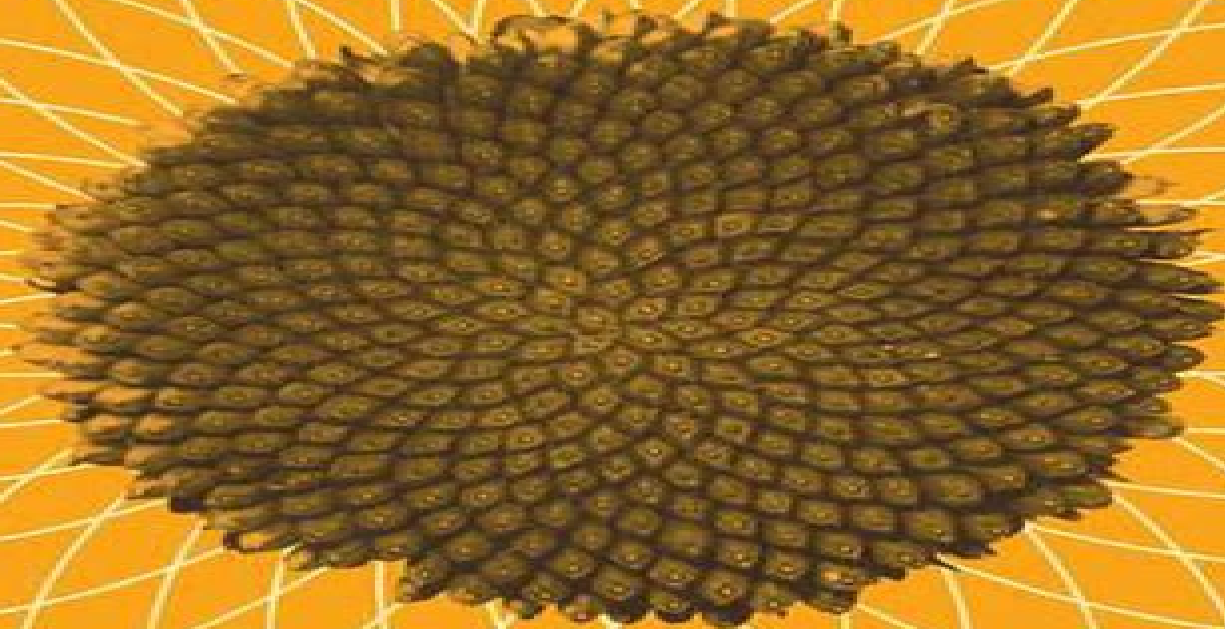


Phyllotaxis

**A Systemic Study in
Plant Morphogenesis**



ROGER V. JEAN

Phyllotaxis A Systemic Study In Plant Morphogenesis

K.V. Krishnamurthy



Phyllotaxis A Systemic Study In Plant Morphogenesis:

Phyllotaxis Roger V. Jean, 1994-01-28 Phyllotaxis the study of the patterns exhibited by leaves and other organs of plants raises some of the deepest questions of plant morphogenesis What principles of biological organisation produce these dynamical geometric systems The constant occurrence of the Fibonacci sequence in such systems is a phenomenon that has fascinated botanists and mathematicians for centuries In this book first published in 1994 the many facets of phyllotaxis are dealt with in an integrated manner for the first time The author describes a unified concept of phyllotaxis based on experimental anatomical cellular physiological and paleontological observations The book provides a framework for formal analyses of botanical data and emphasises the relevance of the phyllotactic paradigm in the study of other structures such as crystals and proteins It is of interest to crystallographers and physicists as well as to botanists and mathematicians

Phyllotaxis Roger V. Jean, 2009-03-19 In this book the many facets of phyllotaxis are dealt with in an integrated manner The author describes a unified concept of phyllotaxis and presents a mathematical model of plant growth based on experimental anatomical cellular physiological and paleontological observations The model not only provides a framework for formal analyses of botanical data but also emphasizes the relevance of phyllotaxis to other structures such as crystals and proteins

