DOWNLOAD PDF SCALING PHYSIOLOGICAL PROCESSES

Chapter 1 : Scaling Physiological Processes: Leaf to Globe (Physiological Ecology) - Ebook pdf and epub

Traditional plant physiological ecology is organism centered and provides a useful framework for understanding the interactions between plants and their environment and for identifying characteristics likely to result in plant success in a particular habitat.

Scaling relationships have been a persistent theme in biology at least since the time of Leonardo da Vinci and Galileo. Because scaling relationships are among the most general empirical patterns in biology, they have stimulated research to develop mechanistic hypotheses and mathematical models. While there have been many excellent empirical and theoretical investigations, there has been little attempt to synthesize this diverse but interrelated area of biology. In an effort to fill this void, Scaling in Biology, the first general treatment of scaling in biology in over 15 years, covers a broad spectrum of the most relevant topics in a series of chapters written by experts in the field. Some of those topics discussed include allometry and fractal structure, branching of vascular systems of mammals and plants, biomechanical and life history of plants, invertebrates and vertebrates, and species-area patterns of biological diversity. Many more examples are included within this text to complete the broader picture. Scaling in Biology conveys the diversity, promise, and excitement of current research in this area, in a format accessible to a wide audience of not only specialists in the various sub-disciplines, but also students and anyone with a serious interest in biology. One of the first textbooks in this emerging important field of ecology. Most of ecology is about metabolism: The energy requirements of individuals â€" their metabolic rates â€" vary predictably with their body size and temperature. Ecological interactions are exchanges of energy and materials between organisms and their environments. So metabolic rate affects ecological processes at all levels: Each chapter focuses on a different process, level of organization, or kind of organism. It lays a conceptual foundation and presents empirical examples. Together, the chapters provide an integrated framework that holds the promise for a unified theory of ecology. The book is intended to be accessible to upper-level undergraduate, and graduate students, but also of interest to senior scientists. Its easy-to-read chapters and clear illustrations can be used in lecture and seminar courses. Together they make for an authoritative treatment that will inspire future generations to study metabolic ecology. The brain is composed of many interconnected neurons that form a complex system, from which thought, behavior, and creativity emerge through self-organization. By studying the dynamics of this network, some basic motifs can be identified. Recent technological and computational advances have led to rapidly accumulating empirical evidence that spontaneous cortical activity exhibits scale-free and critical behavior. Multiple experiments have identified neural processes without a preferred timescale in the avalanche-like spatial propagation of activity in cortical slices and in self-similar time series of local field potentials. Even at the largest scale, scale-free behavior can be observed by looking at the power distributions of brain rhythms as observed by neuroimaging. These findings may indicate that brain dynamics are always close to critical states â€" a fact with important consequences for how brain accomplishes information transfer and processing. Capitalizing on analogies between the collective behavior of interacting particles in complex physical systems and interacting neurons in the cortex, concepts from non-equilibrium thermodynamics can help to understand how dynamics are organized. In particular, the concepts of phase transitions and self-organized criticality can be used to shed new light on how to interpret collective neuronal dynamics. Despite converging support for scale-free and critical dynamics in cortical activity, the implications for accompanying cognitive functions are still largely unclear. This Research Topic aims to facilitate the discussion between scientists from different backgrounds, ranging from theoretical physics, to computational neuroscience, brain imaging and neurophysiology. By stimulating interactions with the readers of Frontiers in Physiology, we hope to advance our understanding of the role of scale-freeness and criticality in organizing brain dynamics. What do these new perspectives tell us about the brain and to what extent are they relevant for our cognitive functioning? For this Research Topic, we therefore solicit reviews, original research articles, opinion and method papers, which address the principles that organize the dynamics of cortical activity. While focusing on work in the neurosciences, this Research Topic also welcomes theoretical contributions from physics or computational approaches. Conifers--pine, fir, and spruce trees--are dominant species in forests around the world. This book focuses on the physiology of conifers and how these physiological systems operate. Special consideration is devoted to the means by which ecophysiological processes influence organismal function and distribution. Chapters focus on the genetics of conifers, their geographic distribution and the factors that influence this distribution, the impact of insect herbivory on ecophysiological parameters, the effects of air pollution, and the potential impact that global climatic changes will have upon conifers. Because of the growing realization that forests have a crucial role to play in global environmental health, this book will appeal to a developing union of ecologists, physiologists and more theoretically minded foresters. 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Chapter 2 : scaling_physiological_processes_leaf_to_globe

Traditional plant physiological ecology is organism centered and provides a useful framework for understanding the interactions between plants and their environment and for identifying characteristics likely to result in plant success in a particular habitat. This book focuses on extending concepts.

