

"Type grouping" in skeletal muscles after experimental reinnervation

G. Karpati, M.D., and W. K. Engel, M.D.

APPLICATION OF histochemical techniques to the study of human muscle biopsies has helped to elucidate a number of pathologic reactions of skeletal muscle that are not evident in routinely stained paraffin-embedded tissue.¹⁻⁴ One of these abnormalities has been termed "type grouping" and defined as "groups of fibers of the same histochemical type much larger than usual . . . consisting of 50-100 fibers or more."² Normally, in histochemically mixed muscles, the two basic histochemical fiber types (types 1 and 2) are intermingled in a mosaic pattern when viewed in cross section. In normal human muscle the number of fibers of similar histochemical type in tight contiguity does not exceed 50 and is usually less than 15. Type grouping is commonly observed in muscle biopsies of patients with chronic peripheral neuropathies (Fig. 1) and somewhat less often in the advanced stage of motor neuron disease. It has been postulated to be a sign of reinnervation by "collateral sprouting."²

In this paper we present an experimental model in which typical type grouping was produced in histochemically mixed muscles of the guinea pig by experimental reinnervation. The results support the suggestion that collateral sprouting is at least one pathogenic mechanism which may be responsible for type grouping in disease in human beings.

MATERIALS AND METHODS

In adult (3-month-old), male albino guinea pigs, experimental reinnervation of the gastrocnemius and plantaris muscles was produced on one side of each animal. All experimental procedures were done on animals under intraperitoneal pentobarbital sodium anesthesia (25 mg. per kilogram). The three methods used for experimental reinnervation are shown

in Figure 2. In group A (12 animals) the lower one-third of one sciatic nerve was exposed from a posterior thigh approach by blunt dissection of the hamstring muscles and the exposed nerve was crushed with uniform force for ten seconds. The crushing instrument was a mosquito forceps on which the serrated jaws were enveloped in polyethylene tubing. At ten and twelve weeks after the procedure, these animals were sacrificed with an overdose of barbiturate. In group B (6 animals) one sciatic or posterior tibial nerve was exposed at the region of the sciatic nerve bifurcation as described above and with the tip of a fine jeweler's forceps the nerve was crushed vigorously at three separate places about 2 mm. apart. Ten days later the same procedure was repeated on the same nerves at a slightly more distal portion of the nerve. These animals were sacrificed six months after the second procedure. In group C (6 animals) the sciatic nerve bifurcation was exposed in the popliteal fossa and the sciatic or posterior tibial nerve was completely severed just above or below the bifurcation. The severed ends were carefully approximated by suturing of the nerve sheath with two 7-0 silk sutures. These animals were sacrificed at four to six months after the operation.

Two types of controls were used: [1] the contralateral unoperated or sham-operated side of the experimental animals and [2] completely normal adult male guinea pigs.

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Skeletal Research An Experimental Appr

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The Basic Principles of External Skeletal Fixation Using the Ilizarov and Other Devices Leonid Solomin,2013-02-17 The Ilizarov device has revolutionized the treatment of non healing fractures and the correction of deformities This book supplies all the information required in order to use the Ilizarov and other external fixation devices optimally it will serve as an indispensable manual for both trainee and experienced orthopedic surgeons Biomechanical principles preoperative preparation and the use of a system of coordinates to allow safer insertion of K wires and half pins are thoroughly discussed External fixation of a variety of fractures in different pathologic settings is then clearly explained in a series of detailed chapters with the aid of high quality illustrations Numerous case reports are included to illustrate the results of different treatment methods In addition postoperative management and treatment of complications are described Since the first edition the text has been thoroughly updated with inclusion of contributions from leading world experts