Phyllotaxis and Symmetry in Angiosperms Jean-Paul Walch, Solange Blaise, 2024-08-27 Symmetry and the causes of shifts in different types of symmetries in flowers follow specific patterns that are ruled by developmental and genetic factors Using a unified system of phyllotactic equations we have modeled the molecular mechanisms and pressure forces that act in inflorescence and floral meristems giving flowers their organ arrangement In this book we state general physical principles whereby the symmetry of the perianth is derived from the symmetry of certain TCP gene expression Thus we define the interplay between the expression of CYC2 like genes and the phyllotactic mechanisms This new evo devo approach is applied to major groups of angiosperms with predominantly actinomorphic flowers in which rare zygomorphy is positional and groups with mainly bilaterally symmetrical flowers in which zygomorphy is constitutional It has thus allowed us to revisit the contributions of the great floral morphologists of the 20th and early 21st centuries *Phyllotaxis Models*

Jean-Paul Walch, Solange Blaise, 2023-08-15 The equations of phyllotaxis were discovered by Douady and Couder these describe the inhibition force generated by an incipient primordium preventing the initiation of other primordia in its vicinity the method that was lacking was to take into account the distance of primordia to the meristem apex over the course of its development With these parameters our model integrates both biochemical forces inhibition due to auxin and mechanical forces contact pressure This powerful tool allows us to revisit many important notions of plant biology For example we model auxin concentrations at the plant apex as well as the development of vegetative and reproductive meristems We also explain why the whorls of monocots are trimerous and those of plants with quincuncial perianths are pentamerous We design a geometric method for reconstructing inflorescences from their building blocks i.e. floral meristems We also show that

phyllotaxic spirals are only the application of a general property of symmetry the advantages of which have been exploited by natural selection

Symmetry in Plants Roger V. Jean, Denis Barabási, 1998 The book deals with biological mathematical descriptive causal and systemic phyllotaxis It aims at reflecting the widest possible range of ideas and research closely related to phyllotaxis and contains 30 well illustrated chapters The book has three parts of equal importance The first two parts concern data collecting pattern recognition and pattern generation to which students of phyllotaxis are well accustomed The third part is devoted to the problem of origins of phyllotactic patterns giving the field of phyllotaxis the universality it requires to be fully understood Phyllotaxis like patterns are found in places where genes are not necessarily present Part III concerns general comparative morphology homologies with phyllotactic patterns and recent trends on evolution that can help to understand phyllotaxis The distinguished researchers who accepted to participate in the production of this book strongly contributed to the field of phyllotaxis in the past and have devoted a lot of their time to the fascinating subject coming up with most valuable findings or are newcomers with original ideas that may be very relevant for the future of the field The book summarizes and updates their contributions and promotes new avenues in the treatment of phyllotaxis This book on mathematical and biological phyllotaxis is the first collective book ever A landmark in the history of phyllotaxis

Diatom Morphogenesis Vadim V. Annenkov, Joseph Seckbach, Richard Gordon, 2021-11-23 DIATOM MORPHOGENESIS A unique book presenting the range of silica structures formed by diatoms theories and hypotheses of how they are made and applications to nanotechnology by use or imitation of diatom morphogenesis There are up to 200 000 species of diatoms each species of these algal cells bearing an ornate amorphous silica glass shell The silica is structured at 7 orders of magnitude size range and is thus the most complex multiscalar solid structure known Recent research is beginning to unravel how a single cell marshals chemical physical biochemical genetic and cytoskeletal processes to produce these single cell marvels The field of diatom nanotechnology is advancing as this understanding matures Diatoms have been actively studied over the recent 10 20 years with various modern equipment experimental and computer simulation approaches including molecular biology fluorescence based methods electron confocal and AFM microscopy This has resulted in a huge amount of information but the key stages of their silica morphogenesis are still not clear This is the time to reconsider and consolidate the work performed so far and to understand how we can go ahead The main objective of this book is to describe the actual situation in the science of diatom morphogenesis to specify the most important unresolved questions and to present the corresponding hypotheses The following areas are discussed A tutorial chapter with a glossary for newcomers to the field who are often from outside of biology let alone phycology Diatom Morphogenesis general issues including symmetry and size issues Diatom Morphogenesis simulation including analytical and numerical methods for description of the diatom valve shape and pore structure Diatom Morphogenesis physiology biochemistry and applications including the relationship between taxonomy and physiology biosilicification hypotheses and ideas about applications of

diatoms Audience Researchers scientists and graduate students in the fields of phycology general biology marine sciences the chemistry of silica materials science and ecology