AlienCat Scaling can be defined as the structural and functional consequences of a change in size and scale among similarly organized animals. To examine what "consequences of a change in size" means, consider what would happen if one scaled up a cockroach simply by expanding it by a factor of in each of its three dimensions. Its mass, which depends on volume, would increase by a factor of 1 million x x The ability of its legs to support that mass, however, depends on the cross-sectional area of the leg, which has only increased by a factor of ten thousand x Similarly, its ability to take in oxygen through its outer surface will also grow only by ten thousand, since this too is a function of surface area. This disparity between the rapid growth in volume and the slower growth in surface area means the super-sized cockroach would be completely unable to support its weight or acquire enough oxygen for its greater body mass. The consequences of body size on the physiology, ecology, and even behavior of animals, can be appreciated if one examines in more detail differences in function between organisms of widely different sizes. For example, consider that a 4-ton elephant weighs about 1 million times more than a 4-gram shrew, and further consider that the shrew consumes enough food daily to equal about 50 percent of its body weight. Imagine then what the daily food consumption of 1 million shrews would be 2 tons of food , and realize that the elephant is probably consuming instead only about pounds of food. From this example it is obvious that daily food requirements do not scale directly with body mass. In fact, most body processes scale to some proportion of body mass, rarely exactly 1. Allometric Analysis How can one determine the relationship of body processes to body mass? The best technique for uncovering the relationship is to plot one variable for example, food requirements or metabolic rate against body mass for groups of similar animals for example, all mammals, or even more specifically, carnivorous mammals. Such a plot is called an X-Y regression. Using a statistical technique called least-squares regression gives an equation that best fits the data. The exponent b is of particular interest, since it gives the scaling relationship one is looking for in nonlinear relations, such as that of metabolism and body mass. This mathematical technique is called allometric analysis. Allometric analysis can be used to predict the capacity or requirements of an unstudied animal, one that might be too rare to collect or too difficult to maintain in captivity for study. Metabolism Using this technique, several interesting relationships between animal structure and function have been uncovered. Among the most well studied is the relationship between animal metabolism and body mass, introduced above, in which M metabolism scales to the 0. This means that while the total energy needs per day of a large animal are greater than that of a small animal, the energy requirement per gram of animal mass-specific metabolism is much greater for a small animal than for a large animal. Why should this be the case? For birds and mammals that maintain a constant body temperature by producing heat, the increased mass-specific metabolism of smaller animals was once thought to be a product of their greater heat loss from their proportionately larger surface area-to-volume ratio. However, the same mathematical relationship between metabolism and body mass has been found to hold for all animals studied, and even unicellular organisms as well. Therefore, the relationship of metabolism to body size seems to represent a general biological rule, whose basis eludes scientific explanation at this time. Allometric analysis has shown that different body processes, involving different organs, scale with different exponents of body mass. Thus, the oxygen delivery system heart and lungs is directly proportional to body mass, even though the metabolism, and thus oxygen requirements, of the body scale with body mass to the 0. If the hearts are proportionately the same size for large and small animals, but mass-specific oxygen requirements are higher for small animals, then this implies that hearts in small animals must pump faster to deliver the greater quantity of oxygenated blood. Similarly, lung ventilation rates of smaller animals must be higher than those of larger animals. Both predictions have been borne out by measurements that support this conclusion from the allometric analysis. Locomotion The energy requirement for locomotion also scales with body size, in much the same way that metabolism does. But here another factor comes into play: It is obvious that locomotion is much more energetically expensive than sitting still, but are some types of locomotion more expensive than others? In plotting the cost of running versus body mass, one notes that metabolic cost increases directly as a function of mass. What about swimming and flying? Again, cost increases with mass, but the regression lines for these allometric analyses exhibit different slopes than the one for runners. As might be expected the cost per kilometer per gram of animal is lowest for swimmers, where the body mass is supported by buoyancy; next highest for flyers, where body mass is partially supported by air mass; and highest for runners, who lose energy to friction with the ground. While water is more viscous to move through than air, swimmers especially fish have streamlined bodies that reduce frictional drag and reduce cost. Allometric analysis helps explain why animals can only get so large or so small. Limits placed on structural support, amount of gut surface area required to process the required energy per day, and cost of locomotion become limiting factors for large animals. High surface area-to-volume ratios, high metabolic costs of existence, and limits on the speed of diffusion and cell surface area become limiting factors for small animals. Thus, animal structural design has functional implications that determine physiological processes and ultimately the ability to exist under specific ecological constraints.

