Tissue With Stellate Cells Whose Function Is Communication

Pericyte Biology in Different Organs
Cellular and Molecular Mechanisms Underlying the Pathogenesis of Hepatic Fibrosis
Transactions of the American Surgical Association
CCN Proteins
Cells—Advances in Research and Application: 2012 Edition
Signaling Pathways in Liver Diseases
State of the Art of Hepatology
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Cytokines and Cell Homeostasis in the Gastroinstestinal Tract
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3D Bioprinting
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Interleukin (IL)-13 Induces Connective Tissue Growth Factor Via TGF-beta Independent Smad Signaling in Rat Hepatic Stellate Cells
Stellate Cells in Health and Disease
Network Neuroscience
Tissue Repair, Contraction and the Myofibroblast
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Liver Myofibroblasts

Cooperation of Liver Cells in Health and Disease
Proteases in Gastrointestinal Tissues
Liver Diseases

AVILA RONNIE

Pericyte Biology in Different Organs
Springer Nature
This detailed volume explores hepatic stellate cells, which have become a spotlight of liver cell biology due to their pleiotropic functions that extend well beyond extracellular matrix production to pivotal roles in hepatic homeostasis, immunity, and metabolism. The book features methods to isolate, evaluate, and manipulate this cell type in an effort to elucidate hepatic biology and establish prospects for treating disease. Written for the highly successful Methods in Molecular Biology series, chapters include introductions to their respective topics, lists of the necessary materials and reagents, step-by-step and readily reproducible laboratory protocols, as well as tips on troubleshooting and avoiding known pitfalls. Authoritative and practical, Hepatic Stellate Cells: Methods and Protocols serves as an ideal aid to help researchers accelerate the

outstanding science that has steadily unveiled the mysteries of stellate cell biology and their role in disease.

Cellular and Molecular Mechanisms Underlying the Pathogenesis of Hepatic Fibrosis

ScholarlyEditions

Revealing essential roles of the tumor microenvironment in cancer progression, this volume focuses on non-hematopoietic cells within the tumor microenvironment.Further, it teaches readers about the roles of distinct constituents of the tumor microenvironment and how they affect cancer development. Topics include fibroblasts, adipocytes, mesenchymal stem cells, stellate cells, and more. Taken alongside its companion volumes, Tumor Microenvironment: Non-Hematopoietic Cells updates us on what we know about the different aspects of the tumor microenvironment as well as future directions. Useful for introducing the newer generation of researchers to the history of how scientists focused in the tumor microenvironment and how this knowledge is currently applied for cancer treatments, it will be essential reading for advanced cell biology and cancer biology students as well as researchers

seeking an update on research in the tumor microenvironment. All of the chapter authors are renowned international experts in the cancer biology field in specific subfields that will be the focus of their chapters.

Transactions of the American Surgical Association

Hepatic Stellate Cells

It is only during the last decade that the functions of sinusoidal endothelial cells, Kupffer cells, hepatic stellate cells, pit cells and other intrahepatic lymphocytes have been better understood. The development of methods for isolation and co-culturing various types of liver cells has established that they communicate and cooperate via secretion of various intercellular mediators. This monograph summarizes multiple data that suggest the important role of cellular cross-talk for the functions of both normal and diseased liver. Special features of the book include concise presentation of the majority of detailed data in 19 tables. Original schemes allow for the clear illustration of complicated intercellular relationships. This is the first ever presentation of the newly emerging field of liver biology, which is important for hepatic function in health and disease and

opens new avenues for therapeutic interventions.

CCN Proteins

Academic Press

The present book is an attempt to describe the most recent developments in the area of pericyte biology which is one of the emergent hot topics in the field of molecular and cellular biology today. Here, we present a selected collection of thirteen detailed chapters on what we know so far about pericytes in distinct organs in physiological and pathological conditions. Further, it provides an update on the most novel functions attributed to these cells and will introduce a newer generation of researchers and scientists to the importance of these cells, ranging from their discovery in different organs through current state-of-the-science. It will be invaluable for both advanced cell biology students as well as researchers in cell biology, stem cells and vascular research. This volume explores pericytes' physiologic roles in different tissues, ranging from the pancreas, lungs and liver through skeletal muscle, gut, retina and more. Together with its companion volumes Pericyte Biology in Disease and

Pericyte Biology – Novel Concepts, Pericyte Biology in Different Organs presents a comprehensive update on the latest information and most novel functions attributed to pericytes. To those researchers newer to this area, it will be useful to have the background information on these cells' unique history. It will be invaluable for both advanced cell biology students as well as researchers in cell biology, stem cells and researchers or clinicians involved with specific organs.