Phyllotactic Patterns: A Multidisciplinary Approach Denis Barabe, Christian R Lacroix, 2020-04-22 The book provides a current review of the field of phyllotaxis from a variety of perspectives that is morphological developmental biochemical molecular genetics biophysical and evolutionary This unique book covers phyllotactic processes from the level of genes involved in the establishment of patterns to modeling the emergence of those patterns in space and time The models in question deterministic or stochastic touch on various fields including geometry biochemistry and biophysics Not only providing a recent review but also current critique and analysis of the discipline the book will appeal to a variety of individuals involved in developmental modeling as well as pattern initiation and formation The text is highly illustrated with excellent pictures representing recent developments in the field A biological context or perspective to models and ideas is explored in the book Terminology specific to the discipline is defined and updated as well

The Whole Elephant Revealed Marja de Vries, 2012-05-25 The Whole Elephant Revealed offers clear insights into the existence and operation of universal laws and the golden ratio It is a synthesis based on common insights found in all wisdom traditions into the operation of universal laws on the one hand and on cutting edge scientific discoveries that are in line with those insights on the other hand These principles are called universal because they work on all levels of existence apply to everything that exist and create order and harmony in the universe Insights into the operation of the universal laws reveals a whole new worldview It helps us to understand how everything works in the universe who we really are and how we can make conscious choices that are more in line with these universal laws Above all it helps us to understand what works and what doesn't work in the long term Everything that operates in line with the universal laws follows the path of least resistance and is in harmony with the greater whole It makes us realize that while everything in the universe works in harmony with these principles many aspects of our personal life and our Western culture are not in line with the operation of these underlying principles If we choose to act in line with the operation of the universal laws it will go easier will be more in tune with who we really are and more in harmony with the greater whole This choice is hard to make though if we don't know those principles For that reason the rediscovery of the working of these principles seems to be of extreme importance In this time of great changes and global unbalance a growing number of people begin to feel the need for a clear and well founded insight into the universal laws because this gives an understanding of what is needed to restore the balance and harmony in ourselves as well as worldwide Because the nature of these principles is universal they apply to all aspects of our individual and social life Therefore they can be used as a frame of reference for all personal and social transformations which aim at a greater harmony within ourselves and with the greater whole

Do Plants Know Math? Stéphane Douady, Jacques Dumais, Christophe Golé, Nancy Pick, 2024-09-24 A breathtakingly illustrated look at botanical spirals and the scientists who puzzled over them Charles Darwin was driven to distraction by plant spirals growing so

exasperated that he once begged a friend to explain the mystery if you wish to save me from a miserable death The legendary naturalist was hardly alone in feeling tormented by these patterns Plant spirals captured the gaze of Leonardo da Vinci and became Alan Turing's final obsession This book tells the stories of the physicists mathematicians and biologists who found themselves magnetically drawn to Fibonacci spirals in plants seeking an answer to why these beautiful and seductive patterns occur in botanical forms as diverse as pine cones cabbages and sunflowers Do Plants Know Math takes you down through the centuries to explore how great minds have been captivated and mystified by Fibonacci patterns in nature It presents a powerful new geometrical solution little known outside of scientific circles that sheds light on why regular and irregular spiral patterns occur Along the way the book discusses related plant geometries such as fractals and the fascinating way that leaves are folded inside of buds Your neurons will crackle as you begin to see the connections This book will inspire you to look at botanical patterns and the natural world itself with new eyes Featuring hundreds of gorgeous color images Do Plants Know Math includes a dozen creative hands on activities and even spiral plant recipes encouraging readers to explore and celebrate these beguiling patterns for themselves *Plants* Martin Ingrouille, Bill Eddie, 2006-08-17 Plants are so much part of our environment that we often take them for granted yet beautiful fascinating and useful plants are everywhere from isolated moss colonies on stone walls to vast complex communities within tropical rainforests How did this array of form and habitat come about and how do we humans interact with the plant kingdom This unique new textbook provides a refreshing and stimulating consideration of these questions and throws light in a new way on the complexity ecology evolution and development of plants and our relationship with them Illustrated throughout with numerous line diagrams and beautiful colour photographs the book provides a comprehensive introduction to the fascinating lives that plants lead and the way in which our lives are inextricably linked to theirs It will be particularly useful to students seeking a more ecological and process oriented approach than is available in other plant science textbooks *Rice* C. Wayne Smith, Robert H. Dilday, 2002-09-09 Thorough coverage of rice from cultivar development to marketing Rice Evolution History Production and Technology the third book in the Wiley Series in Crop Science provides unique single source coverage of rice from cultivar development techniques and soil characteristics to harvesting storage and germplasm resources Rice covers the plant's origins and history physiology and genetics production and production hazards harvesting processing and products Comprehensive coverage includes Color plates of diseases insects and other production hazards The latest information on pest control Up to date material on marketing A worldwide perspective of the rice industry Rice provides detailed information in an easy to use format making it valuable to scientists and researchers as well as growers processors and grain merchants and shippers *EVOLUTION* Michael Ruse, Joseph Travis, 2009-01-01 Spanning evolutionary science from its inception to its latest findings from discoveries and data to philosophy and history this book is the most complete authoritative and inviting one volume introduction to evolutionary biology available Clear informative and comprehensive in

