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Dated: December 1, 2003.

Reesa Nichols,

NCI Project Clearance Liaison.

[FR Doc. 03–30495 Filed 12–8–03; 8:45 am]

BILLING CODE 4140–01–M

DEPARTMENT OF HEALTH AND HUMAN SERVICES

National Institutes of Health

Government-Owned Inventions; Availability for Licensing

AGENCY: National Institutes of Health, Public Health Service, DHHS.

ACTION: Notice.

SUMMARY: The inventions listed below are owned by an agency of the U.S. Government and are available for licensing in the U.S. in accordance with 35 U.S.C. 207 to achieve expeditious commercialization of results of federally-funded research and development. Foreign patent applications are filed on selected inventions to extend market coverage for companies and may also be available for licensing.

ADDRESSES: Licensing information and copies of the U.S. patent applications listed below may be obtained by writing to the indicated licensing contact at the Office of Technology Transfer, National Institutes of Health, 6011 Executive Boulevard, Suite 325, Rockville, Maryland 20852–3804; telephone: (301) 496–7057; fax: (301) 402–0220. A signed Confidential Disclosure Agreement will be required to receive copies of the patent applications.

A Mouse Model for Systemic Inflammation in Glucocerebrosidase-Deficient Mice With Minimal Glucosylceramide Storage

Richard L. Proia (NIDDK). DHHS Reference No. E–256–2003/0—Research Tool. *Licensing Contact:* Susan Carson; (301) 435–5020; *carsonsu@mail.nih.gov.*

Gaucher disease, the most common lysosomal storage disease, is an inherited metabolic disorder in which harmful quantities of the lipid glucocerebroside accumulate in the spleen, liver, lungs, bone marrow and in rare cases in the brain, due to a deficiency of the enzyme glucocerebrosidase (Gba) that catalyses the first step in the biodegradation of glucocerebrosides. Type 1 Gaucher disease is the most common and is distinguished from the other forms of the disease, types 2 and 3, by the lack of neurologic involvement. The clinical features of Type 1 are heterogeneous, vary broadly in clinical severity and affect many organ systems. The major disease manifestations include enlarged spleen and liver, bone lesions, hematologic abnormalities and lung involvement. The disease has also been associated with a sustained inflammatory reaction. Gaucher disease is most prevalent in the Ashkenazi Jewish population with an incidence of approximately 1 in 450 persons while in the general public the incidence is 1 in 100,000. There are an estimated 30,000 Gaucher disease patients world-wide with approximately 3000 patients currently receiving enzyme replacement therapy which has been shown to be highly effective in treatment of the disease. The cost of therapy is approximately $100,000-$300,000 annually and is a life-long treatment, which makes the case for affordable new therapies urgent.

The etiology of the disease has been difficult to study due to the absence of viable mouse models for the disease, as a complete disruption of the glucocerebrosidase (Gba) gene results in rapid neonatal death. In an attempt to produce a viable model scientists at the NIDDK introduced a human Gaucher disease point mutation, L444P, into the mouse Gba gene in order to cause a partial enzyme deficiency (J. Clin. Invest (2002) 109, 1215–1221; Proc. Natl. Acad. Sci. USA (1998) 95, 2503–2508).

The mice exhibit a partial glucocerebrosidase deficiency (15–20% of normal activity), without bulk accumulation of glucosylceramide or the presence of Gaucher cells. The mice demonstrate other clinical features of Gaucher disease, including multisystem inflammation, B cell hyperproliferation, skin abnormalities, anemia and lymphadenopathy. These mice provide a useful model for studying certain aspects of Gaucher disease pathology and in evaluating new therapeutic treatments.

Tec Kinase Deficient Mice

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DHHS Reference No. E–178–2003/0 and DHHS Reference No. E–178–2003/1—Research Tools.

