Brought Biggest Increases Among People 45-to-54 Years Old" Economics and Statistics Administration. U.S. Census Bureau October 3, 2001. <<http://www.census.gov/Press-Release/www/2001/cb01cn184.html>>

² "We The People: Aging in the United States" Yvonne J. Gist and Lisa I. Hetzel. U.S. Census Bureau. Census 2000 Special Reports. December 2004. CENSR-19.

³ Table 2a. "Projected Population of the United States, by Age and Sex:2000 to 2050." U.S. Census Bureau, 2004. <<http://www.census.gov/ipc/www/usinterimproj/>>

risk nature of the project. ATP projects have the potential to address issues related to the aging of the U.S. population, including (i) chronic disease; (ii) independent living devices; (iii) tissue engineering; and (iv) organ transplantation.

Addressing Chronic Disease

- ❖ **Heart disease is the leading cause of death among the elderly.** *Osiris Therapeutics Inc., Baltimore, MD*, has derived bone marrow from mesenchymal stem cells (MSC), which have been shown in animal models to enhance the repair of the area of ischemia. The cardiac recovery of the MSC treated animals is significantly improved compared to conventional therapy. **(in clinical trials)**
 - If successful, a cardiac patient will have stem cells implanted within the heart tissue, which will heal without scarring.
- ❖ **Approximately 350,000 coronary artery bypass surgeries** are performed each year in the United States. This procedure may be enhanced by the use of a small diameter vascular prosthesis made from synthetic grafting materials. The new prosthesis possesses long-term mechanical properties similar to that of natural tissue. *Kensey Nash Corporation, Exton, PA*. **(in pre-clinical trials)**
 - This type of prosthesis is expected to replace the harvesting of the patient's own saphenous vein from the leg, thereby reducing patient trauma.
 - Reduction in surgical time and medical costs are also anticipated.
- ❖ **Alzheimer's disease affects as many as 4.5 million Americans**. About 5 percent of men and women between the ages of 65 and 74 have Alzheimer's disease, and nearly half of those age 85 and older may have the disease. Alzheimer's disease is being addressed through computer applications designed to monitor and remediate cognitive decline in older adults by tracking a user's interactions with computers in their homes. *Spry Learning Company, Portland, OR* **(awarded in 2004)**.
 - Early detection of cognitive impairment could make a significant difference in the ability to delay the onset and effectively treat the disease.
 - Early intervention is likely to provide significant health benefits, cost savings, and independence to elders and their family caregivers.

- ❖ **Osteoporosis is a major health threat for 44 million Americans**, 68% of whom are women. The occurrence of osteoporosis increases with age, yet few are aware they have the disease and even fewer receive therapy. Analysis of bone microarchitecture is expected to provide more accurate detection and better management of patients with the disease. *Imaging Therapeutics, Inc., Foster City, CA. (in clinical trials)*
 - Rapid, low-cost methods for accurately measuring bone microarchitecture that enables widespread detection of disease as well monitoring response to treatment.
- ❖ **Arthritis affects one in every two people over 65 years of age**. Using advanced imaging technologies to analyze magnetic resonance images (MRI's) of joints, cartilage degeneration diagnoses within the joint can be used to screen patients providing information on treatments such as surgery or drugs and verifying success of a particular therapy over time. *Imaging Therapeutics, Inc., Foster City, CA. (in prototype)*
 - Detailed three-dimensional visualizations of affected joints offer physicians a more effective method of treating musculoskeletal disease.

Providing Independent Living

- ❖ **ATP funding helps elders live more independently**. *Honeywell International, Inc., Minneapolis, MN. (available in late 2005)*
 - An automated system called Independent Lifestyle Assistant (I.L.S.A.) will monitor the senior at home, noting activity level and whether medications have been taken on schedule.
 - I.L.S.A. uses a variety of sensors and wireless communications devices located throughout the home that offer telephone or wireless web reminders to take medication. The system maintains privacy and secure communication, and it can alert a third party, such as a caretaker, when assistance may be required.

- ❖ **Wearable transdermal patches** offer a painless, precisely controlled, and timed administration of any drug, including pills and injectibles. *StrataGent Life Sciences, Inc., Los Gatos, CA. (in pre-clinical trials)*
 - Wearable transdermal patches offer more accurate and improved compliance due to ease of use and reduced frequency of administration, which is particularly beneficial to patients that suffer from memory impairment and provides:
 - Enhanced therapeutic effect by maintaining steady levels of drug in the blood.
 - Elimination of undesirable side effects that result from erratic dosage taking.

- ❖ **Orthopedic injuries** including cartilage, knee joint and tendon, are being repaired using synthetic bioabsorbable polymers. As the population ages, major clinical issues have emerged for orthopedic and cardiovascular disease and trauma that cannot be properly addressed with the currently used material base. *Integra Life Sciences Corp., Plainsboro, NJ. (in commercialization)*
 - Polymeric implant materials are being designed for use in tissue regeneration with a focus on orthopedic applications. The new polymers are degradable without generating excessive amounts of acidic by-products, thus improving biocompatibility and utility in a wide range of medical implants.

Improving Health through Tissue Engineering and Organ Transplantation

- ❖ **T cells, a key part of the body's immune system,** are tailored to fight specific diseases. *Cytomatrix, LLC, Woburn, MA. (in prototype)*
 - Using tissue engineering to manufacture an “artificial thymus” bioreactor to generate large quantities of T lymphocytes or T cells in the laboratory. The thymus is a glandlike structure, which is the site for T cell development in the body.
 - These T cells, which play a key role in the body's immune system, can be used for the research and development of cellular products and services to treat cancer, prevent viral and bacterial infections, and reconstitute the immune system.

- ❖ **Bed Sores** can be treated using tissue-engineered products. A major obstacle to the use of skin substitutes has been the ability to effectively preserve and transport samples. Traditional cryogenic preservation techniques induce tissue damage. *Stratatech Corporation, Madison, WI. (in development)*
 - An ice-free freezing process called vitrification, followed by drying may enable room-temperature preservation and shipping of living cells, tissues, and tissue-engineered products.
 - Extended shelf life of tissue-engineered products will enable storage at the point of care and expand applications to unhealable diabetic foot ulcers, burns, and large skin wounds.

- ❖ **Each year over 1 million Americans suffer from damaged cardiovascular tissue or heart attacks.** Although most survive the heart attack, they are at risk of developing many complications that may severely limit their lifestyle and incur significant healthcare expenses. Damaged cardiovascular tissue can be repaired by use of a “scaffold” made from biomaterials using a patient's own cells. *Tepha, Inc., Cambridge, MA. (in animal testing)*
 - Tissue engineered materials can restore defective cardiovascular tissues which, over time, are expected to be completely absorbed by the body.
 - Living tissue replacement could potentially have life-long durability.

- ❖ **In 2003, there were 25,467 organ transplants** performed in the United States. Once a risky medical procedure, organ transplantation has become commonplace. But there remains a risk of organ rejection as well as a growing shortage of organs from human donors. *Revivicor Inc., (formerly PPL Therapeutics), Blacksburg, VA. (in pre-clinical trials)*
 - The use of pig organs and tissues is a promising solution for overcoming significant obstacles from organ rejection and for addressing the current shortage of organs.
 - *Revivicor* has developed genetically altered pigs, with a specific gene inactivated, that prevents hyperacute rejection of the transplanted tissue.

Factsheet 1.B4 (March 2005 by Richard Spivack)