scope Evolution opens with a series of major essays dealing with the history and philosophy of evolutionary biology with major empirical and theoretical questions in the science from speciation to adaptation from paleontology to evolutionary development evo devo and concluding with essays on the social and political significance of evolutionary biology today A second encyclopedic section travels the spectrum of topics in evolution with concise informative and accessible entries on individuals from Aristotle and Linnaeus to Louis Leakey and Jean Lamarck from T H Huxley and E O Wilson to Joseph Felsenstein and Motoo Kimura and on subjects from altruism and amphibians to evolutionary psychology and Piltdown Man to the Scopes trial and social Darwinism Readers will find the latest word on the history and philosophy of evolution the nuances of the science itself and the intricate interplay among evolutionary study religion philosophy and society Appearing at the beginning of the Darwin Year of 2009 the 200th anniversary of the birth of Charles Darwin and the 150th anniversary of the publication of the Origin of Species this volume is a fitting tribute to the science Darwin set in motion

Self-organized Criticality and Predictability in Atmospheric Flows Amujuri Mary Selvam, 2017-05-05 This book presents a new concept of General Systems Theory and its application to atmospheric physics It reveals that energy input into the atmospheric eddy continuum whether natural or manmade results in enhancement of fluctuations of all scales manifested immediately in the intensification of high frequency fluctuations such as the Quasi Biennial Oscillation and the El Nino Southern Oscillation cycles Atmospheric flows exhibit self organised criticality i e long range correlations in space and time manifested as fractal geometry to the spatial pattern concomitant with an inverse power law form for fluctuations of meteorological parameters such as temperature pressure etc Traditional meteorological theory cannot satisfactorily explain the observed self similar space time structure of atmospheric flows A recently developed general systems theory for fractal space time fluctuations shows that the larger scale fluctuation can be visualised to emerge from the space time averaging of enclosed small scale fluctuations thereby generating a hierarchy of self similar fluctuations manifested as the observed eddy continuum in power spectral analyses of fractal fluctuations The interconnected network of eddy circulations responds as a unified whole to local perturbations such as global scale response to El Nino events The general systems theory model predicts an inverse power law form incorporating the golden mean for the distribution of space time fluctuation patterns and for the power variance spectra of the fluctuations Since the probability distributions of amplitude and variance are the same atmospheric flows exhibit quantumlike chaos Long range correlations inherent to power law distributions of fluctuations are identified as nonlocal connection or entanglement exhibited by quantum systems such as electrons or photons The predicted distribution is close to the Gaussian distribution for small scale fluctuations but exhibits a fat long tail for large scale fluctuations Universal inverse power law for fractal fluctuations rules out unambiguously linear secular trends in climate parameters

