Nonhuman Primates

The Essential Need for Animals in Medical Research

Introduction

Medical advances are usually built on a foundation of basic biomedical research and the application of newly found knowledge is often proved feasible in nonhuman primate (NHP) models. Although irreplaceable in many types of research, only about 1/4 of one percent of animals used in research in the U.S. are NHPs and most of these animals are species of monkeys, not chimpanzees or other great apes. Historically, the polio vaccine, blood transfusions, and organ transplantation among many other advances could not have been possible without NHP research. Following are but some of the health concerns currently being investigated to which NHPs are making lifesaving and life-improving contributions.

Brain Function, Cognition & Mental Illness

NHPs are invaluable animal models for studying human brain function and neurological diseases. Research with nonhuman primates is contributing to our knowledge of the cause of and the effectiveness of proposed treatments for Alzheimer's disease. Such models also have been crucial to improving available treatments of Parkinson's disease, including the development of dopamine agonists and deep brain stimulation. Furthermore, forms of affective disorders, such as major depression, Tourette syndrome, and anxiety disorders, like Obsessive Compulsive Disorder (OCD), that were formerly thought resistant to all available therapies are now being treated using deep-brain stimulation, which was pioneered in NHPs. NHPs have made unique contributions to our understanding of cognitive aging and to the search for possible methods to prevent cognitive declines with age.

Children's' Health

In a major finding, NHP research has defined a link between maternal auto-antibodies and increased risk of a child having autism. Also NHP studies have begun on the long-term effects of oxytocin, a new treatment already being used in children with autism.

Since they possess key features of human lung architecture and immunity, NHPs are essential for studying chronic lung diseases, their origins and treatments for all age groups, but particularly children. For example, a recent NHP study of steroid use inchildhood asthma has provided important data about the disruptive impact on lung development of the common therapy. Since tests cannot be performed in healthy children for ethical reasons, infant monkeys provide data on the long-term health effects of environmental exposures such as ozone, tobacco and other allergens.

Research with marmoset monkey embryos greatly contributed to our understanding of the tragic effects of thalidomide. Before a public health disaster occurs, many biologically active compounds that have been shown to cause birth defects (teratogenesis) in other species are evaluated in monkeys to discover if they could potentially cause birth defects in humans. Thus, NHP research helps to prevent birth defects and reduce the infant mortality rate.

Genetics & Personal Medicine

NHPs share with humans fundamental genetic processes relevant to specific diseases, which other mammalian species often lack. Therefore, analyses of NHPs are providing unique information helping scientists to understand how genetic variance influences individual differences in risk for and treatment of disease. For example, KLK3, the gene that produces prostate-specific antigen (PSA) and is associated with prostate cancer is found only in humans and monkeys. Polycystic ovary syndrome, a cause of infertility and other health risks, is another of the numerous examples of disease processes influenced by gene differences among individuals and this condition also occurs in primates. As scientists identify more genomic biomarkers predictive of disease progression and therapeutic response, it is likely NHPs will be the best model in which to investigate personalized treatments in advance of human studies.

Atherosclerosis of the coronary arteries and its complications are the principle processes that result in coronary heart disease (CHD), suffered by people and other primates, which remains a leading cause of death and disability. When it is not feasible or appropriate for humans to participate in experiments, NHP models provide the advantage of being most similar in terms of the origins of disease and

arterial pathology, including reproductive and central nervous system characteristics that promote or protect against atherosclerosis. In addition, since all primates depend upon social relationships, NHPs sometimes serve as human surrogates in studies related to psychosocial stress, a recognized CHD risk.

Infectious Diseases, such as Ebola, AIDS and Malaria

The global response to the recent Ebola virus crisis demonstrates how essential NHPs are to infectious disease research. Promising Ebola vaccine candidates, including those now undergoing human trials, were tested first in NHPs. Following decades of their participation in development of vaccines for humans, captive research chimpanzees were the test subjects to help preserve their own species in the wild. In 2013 six chimpanzees received an experimental vaccine against the Ebola virus[1], a leading cause of death in wild chimpanzees and gorillas, and it proved to be both safe and capable of inducing an immune response. Since the use of captive research chimpanzees, always rare, must now meet extraordinary ethical criteria for approval, the continued availability of other NHPs models is even more critical.

In view of the similarity of human and NHP immune systems, monkeys are the only suitable model for acquired immunodeficiency syndrome (AIDS), when humans cannot be studied for ethical reasons. Thanks to therapeutic methods discovered because of research done with monkeys infected with simian immunodeficiency virus (SIV), HIV is no longer an impending death sentence, but a manageable condition. Today, work involving NHPs continues to expand our understanding of how human immunodeficiency virus (HIV) persists in the body during antiviral treatment and facilitates the development of new HIV treatments that can improve life expectancy and quality of life for HIV positive individuals. Beyond treatments, NHP research is crucial to the struggle to develop an HIV vaccine. Likewise, the search for a vaccine against malaria, a blood disease that infects over 350 million people annually, is dependent on the use of NHPs in biomedical research. New World monkeys (along with chimpanzees) are the only species susceptible to the same strains of malaria parasites as humans[2], and thus the most suitable models for vaccine evaluation.

Stem Cells

Pluripotent stem cells are being used to grow many different types of cells – heart muscle, brain, pancreas, liver, retinal, blood, bone and many more cells. Cultures of these cells can be used to test new drugs for toxicity and effectiveness. These powerful cells are moving out of the laboratory and into preclinical (animal) trials and early human clinical trials to treat disease. The first successful isolation and culture of embryonic stem cells took place at the University of Wisconsin National Primate Research Center in rhesus monkeys (1995), marmosets (1996), and humans (1998). Induced pluripotent stem cells were created using adult human cells in 2007. This last accomplishment was a major breakthrough not involving the use or destruction of embryos or fetal tissue.

Many More . . .

NHPs remain important for safety assessment testing of any new drug before its administration to human volunteers. Cross-species testing is a necessary requirement for demonstrating the safety of novel compounds. Thus far, although they are part of the testing process, cells grown in dishes or developed in computers have not been able to replace the study of live animal models.

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