Cells—Advances in Research and Application: 2012 Edition

Springer Science & Business Media

This essential volume presents comprehensive information on cell death and autophagy in liver diseases, including the role and molecular signaling pathways of cell death in alcohol and non-alcoholic fatty liver disease, bile acids, hepatitis C virus and drug-induced liver injury. The book starts with a discussion of lipotoxicity in non-parenchymal cells, followed by a discussion of cell death and autophagy in cholangiocytes, hepatic stellate cells and Kupffer cells in hepatic biliary diseases, fibrosis and

liver inflammation. The book also covers Bcl-2 family proteins, beta-catenin and HMGB1 signaling in regulating cell death in the liver as well as mitochondria, ER stress and gut microbiota on liver injury. The Cell Death in Biology and Diseases series has recruited world experts ranging from basic scientists to clinicians on cell death in liver diseases. Likewise the contributors of this volume are leaders in their fields with worldwide expertise and perspective. Molecul es, Systems and Signaling in Liver Injury is an essential companion to Hepatocytes and Non-Parenchymal Cells and Diseases. It is beneficial for both clinicians and basic scientists and is relevant to those working on drug discovery for preventing and treating liver diseases by targeting cell death and autophagy pathways. *Signaling Pathways in Liver Diseases* Springer Recapitulating The Stem Cell Niche Ex Vivo, Volume Six in the Advances in Stem Cells and their Niches series, highlights new advances in the field, with this new volume presenting interesting chapters on a variety of topics, including Recapitulating the bone marrow stem cell niche ex vivo, The generation of the liver ex vivo, Recapitulating the thymic

stem cell niche ex vivo, Recapitulating the intestinal epithelium stem cell niche ex vivo, Recapitulating the lung stem cell niche in vitro, Recapitulating mammary tissue in vitro, and Recapitulating muscle in vitro. Provides the authority and expertise of leading contributors from an international board of authors Presents the latest release in the Advances in Stem Cells and their Niches series Includes the latest information on Recapitulating the stem cell niche ex vivo

State of the Art of Hepatology

BoD – Books on Demand

This text advances fundamental knowledge in modeling in vitro tissues/organs as an alternative to 2D cell culture and animal testing. Prior to engineering in vitro tissues/organs ,the descriptions of prerequisites (from pre-processing to post-processing) in modeling in vitro tissues/organs are discussed. The most prevalent technologies that have been widely used for establishing the in vitro tissue/organ models are also described, including transwell, cell spheroids/sheets, organoids, and microfluidic-based chips. In particular, the authors focus on 3D bioprinting in vitro tissue/organ models using

tissue-specific bioinks. Several representative bioprinting methods and conventional bioinks are introduced. As a bioink source, decellularized extracellular matrix (dECM) are importantly covered, including decellularization methods, evaluation methods for demonstrating successful decellularization, and material safety. Taken together, the authors delineate various application examples of 3D bioprinted in vitro tissue/organ models especially using dECM bioinks.

Transactions of the Meeting of the American Surgical Association

Springer Science & Business Media

1969- includes the association's Minutes, previously published separately.

Cytokines and Cell Homeostasis in the Gastroinstestinal Tract

ScholarlyEditions

Nelson Fausto

The Greek myth of Prometheus with its picture of a vulture feasting on its chained victimhas traditionallyprovided a visualimageofliverregeneration. Itis apowerful and frightening representation but ifone were to substitute the vulture by a surgeon and Prometheus by a patient laying on a properly prepared operating table, the