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Handbook of nutrition and diet in therapy of bone diseases Ronald Ross Watson, Daruka Mahadevan, 2023-08-07 Many diseases nutrients and foods affect bone structure and bone function and are critical for human health and happiness Osteoporosis is the most common bone metabolic disorder in humans Its incidence is related to poor nutrition altered hormonal status ageing diminished physical activity impaired health status and harmful pharmacotherapy Vitamins especially vitamin D and calcium are historically recognized as important for bone health whereas this book also shows that there is evidence for an association between vitamin D calcium bone mineral density and colorectal cancer In addition calcium supplements may increase the risk for cardiovascular events In regular food patterns milk vegetables herbs fruit and omega 3 may be profitable for bone health Eating disorders also influence bone For example obesity is known to promote bone disease This book discusses the multiple mechanisms by which obesity may affect bone mass and the effect of diet induced maternal obesity on fetal bone development as well as the different nutritional factors that can affect adolescent bone health In addition anorexia nervosa treatments that may help prevent loss of bone mass are reviewed These treatments should not only be geared towards females but also towards males

Crafting Bone International Council for Archaeozoology. Worked Bone Research Group. Meeting, 2001 Thirty six papers from the 2nd meeting of the ICAZ worked Bone Research Group held in Budapest in 1999 written by archaeologists and archaeozoologists report on material from North and Central America Europe and South West Asia

Biological Anthropology of the Human Skeleton M. Anne Katzenberg, Shelley R. Saunders, 2011-09-23 This book is virtually required reading for biological anthropologists and will be a useful up to date primer on osteological analyses for a wider audience The Quarterly Review of Biology March 2009 a comprehensive guide to the ever changing discipline of physical anthropology provides an in depth introduction to human skeletal biology The structure of the book makes it easy for the reader to follow the progression of the field of human skeletal biology

PaleoAnthropology 2009 Issue The First Edition of Biological Anthropology of the Human Skeleton is the market leading reference and textbook on the scientific analysis of human skeletal remains recovered from archaeological sites Now featuring scores of new or thoroughly revised content this Second Edition provides the most comprehensive and up to date coverage of the topic available Like the previous edition this Second Edition is organized into five parts with contributing chapters written by experts in the field of human skeletal biology Part One covers theory and application Part Two discusses morphological analyses of bone teeth and age changes Part Three reviews prehistoric health and disease Part Four examines chemical and genetic analysis of hard tissues and Part Five closes with coverage of quantitative methods and population studies Each chapter includes a review of recent studies descriptions of analytical techniques and underlying assumptions theory methodological advances and speculation about future research New or thoroughly revised content includes Techniques in the analysis of human skeletal and dental remains Extensive coverage of new technologies including modern morphometric techniques Advances in the field of forensic anthropology Enhanced discussion of ethical terms regarding the study of aboriginal peoples remains where those people are no longer the dominant culture This book serves as an indispensable research guide to biological anthropologists osteologists paleoanthropologists and archaeologists Now with a stronger focus on teaching complex material to students this revised edition provides enhanced case studies and discussions for future directions making it an invaluable textbook for advanced undergraduates and graduate students in biological anthropology and forensic anthropology programs

Bone and Joint Infections Werner Zimmerli, 2021-03-16 BONE AND JOINT INFECTIONS Explore this comprehensive presentation of bone and joint infections including non implant and implant associated orthopedic infections In the newly revised Second Edition of Bone and Joint Infections From Microbiology to Diagnostics and Treatment accomplished researcher and author Werner Zimmerli delivers a comprehensive overview of the most recent developments in the subject of bone and joint infection Covering much of the new information appearing over the last five years the book includes four new chapters presenting the diagnostic approach in bone and joint infections discussing the identification of pathogens by non culture techniques management of multi resistant bacteria in bone and joint infections by bacteriophages and unusual microorganisms in periprosthetic joint infections Many of the chapters are also updated to include new information on topics like eubacterial PCR multiplex PCR and the shotgun metagenomics approach These subjects are of increased applicability and interest to increase the fraction of cases with identified pathogens The book also helps clinicians to understand MRI based images and rapidly interpret and plan for comprehensive therapy Readers will also benefit from the inclusion of A thorough introduction to the pharmacokinetics and pharmacodynamics of antibiotics in bone and preclinical models of infection in bone and joint surgery An exploration of native joint arthritis in children and adults as well as an overview of septic arthritis of axial joints A practical discussion of the general aspects of periprosthetic joint infection as well as specific aspects of periprosthetic joint infection after total hip and knee shoulder elbow and ankle