The Fabulous Fibonacci Numbers Alfred S. Posamentier, Ingmar Lehmann, 2010-12-30 The most ubiquitous and perhaps the most intriguing number pattern in mathematics is the Fibonacci sequence In this simple pattern beginning

with two ones each succeeding number is the sum of the two numbers immediately preceding it 1 1 2 3 5 8 13 21 ad infinitum Far from being just a curiosity this sequence recurs in structures found throughout nature from the arrangement of whorls on a pinecone to the branches of certain plant stems All of which is astounding evidence for the deep mathematical basis of the natural world With admirable clarity two veteran math educators take us on a fascinating tour of the many ramifications of the Fibonacci numbers They begin with a brief history of a distinguished Italian discoverer who among other accomplishments was responsible for popularizing the use of Arabic numerals in the West Turning to botany the authors demonstrate through illustrative diagrams the unbelievable connections between Fibonacci numbers and natural forms pineapples sunflowers and daisies are just a few examples In art architecture the stock market and other areas of society and culture they point out numerous examples of the Fibonacci sequence as well as its derivative the golden ratio And of course in mathematics as the authors amply demonstrate there are almost boundless applications in probability number theory geometry algebra and Pascal's triangle to name a few Accessible and appealing to even the most math phobic individual this fun and enlightening book allows the reader to appreciate the elegance of mathematics and its amazing applications in both natural and cultural settings

From Models to Simulations Franck Varenne, 2018-09-03 This book analyses the impact computerization has had on contemporary science and explains the origins technical nature and epistemological consequences of the current decisive interplay between technology and science an intertwining of formalism computation data acquisition data and visualization and how these factors have led to the spread of simulation models since the 1950s Using historical comparative and interpretative case studies from a range of disciplines with a particular emphasis on the case of plant studies the author shows how and why computers data treatment devices and programming languages have occasioned a gradual but irresistible and massive shift from mathematical models to computer simulations The Open Access version of this book available at <http://www.taylorfrancis.com> has been made available under a Creative Commons Attribution Non Commercial No Derivatives CC BY NC ND 4.0 license

Proceedings of the Second Temperate Rice Conference J. E. Hill, B. Hardy, 2002 Rice biotechnology Rice genomics Rice and the environment Agronomy Diseases Entomology Genetics Quality Weed science

Growth and Development in Plants (Textbook Series: 21st Century Biology and Agriculture) K.V. Krishnamurthy, 2015-06-01 The topic of the book is covered at the cellular tissue organ and organism levels and inputs from all these hierarchical levels of plant organization have been carefully integrated to get a holistic picture of growth and development in plants The book will be useful to undergraduate post graduate and research students and teachers of botany plant sciences plant biotechnology agriculture and forestry

Dynamic models of plant growth Nikolai Bessonov, Vitaly Volpert, 2006 *Asymmetry in Plants* Bir Bahadur, K. V. Krishnamurthy, Monoranjan Ghose, S. John Adams, 2019-03-25 Plants exhibit forms of asymmetry analogous to handedness in bilaterally symmetrical animals This book explores the evolutionary significance and development of asymmetry Examples of genetic control include the direction of

tendrils or stem coiling of many climbing plants the so called spiral phyllotaxy and floral taxonomy and contorted petal arrangement is another kind of left right symmetry in plants the direction of contortion is fixed in some but not in other plants The book will underscore that all phenomena related to handedness start during embryogenesis itself with the occurrence of embryo rotation Key selling features First consolidated book on Plant Handedness Relates handedness asymmetry and chirality to the evolution of different organizational levels in plant biology Emphasizes handedness as a vital governing force in plant functional evolution Provides a new perspective hitherto ignored into plant development and evolution Describes how an age old phenomenon can give scope for investigation from a very modern interdisciplinary approach

Advances in Computer Science for Engineering and Education III Zhengbing Hu, Sergey Petoukhov, Ivan Dychka, Matthew He, 2020-08-05 This book comprises high quality refereed research papers presented at the Third International Conference on Computer Science Engineering and Education Applications ICCSEEA2020 held in Kyiv Ukraine on 21-22 January 2020 organized jointly by National Technical University of Ukraine Igor Sikorsky Kyiv Polytechnic Institute National Aviation University and the International Research Association of Modern Education and Computer Science The topics discussed in the book include state of the art papers in computer science artificial intelligence engineering techniques genetic coding systems deep learning with its medical applications and knowledge representation with its applications in education It is an excellent source of references for researchers graduate students engineers management practitioners and undergraduate students interested in computer science and their applications in engineering and education

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