outcomeofthe procedurewou ld not differ significantlyfro m that describedbyGr eek poets. Yet few of us who work in the field have stopped long enough to ask where this myth originated. Did the poet observe a case of liver regeneration in a human being? Was it brilliant intuition or perhaps, literally, just a 'gut feeling' of a poet looking for good rhymes that led to the prediction that livers grow when part of the tissueisremov ed? Thisbookdoes notattemptto solve these historical issues. Itdoes, instead, cover in detail some of the major modem themes of research on liver regen eration, injury and repair. As indicated in Dr. N. Bucher's chapter, the modem phase ofexperimenta l studies on liver regeneration started in 1931 with the publication by Higgins and Anderson of a method to perform a two-thirds resection of the liver of a rat. The technique described has 3 remarkable features: 1) it is highly reproducible, resulting in the removal of 68% of the liver, 2) it has minimal if any mortality, and 3) it consists only of blood vessel ligation and does not involve cutting through or wounding hepatic tissue. Landes Bioscience Worldwide, liver fibrosis is a major cause of morbidity

and mortality and is associated with a high medical and economic burden. It is the common consequence of chronic liver injury due to various etiologies. During fibrogenesis, there is a progressive substitution of the liver parenchyma by scar tissue. Recent advances in the understanding of the history of liver fibrosis have shown that the pathogenesis is driven by different cell types and a large variety of soluble mediators. At present, scientists working in this field aim to increase basic knowledge, improve diagnostics, and try to translate experimental findings into new treatment modalities. This book includes 12 selected contributions from the Special Issue “Cellular and Molecular Mechanisms Underlying the Pathogenesis of Hepatic Fibrosis” that was published in Cells. These articles summarize current perspectives and findings in hepatic fibrosis research showing how scientists try to use basic scientific research to create new therapies and diagnostics.

Hepatic Stellate Cells

Academic Press

Tissue-specific stem cells have the capacity to self-renew and differentiate into several types of functional cells that replenish lost

cells throughout an organism?s lifetime. Studies on stem cells from diverse systems have shown that stem cell function is controlled by extracellular cues from the niche and by intrinsic genetic programs within the stem cell. The objectives of this book would be to review the molecular mechanisms that mediate the balanced response of stem cells to the needs of the organisms. Likewise, niches have also been linked to pathologies, by imposing aberrant function on stem cells or other targets. Therefore, the second objective of this book would be to highligh the molecular dysregulation of niche biology leading to the disease. The third objective would be to review the therapeutical targets described within stem cell niches.

3D Bioprinting Springer Nature

Issues for 1880-1934 include papers read before the Association at the meeting.

Recapitulating the Stem Cell Niche ex Vivo University-Press.org

The gastrointestinal tract has a number of unique features. Its extensive surface is formed by a single layer of rapidly renewing cells, the intestinal epithelial cells. These cells are in contact with a

number of other cell populations, including the largest part of the immune system, and with an excessive luminal antigen load, including vast numbers of bacteria. Furthermore two more organs, namely liver and pancreas, are part of the system. The rapid renewal of the epithelial layer, the interactions of different cell types, and the balance between cell proliferation and death, have been fascinating subjects of studies in recent years. Much has been learned, and cytokines have emerged as important mediators for all these interactions and homeostatic systems. This book, the proceedings of the Falk Symposium 113 on `Cytokines and Cell Homeostasis in the Gastrointestinal Tract', held in Regensburg, Germany, 16-18 September 1999, provides a forum for basic scientists and interested clinicians to exchange ideas, to discuss concepts and to plan further studies.

The Tissues and Their Structure. A Description of the Elementary Tissues of the Human Body

Springer Science & Business Media

Cytokine Effector Functions in Tissues discusses the cytokines networks in

the context of the specific-tissue environment. It is an up-to-date collection of articles that addresses the specific issue of how the cytokines are able to condition tissue specific homeostasis. The book helps the reader understand how cytokines network inside the tissues and highlights whether tissue-protection or exacerbation will be finally controlled. It describes the cytokines detected and regulated in different tissues, such as the brain, lungs, spleen, liver, pancreas and intestine, also addressing the issue of timing in specific cell types. Categorizes the cytokines based primarily on tissue and target cells Emphasizes different roles and outcomes observed during innate and adaptive response Represents a rapid guide to cytokines in health and disease in tissue and organ context Presents a different view on how known mediators may work if analyzed in a different perspective, determining the final outcome on tissue-specific target cells