Chapter 3 : PDF The Physiological Ecology Of Woody Plants Free Download | Download PDF Journalist E

Typical plant physiological ecology is organism centered and provides a useful framework for understanding the interactions between crops and their environment and for determining traits attainable to finish in plant success in a selected habitat.

An example is found in frogs â€” aside from a brief period during the few weeks after metamorphosis, frogs grow isometrically. Isometric scaling is governed by the square-cube law. An organism which doubles in length isometrically will find that the surface area available to it will increase fourfold, while its volume and mass will increase by a factor of eight. This can present problems for organisms. In the case of above, the animal now has eight times the biologically active tissue to support, but the surface area of its respiratory organs has only increased fourfold, creating a mismatch between scaling and physical demands. Similarly, the organism in the above example now has eight times the mass to support on its legs, but the strength of its bones and muscles is dependent upon their cross-sectional area, which has only increased fourfold. Therefore, this hypothetical organism would experience twice the bone and muscle loads of its smaller version. This mismatch can be avoided either by being "overbuilt" when small or by changing proportions during growth, called allometry. Allometric scaling[edit] Allometric scaling is any change that deviates from isometry. The skeletal structure becomes much stronger and more robust relative to the size of the body as the body size increases. If, after statistical analyses, for example, a volume-based property was found to scale to mass to the 0. Conversely, if a surface area-based property scales to mass to the 0. One example of positive allometry occurs among species of monitor lizards family Varanidae , in which the limbs are relatively longer in larger-bodied species. Determining if a system is scaling with allometry[edit] To determine whether isometry or allometry is present, an expected relationship between variables needs to be determined to compare data to. This is important in determining if the scaling relationship in a dataset deviates from an expected relationship such as those that follow isometry. The use of tools such as dimensional analysis is very helpful in determining expected slope. For example, different sized frogs should be able to jump the same distance according to the geometric similarity model proposed by Hill [17] and interpreted by Wilson , [18] but in actuality larger frogs do jump longer distances. Dimensional analysis is extremely useful for balancing units in an equation or in this case, determining expected slope. This is the slope of a straight line, but most data gathered in science do not fall neatly in a straight line, so data transformations are useful. It is also important to keep in mind what is being compared in the data. Comparing a characteristic such as head length to head width might yield different results from comparing head length to body length. That is, different characteristics may scale differently. There are two reasons for log transformation - a biological reason and a statistical reason. Biologically, log-log transformation places numbers into a geometric domain so that proportional deviations are represented consistently, independent of the scale and units of measurement. In biology this is appropriate because many biological phenomena e. This will normalize the data set and make it easier to analyze trends using the slope of the line. Sometimes the two analyses can yield different results, but often they do not. If the expected slope is outside the confidence intervals, then there is allometry present. If mass in this imaginary animal scaled with a slope of 5 and this was a statistically significant value, then mass would scale very fast in this animal versus the expected value. It would scale with positive allometry. If the expected slope were 3 and in reality in a certain organism mass scaled with 1 assuming this slope is statistically significant , then it would be negatively allometric. Force is dependent on the cross-sectional area of muscle CSA , which is L2. If comparing force to a length, then the expected slope is 2. Alternatively, this analysis may be accomplished with a power regression. Plot the relationship between the data onto a graph. Fit this to a power curve depending on the stats program, this can be done multiple ways , and it will give an equation with the form: The downside, to this form of analysis, is that it makes it a little more difficult to do statistical analyses. Physiological scaling[edit] Many physiological and biochemical processes such as heart rate, respiration rate or the maximum reproduction rate show scaling, mostly associated with the ratio between surface area and mass or volume of the animal. This means that larger-bodied species e. The straight line generated from a double logarithmic scale of metabolic rate in relation to body mass is known as the "mouse-to-elephant curve".

Chapter 4 : CiteSeerX â€” Citation Query Scaling physiological processes: leaf to globe

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Chapter 6 : Scaling of physiological processes in homeothermic animals.

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Chapter 7 : Allometry - Wikipedia

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Chapter 8 : Scaling Physiological Processes : Jacques Roy :

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