The Geometry of Biological Time (Interdisciplinary Applied Mathematics)

Arthur T. Winfree
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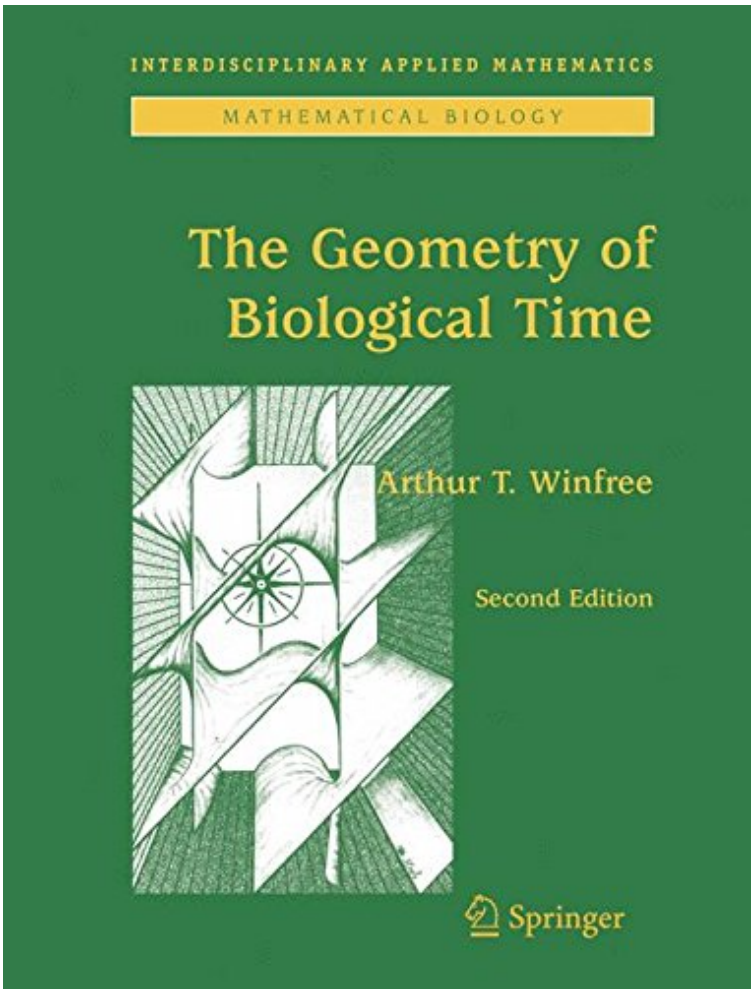

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Arthur T. Winfree : The Geometry of Biological Time (Interdisciplinary Applied Mathematics) before purchasing it in order to gage whether or not it would be worth my time, and all praised The Geometry of Biological Time (Interdisciplinary Applied Mathematics):

10 of 12 people found the following review helpful. A classicBy Critic at largeThis book gets better and better with time. The more I know about the topics covered in this book, the more I realize how important the book is and how much is to be learned from it.For those not familiar with Art Winfree, he was a pioneer in the mathematical and experimental investigation of the temporal and spatial aspects of biological phenomena. I don't know that I would agree with the reviewer who states that the book "transgresses" scientific boundaries. Perhaps a few decades ago this might have been true, but much of what Winfree pioneered is now mainstream science, or at least well-known.The