Signaling Pathways in Liver Diseases

Academic Press

Signaling Pathways in Liver Diseases, Third Edition again provides hepatologists and hepatology researchers with an expert overview of

the complex and novel cellular/extracellular signaling pathways in the liver, and their role in liver diseases. The last few years have seen a great number of developments in this field, which in turn have led to new opportunities for innovative treatments; however, the intricacy of these pathways and their interactions continue to provide a real challenge for clinicians. This outstanding book compiles the emerging knowledge into a single expert resource, cataloguing and organizing it into an accessible and understandable format. With increased focus on the comprehension of cellular mechanisms involved in steatohepatitis, cirrhosis, and liver tumors, which has led to changes in the management of these diseases, this new edition also sees the introduction of exciting new chapters on key emerging areas such as: Autophagy Notch Pathway P13K/PTEN Signaling in Liver Diseases Sirtuins Hepcidin and Iron Epigenetic Regulation of Hepatic Stellate Cells and Liver Fibrosis Oxidative Stress and Signaling in the Liver. Professors Dufour and Clavien have assembled an all-star cast of chapter authors, each of whom has provided clear and

appropriate illustrations to reinforce the text, with a key points box offering a concise and handy summary. Self-assessment questions and answers allow the reader to test their own knowledge. Signaling Pathways in Liver Disease, Third Edition is the perfect educational and reference tool to bridge the information exchange between the laboratory, the clinical ward, and the operating room, and an essential tool for the modern-day hepatologist.

Adult Stem Cell Niches

Academic Press

Hepatic fibrosis and cirrhosis are the common endpoint of a variety of liver diseases and represent a major global health burden. The current model for hepatic fibrosis development is that progressive injurious stimuli lead to dysregulation of extracellular matrix (ECM) turnover. Activation of the hepatic stellate cell (HSC) has been identified as the key cellular event resulting in the accumulation of extracellular matrix (Friedman 2008) and therefore there is considerable interest in factors that regulate HSC activation and collagen expression. There is a strong linkage between inflammation, coagulation and fibrosis

(Tacke, Luedde et al. 2009). One proposed mechanism for this linkage is signalling by coagulation factors through their cellular receptors protease-activated receptors (PARs) to activate stellate cells (Anstee, Wright et al. 2009).This thesis has explored the role of PAR-1, PAR-2 and the cytoplasmic domain of tissue factor in the development of hepatic fibrosis. The close relationship between the coagulation cascade and the inflammatory response led to the hypothesis that coagulation factors and their receptors may play an important role in hepatic fibrogenesis. In order to mimic human liver disease processes, a mouse model was studied using carbon tetrachloride administration to generate liver fibrosis. Mice with deletion of the PAR-1 gene, PAR-2 gene, with deletion of the cytoplasmic domain of TF and with dual deletion of PAR-2 gene and TF cytoplasmic domain were individually studied and compared to wildtype. Common fibrosis endpoints were studied in vivo. In vitro experiments were performed with a line of human hepatic stellate cells. Initial experiments demonstrate

PAR-1 deficiency protects against liver fibrosis with reduced histological fibrosis, hydroxyprolin e content, TGF [beta] gene and protein expression seen. This adds evidence to support the view that PAR-1 is involved in hepatic fibrogenesis. PAR-2 deficiency was also found to afford protection from hepatic fibrosis. PAR-1 and PAR-2 activation also induce a profibrogenic phenotype in human hepatic stellate cells in vitro adding weight to the evidence these receptors are important in fibrosis development. In addition to its important role in haemostasis, tissue factor is increasingly recognised as a signalling receptor in a number of non coagulant roles. Deletion of the cytoplasmic domain of tissue factor led to reduction in profibrogenic cytokines, HSC activation and reduced macrophage recruitment and activation which supports the reduced hepatic fibrosis observed. Macrophages play a pivotal role as regulators of fibrosis. They are profibrogenic in fibrosis development but also play a role and are necessary for fibrosis resolution. The reduced macrophage recruitment and activation observed in the PAR-2 and mice with

deletion of the cytoplasmic domain of tissue factor may in part explain the amelioration of hepatic fibrosis seen in these mice. A single treatment to completely ameliorate fibrosis may be difficult to achieve given the complex and multiple pathways involved in ECM remodelling. Understanding the mechanisms of fibrosis provide a platform to develop antifibrotic therapies. This thesis has provided further insight into the role of PAR-1 and PAR-2 and the cytoplasmic domain of tissue factor in hepatic fibrogenesis. Both PAR-1 and PAR-2 antagonists are being developed and may represent a novel therapeutic approach in preventing fibrosis in patients with liver disease. The cytoplasmic domain of tissue factor is an attractive therapeutic target as the coagulation is not affected in the host, particularly important in patients with cirrhosis.