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Stimulation of T lymphocytes through the T Cell Receptor (TCR) elicits broad responses required for proper immune function, including cell proliferation, cytokine production and apoptosis. Activation of distinct families of tyrosine kinases (Zap-70, Src) are important in TCR signalling, while the role of other tyrosine kinases, such as the Tec Kinases Rlk and Itk is less clear. However, evidence suggests that these kinases play a role in CD4+ T helper (Th) cell differentiation. Responses to infection are regulated in part by two distinct types of T helper cells, type 1 (Th1) and Th2 subclasses which produce different cytokines and have discrete effector functions. Th1 cells produce interferon-gamma (IFN-gamma), which is a key mediator of cellular immunity. In contrast Th2 cells produce interleukin 4 (IL–4), Il–5, Il–10, and Il–13 which assist humoral immunity and dominate immune responses to both helminths and allergens. Regulation of these subclasses is important not only for normal immune response, but also for abnormal disease processes, including autoimmunity and hypersensitivity. Generation of type 1 and type 2 Th cells is influenced by multiple factors including cytokines, costimulation and TCR-based signals. Understanding the mechanisms and signals important in T cell signalling is important for identifying new therapeutics that target Th1 and Th2-mediated pathologies (for example autoimmune disorders and asthma, respectively).

The Tec family of tyrosine kinases have been implicated as important mediators of polarized cytokine production and Th2 cell differentiation. Rlk is preferentially expressed in Th1 cells and Itk is important in Th2 response. Numerous studies have implicated alterations in the strength of TCR-mediated signals as playing important roles in Th cell differentiation. Researchers at the NIH have developed transgenic mouse models in order to address these issues. Rlk-deficient mice and Rlk/Itk double-deficient mice were generated and have been shown to have defects in TCR responses including proliferation, cytokine production and apoptosis in vitro and adaptive immune response to infectious agents in vivo (Science (1999) 284, 638–641; Nature Immunol (2001) 2: 1183–188). Molecular analyses of cells from these mice indicate that these kinases are critical for proper regulation of phospholipase C, calcium mobilisation and ERK activation as well as activation of downstream transcription factors in response to T cell receptor stimulation. Defects are minor in Rlk-deficient animals and most severe in Rlk/Itk double-deficient mice.

These mice provide a useful mechanistic model for dissecting out the complex interactions of TCR signalling. Additionally, the mice are useful for evaluation of therapeutics directed at specific classes of diseases (Th1 or Th2) and the utility of potential global Tec kinase inhibitors.

A Mouse Model for Type 2 Diabetes

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DHHS Reference No. E–132–2003/0—Research Tool.

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Diabetes affects over 120 million people worldwide (16 million in the US) and is a major health problem with associated health costs estimated at almost $100 billion dollars. Type 2 diabetes affects as many as 10% of the population of the Western World (with 15 million patients in the U.S. alone) and arises from a heterogeneous etiology, with secondary effects from environmental influences. Risk factors for type 2 diabetes include obesity, high blood pressure, high triglycerides and age. Type 2 diabetes is an active area for drug development and there continues to be a need for novel animal models and research tools to aid in the discovery and development of new, more efficient and cost-effective therapeutics.

Peripheral insulin resistance and impaired insulin action are the primary characteristics of type 2 diabetes. The first observable defect in this major disorder occurs in muscle, where glucose disposal in response to insulin is impaired. In an effort to study the progression of diabetes, researchers at NIDDK have developed a transgenic mouse strain (MKR) with a dominant-negative insulin-like growth factor-I receptor (KR–IGF–IR) specifically targeted to skeletal muscle (Genes & Development (2001) 15, 1926–1934). Expression of KR–IGF–IR resulted in the formation of hybrid receptors between the mutant and the endogenous IGF–I and insulin receptors, thereby abrogating the normal function of these receptors and leading to insulin resistance. Pancreatic β-cell dysfunction developed at a relative early age, resulting in diabetes.