idea of "transgressing boundaries" implies a certain sense of rebellion and frequently has polticial overtones, and I would best describe Winfree as an explorer, not a rebel. He, along with a few other scietists scattered throughout various disciplines, followed where his interests and results led him. In a way, this is the essence of pure science.Later in his life Winfree was recognized in many ways, deservedly so, and continued to work on his ideas until his death. By that time, his work was well known to scientists in a variety of areas. As another reviewer stated, Winfree was not concerned so much with his image, as with explaining his ideas and thought processes that he used in trying to "get it right".If you are new to the work of Art Winfree this book will serve as a valuable part of your education. If you are an old hand, who has not looked at the material in the book in a long time, it is always worth yet another reading. This is a very good book. It is a classic of science.52 of 57 people found the following review helpful. Completely Interdisciplinary ScienceBy A CustomerThis 2nd edition of a 1980 book is about 50% enlarged. Its readers today will probably be scientists two generations removed from those familiar with the first printing but this review stresses only the new stuff.The book has two main parts: a first half containing ten chapters mostly about principles and theory, and a second half containing thirteen more about specific experimental systems. It seems curiously hard to decide whether the subject matter is narrow to the point of caricaturing academic specialization, or incredibly broad to the point of suggesting a smorgasbord for science dilettantes. Among the forty thousand academic science journals viable today, not one is devoted to the topic of "biological waves, oscillations, and phase singularities" featured in this book, so it must be too narrow even for such tastes. Yet the literature drawn upon spans an unmatchably wide gamut, ranging from practical medicine to abstract topology, from recent molecular genetics to history of science, from 1836 to 2000. And Science Citations Index shows that the first edition has been cited about a thousand times in widely diverse publications, continuing at about constant rate over the past twenty years. Maybe this is why Springer-Verlag chose to provoke a 2nd edition even after so long.Updating is usually an opportunity to erase blunders, but this author instead preserves and draws attention to them: how did this mistake happen, and how did the item come to be seen from a different perspective, with different meaning? To avoid giving offense the author preserves mostly his own blunders for such object lessons while going out of his way to credit the innovations of others.Almost the whole 1980 text is preserved, with new material intercalated on a shaded background, except for two entirely new fat chapters. One concerns the self-organization of excitable media into three-dimensional vortices with exotic topologies. This is almost wholly theoretical (supercomputer calculations and topology): the only ones discovered in the laboratory (so far) are simple vortex rings. The website mentioned in the preface contains much of the same material but more beautifully illustrated in subsequent Powerpoint lectures not mentioned in the book. The other new chapter concerns real cardiology and the role of phase singularities in sudden cardiac death. This seems a morass of details where I would have preferred to see the elegant tree that grew from seeds planted in the first edition. This tree was recognized midway between editions by a medical award normally given only to cardiologists. The new chapter gives the impression that it is already being cut down or at least pruned, and the author is more concerned about the details of that process than about defending its original structure. His 1987 book, was written a few years before the anticipated role of phase singularities and rotors in cardiology found confirmation in quantitative experiments, so the interested reader (if any) must still resort to the cited journal literature for that story.Another chapter reports on revolutionary developments entirely unforeseen in the first edition: this is the story of molecular genetics of the circadian biological clock. The author provides a readable summary of discoveries up to the end of 1999, but quite a lot of facts have accumulated since that time. The author's point of view is that present-day facts, while unanticipated in detail, do bear out the almost-forgotten theory elaborated in a 1963 book (Goodwin) as to basic principles, and the contrarian expectation stressed in the first edition, that the details may prove to be surprisingly diverse taxonomically.One of the best resources this eight hundred page book provides is its dual index, with almost two thousand topics and as many cited references, half of them since the first edition. Because the material is both mathematical and experimental, and each item is encountered several times but from different directions in the text, the index is indispensable to persons with finite lifetime who accordingly prefer not to read every word in sequence. Find the topic, jot down its several pages, read one and note a reference from which that argument draws its data, then see the other index for all pages on which that source document is alluded to. The references, by the way, seem exceptionally complete and up-to-date (up to the last day of the 20th century, when it appears the ms was sent to press).The preface points to a website for Errata. While this may be helpful to specialists, for the rest of us a better discovery lurks nearby: a link to a series of richly illustrated lectures given since the book went to press. These cover much of the same material in about three hundred substantially distinct slides but with entirely different organization in Powerpoint color (in contrast to about as many BW line drawings in the book). The web site URL changed: it now seems to be eebweb.biosci.Arizona.edu/~art for Errata, and for the Powerpoints, eeb8.biosci.Arizona.edu/art/2000_lectures.The author was professor of biological sciences at Purdue University until a few years after the first edition, and has since been professor of ecology and evolutionary biology at the University of Arizona. These seem peculiar credentials for authorship of a monograph mostly about topology, physical chemistry, and cardiac electrophysiology in an Applied Mathematics series. The key to understanding this phenomenon may be the first word, standing out in yellow against the green book cover: Interdisciplinary. Whatever may be hyped to the contrary, the academic world resents and resists activities that

transgress its historically-defined disciplinary boundaries. You will find them all transgressed in this book.

Dealing with dynamics of processes that repeat themselves regularly, this revised and updated edition extends the thread from 1980 to the present day, concentrating on areas of interest where there will be much activity in the future. This involves going through spatial biochemical, electrophysiological, and organismic dynamical systems and patterns that were discovered by pursuing the theme of phase singularities introduced in the original book. In particular the work on excitability in cell membranes will be thoroughly updated as will the references throughout the book.

From the reviews: "This book is a wonderful exposition about his lifes work and is presented with such clarity that the reader gains an insight into details of his manner of thinkingthe reader is taken on a quest to solve biological mysteries and travels from the intricate beginnings of formulating the questions, through the apices and troughs of analyzing, and on to the discovery of the holy grail, that which yields biological predictions and answers. One leaves with a sense of understanding that hopefully can be applied to ones own workthis book could easily serve a dual purpose. First, through the introduction of basic mathematical concepts such as topology combined with modeling, the book serves as an introduction helping the non-applied reader to see the beauty of mathematical modeling. Second, because Winfree explains the modeling process very thoroughly, instead of just presenting equations, the book can serve as a medium for the medical professional to acquire an understanding of the modeling process. A wonderful accomplishment...I am proud to have this book on my shelf and consider ita seminal text in mathematical modeling. This is a text that every first year graduate student should look at in some detail." (Mathematical s) "The new edition of The Geometry of Biological Time is a fascinating update of the delightful original. This new edition contains thoughtful commentary on new developments in the field, adding a historical and sociological dimension to the original book's elegant and unifying treatment of biological problems involving processes that repeat themselves regularly, i.e. involve 'rhythmic return through a cycle of change.' The book is an enjoyable page-turner, even for those readers with only a passing interest in biology, and demonstrates well the synergistic effect between biology and mathematics. ...The term 'page-turner' may seem unusual in mathematics; however, it is appropriate here. Not only is the reader continually tantalized by the figures appearing on the ensuing pages, but the new commentary lends a mystery-novel feeling to the book. This second edition was created by inserting new text boxes into the original, mostly intact, edition. This style leads to a fascinating historical picture. For example, the text, '(...In the latter cases the periodicity approximation gets worse closer to the pivot. I wish here to sweep such matters under the rug (in 1978))' is followed by a new text box that begins, 'The bulge under the rug grew and grew...', continuing with a description of developments over the last two decades. The plot continues even now, with descriptions of the last twenty years often followed in the book by descriptions of current puzzles. In summary, the original book is good and the second edition is even better; the historical commentary is fascinating, and there are also a few reorganized and new chapters presenting additonal biological examples." (MAA Online)