CCN Intercellular Signaling Proteins—Advances in Research and Application: 2012 Edition

Frontiers Media SA

This volume explores the latest collection of cell models that are used in preclinical cancer research, and covers both two-dimensional and three-dimensional culturing techniques.

The chapters in this book are divided into two parts. Part One discusses two-dimensional cancer cell culture, cell models at the Air-Liquid Interface, and the latest advancements in three-dimensional complex spheroid models and dedicated disease animal models. Part Two contains technical chapters that illustrate step-by-step methodologies for specific cancer cell culture methods. The methods discussed range from the generation of isogenic cancer cell lines, the use of serum-free growth conditions, and three-dimensional cell cultures and their specific assays for the efficacy assessment of new anticancer therapies. Written in the highly successful Methods in Molecular Biology series format, chapters include introductions to their respective topics, lists of the necessary materials and reagents, step-by-step, readily reproducible laboratory protocols, and tips on troubleshooting and avoiding known pitfalls. Cutting-edge and comprehensive, Cancer Cell Culture: Methods and Protocols is a valuable tool to help researchers involved in this important field to further improve or advance their models for cancer

research. *Interleukin (IL)-13 Induces Connective Tissue Growth Factor Via TGF-beta Independent Smad Signaling in Rat Hepatic Stellate Cells* Frontiers Media SA Please note that the content of this book primarily consists of articles available from Wikipedia or other free sources online. Pages: 129. Chapters: Barrier cells, Blood and immune system cells, Blood cells, Connective tissue cells, Endocrine cells, Epithelial cells, Human cells, Motile cells, Nervous tissue cells, Spermatozoon, Red blood cell, Amoeboid, Melanocyte, Ovum, Cnidocyte, Haematopoiesis, Dendritic cell, Macrophage, Fibroblast, Microvillus, Microglia, Platelet, T helper cell, Astrocyte, Hematopoietic stem cell, B cell, CD4+ T cells and antitumor immunity, Telocytes, Neutrophil granulocyte, Eosinophil granulocyte, Regulatory T cell, Osteoclast, Megakaryocyte, Hair cell, List of distinct cell types in the adult human body, Sensory neuron, Natural killer cell, Rod cell, Cone cell, Mast cell, Plasma cell, Cytotoxic T cell, Monocyte, Erythropoiesis, Parietal cell, Endothelial progenitor cell, Retinal ganglion cell, Sertoli cell, Hepatocyte,

Osteoblast, Natural Killer T cell, Basophil granulocyte, Leydig cell, Paneth cell, Podocyte, Clara cell, Retina bipolar cell, Pericyte, Keratinocyte, Retina horizontal cell, Squamous epithelium, Kupffer cell, Reticulocyte, Erythrocyte aggregation, Myeloblast, Hepatic stellate cell, Neuroendocrine cell, Merkel cell, Basophil activation, Adipocyte, Goblet cell, Myofibroblast, Chromaffin cell, Retina amacrine cell, Codocyte, Somatotrope, Cerebellum granule cell, Proerythroblast, Chondrocyte, Rouleaux, Enterochromaffin cell, Koilocyte, Pseudostratified epithelium, Brush border, Respirocyte, Osteocyte, Hemocyte, Thyroid epithelial cell, Enterochromaffin-like cell, Simple cuboidal epithelium, Choanocyte, Simple columnar epithelium, Mesoangioblast, Gastric chief cell, Magnocellular neurosecretory cell, Ameloblast, Transitional epithelium, Nissl body, Cholangiocytes, Parafollicular cell, Target cell, Hypersegmented neutrophil, Human platelet antigen, Type II pneumocyte, Stromal cell, Myocyte, Tendon cell, Boettcher cell, APUD... Stellate Cells in Health and Disease BoD – Books on Demand (Cont.) This cell type, comprising a