One of the great advantages of the MKR mouse over other mouse models is the early onset of the disease phenotype as seen by insulin resistance (as early as 4 weeks), fasting hyperglycemia (from 5 weeks) and abnormal glucose tolerance (at 7–12 weeks). The MKR mice provide an extremely useful model for the study of type 2 diabetes, its pathogenesis and potential new therapies.

A Tet-Regulated Mouse Model for Cataract

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Cataract is the most common cause of blindness worldwide, with an estimated 25 million blind and 119 million visually impaired individuals worldwide. Over 20 million adults in the U.S. alone are currently diagnosed with cataracts making this disease a major health concern. The incidence of cataract increases with age and a number of etiologic factors have been proposed in the pathogenesis of age-related cataract in humans including genetic factors, environmental factors and metabolic and biochemical changes in the crystalline lens. Ultraviolet radiation exposure and oxidative injury to the lens has been considered by some to be one of the most important factors in cataractogenesis. The present therapy of choice for cataract is laser surgery.

Experimental investigation of human age-related cataract is hindered by a lack of available animal models of cataract. Several laboratory mice strains with heritable cataracts have been studied including the Nakona, Frasier and the Philly mouse strains. An animal model with a predictable phenotype of cataract, particularly one with a pathogenesis relating to oxidative injury to the lens (the proposed central factor in human-related cataract) would be of great value to ophthalmic researchers and in the development of pharmacological agents for delaying or preventing cataract.

Researchers at the NIEHS have developed a transgenic mouse model in which the DNA repair gene DNA polymerase β (β-pol) is highly over-expressed in the lens epithelial cells of the eye (DNA Repair (2003) 609–622). A bicistronic tetracycline-responsive transgenic system was used to over-express β-pol in mice. Over-expression of β-pol in the lens epithelium results in the early onset of severe cortical cataract with cataractogenesis beginning within 4 days after birth. In utero and post-natal suppression of transgenic Flag-β-pol-expression by doxycycline administration completely prevents cataract formation through adulthood, yet cataract is subsequently observed following removal of doxycycline and re-expression of the transgene. This predictable and regulated onset of cataract makes this mouse an ideal animal model both for evaluating new therapeutics for delaying or preventing cataract as well as for understanding the mechanisms responsible for cataract formation.

A Mouse Model for Human Osteoarthritis

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Osteoarthritis (OA) is the most common form of arthritis and affects more than 20 million Americans, costing billions of dollars in health care annually. Osteoarthritis is caused by the breakdown of joint cartilage, leading to a loss of the cartilage ''cushion'' between the bones of the joints. Risk factors associated with OA include age, obesity, traumatic injury and overuse due to sports or occupational stresses. There is no cure for OA and current treatments are directed at the symptomatic relief of pain, and at improving and maintaining joint function. There remains, however, a critical need both to develop OA treatments that focus on slowing down the degenerative process of the disease and for validated animal models to test these new treatments. NIH scientists at the NIDCR have generated a mouse model for osteoarthritis (FASEB J. (2002) 16, 673–680) that fills one part of this important gap.

The mouse model is a double knockout mouse that lacks biglycan and fibromodulin, two members of the small leucine-rich proteoglycan family, and that spontaneously develops OA. All the hallmarks of human osteoarthritis are present, including: progressive degeneration of the articular cartilage from early fibrillation to complete erosion, subchondral sclerosis, an absence of inflammation and development of osteophytes and cysts. Advantages over the existing models for osteoarthritis include: high phenotypic penetrance, early onset (at 1–2 months) and a rapid disease progression (between 3–6 months) which can be accelerated by moderate levels of exercise, such as treadmill running. These properties, combined with a normal life span, make the biglycan/fibromodulin-deficient mouse an ideal animal model for evaluating new drugs and treatments for osteoarthritis.

Dated: December 1, 2003.

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[FR Doc. 03–30496 Filed 12–8–03; 8:45 am]

BILLING CODE 4140–01–P