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Bones John D. Currey,2013-10-31 This is a comprehensive and accessible overview of what is known about the structure and mechanics of bone bones and teeth In it John Currey incorporates critical new concepts and findings from the two decades of research since the publication of his highly regarded *The Mechanical Adaptations of Bones* Crucially Currey shows how bone structure and bone s mechanical properties are intimately bound up with each other and how the mechanical properties of the material interact with the structure of whole bones to produce an adapted structure For bone tissue the book discusses stiffness strength viscoelasticity fatigue and fracture mechanics properties For whole bones subjects dealt with include buckling the optimum hollowness of long bones impact fracture and properties of cancellous bone The effects of mineralization on stiffness and toughness and the role of microcracking in the fracture process receive particular attention As a zoologist Currey views bone and bones as solutions to the design problems that vertebrates have faced during their evolution and throughout the book considers what bones have been adapted to do He covers the full range of bones and bony tissues as well as dentin and enamel and uses both human and non human examples Copiously illustrated engagingly written and assuming little in the way of prior knowledge or mathematical background *Bones* is both an ideal introduction to the field and also a reference sure to be frequently consulted by practicing researchers

Finite Element Analysis David Moratal,2010-08-17 Finite element analysis is an engineering method for the numerical analysis of complex structures This book provides a bird s eye view on this very broad matter through 27 original and innovative research studies exhibiting various investigation directions Through its chapters the reader will have access to works related to Biomedical Engineering Materials Engineering Process Analysis and Civil Engineering The text is addressed not only to researchers but also to professional engineers engineering lecturers and students seeking to gain a better understanding of where Finite Element Analysis stands today

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Segmentation of Hand Bone for Bone Age Assessment Yan Chai Hum, 2013-05-25 The objective of this Brief is to provide a solution to the unsolved technical problem in segmentation for the automated bone age assessment system The task is accomplished by first applying the modified histogram equalized module then applying the proposed automated anisotropic diffusion technique It is followed by a novel fuzzy quadruple division scheme to optimize the central segmentation algorithm and then an additional quality assurance scheme The designed segmentation framework works without demanding scarce resources such as training sets and skillful operators The results have shown that the designed framework is capable of separating the soft tissue and background from the hand bone with high accuracy This Brief should be especially useful for students and professional researchers in the Biomedical and image processing fields

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Table of Contents Skeletal Research An Experimental Appr

1. Understanding the eBook Skeletal Research An Experimental Appr
 - The Rise of Digital Reading Skeletal Research An Experimental Appr
 - Advantages of eBooks Over Traditional Books
2. Identifying Skeletal Research An Experimental Appr
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Skeletal Research An Experimental Appr
 - User-Friendly Interface
4. Exploring eBook Recommendations from Skeletal Research An Experimental Appr
 - Personalized Recommendations
 - Skeletal Research An Experimental Appr User Reviews and Ratings
 - Skeletal Research An Experimental Appr and Bestseller Lists
5. Accessing Skeletal Research An Experimental Appr Free and Paid eBooks

- Skeletal Research An Experimental Appr Public Domain eBooks
- Skeletal Research An Experimental Appr eBook Subscription Services
- Skeletal Research An Experimental Appr Budget-Friendly Options
- 6. Navigating Skeletal Research An Experimental Appr eBook Formats
 - ePub, PDF, MOBI, and More
 - Skeletal Research An Experimental Appr Compatibility with Devices
 - Skeletal Research An Experimental Appr Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Skeletal Research An Experimental Appr
 - Highlighting and Note-Taking Skeletal Research An Experimental Appr
 - Interactive Elements Skeletal Research An Experimental Appr
- 8. Staying Engaged with Skeletal Research An Experimental Appr
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Skeletal Research An Experimental Appr
- 9. Balancing eBooks and Physical Books Skeletal Research An Experimental Appr
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Skeletal Research An Experimental Appr
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Skeletal Research An Experimental Appr
 - Setting Reading Goals Skeletal Research An Experimental Appr
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Skeletal Research An Experimental Appr
 - Fact-Checking eBook Content of Skeletal Research An Experimental Appr
 - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development

- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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