small percentage of total liver cells (approximately 5-10%), rapidly change their phenotype in response to liver injury, and, similarly, upon being taken out of the liver and cultured in 2-D on tissue culture plastic. This cell type plays a major role in relaying signals to and from both parenchymal and other nonparenchymal cells; stellate cells are also in charge of maintaining the components of the Space of Disse and are the key players in the pathology of liver fibrosis. They are found to be tightly complexed with sinusoidal endothelial cells and at the same time found to be tightly interacting with hepatocytes, sometimes even penetrating the hepatic plate. Stellate cell function, is therefore, highly dependent upon its interaction with other liver cells in maintaining the tightly knit structure-function relationship. For this reason, the liver bioreactor serves as a highly useful tool, in order to better understand the hepatic stellate cell's role in these complex situations. In this dissertation, detection and characterization methods are developed with the goal of capturing the heterogeneous stellate cell population as

a whole with a toolbox of characterizati on markers, as well as to learn more about their functionality and location within tissue structures. These tools can be used to detect and characterize the population at various timepoints during tissue formation inside the bioreactor, as well as after exposure to physiologically -relevant concentrations of toxins, viruses, pharmaceutic als, etc. ... *Network Neuroscience* MDPI This dissertation, "Functional Implications of Cytoglobin, a Novel Protein, in Liver Fibrosis" by Kwun-nok, Mimi, Man, □□□, was obtained from The University of Hong Kong (Pokfulam, Hong Kong) and is being sold pursuant to Creative Commons: Attribution 3.0 Hong Kong License. The content of this dissertation has not been altered in any way. We have altered the formatting in order to facilitate the ease of printing and reading of the dissertation. All rights not granted by the above license are retained by the author. Abstract: Abstract of thesis entitled FUNCTIONAL IMPLICATIONS OF CYTOGLOBIN, A NOVEL PROTEIN, IN LIVER FIBROSIS Submitted by MAN Kwun Nok Mimi for the degree of Master of Philosophy at the University of Hong Kong in December 2006

Cytoglobin is a recently discovered hexacoordinate globin protein with a yet undefined function. It was found to be up-regulated in toxin-induced liver fibrosis and during hypoxic conditions in models. Though it has been documented to be mainly localized in fibroblasts in connective tissues in various organs and in hepatic stellate cells, there are controversies regarding its subcellular localization and its localization in certain cell types, e.g. hepatocytes. Cytoglobin has been hypothesized to function as a scavenger of reactive oxygen species, as a reservoir for the supply of oxygen during stress conditions, and in the metabolism of the extracellular matrix. The objective of this project is to delineate the functional property of cytoglobin by exploring its localization and its expression pattern in acute toxicological response towards the hepatotoxin carbon tetrachloride and during development of carbon tetrachloride-induced liver fibrosis in mouse. The localization of cytoglobin in normal mouse tissues was studied using immunohistochemistry. Cytoglobin was found to be expressed in fibroblasts in connective tissues around blood vessels in liver and

other organs, as well as in the hepatic stellate cells. In the brain, cytoglobin was expressed in both the nuclei and cytoplasmic processes of certain neurons. The localization of cytoglobin in fibroblasts and hepatic stellate cells, which are the producers of extracellular matrix (ECM) in normal and disease states respectively, may imply a role in extracellular matrix metabolism. The expression pattern of cytoglobin and procollagen I alpha 1 chain (Col1a1), a molecule in the ECM, during acute liver injury caused by carbon tetrachloride was studied using immunohistochemistry and real-time polymerase chain analysis. Up-regulation of cytoglobin mRNA began at 12h and peaked at 24h post-administration with expression level over 3.5-fold higher than normal. The expression level of Col1a1 increased at 48h post-administration with over 7.5-fold up-regulation. The increase in expression of Col1a1 mRNA 24h following that of cytoglobin mRNA may imply a role for cytoglobin in metabolism of Col1a1. Alternatively, cytoglobin may be up-regulated for scavenging reactive species generated during acute liver injury, or act as an oxygen

supplier to regions under histotoxic hypoxia during liver injury. To determine whether the expression of cytoglobin is correlated to the progression of liver fibrosis, the number of cytoglobin-expressing cells during the development of liver fibrosis was quantified and the expression level of cytoglobin mRNA in regions of fibrosis and in intact parenchyma was compared. The number of cytoglobin-expressing cells was found to increase with the severity of liver fibrosis until 6 weeks. Level of cytoglobin mRNA was higher in the parenchyma of mouse with 8 weeks' treatment as compared with that of normal. These results may represent a positive correlation of cytoglobin with liver fibrosis. DOI: 10.5353/th_b3882073 Subjects: Globin Globin genes - Expression Liver - Fibrosis

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