defined, along with the auxiliary pressureless equation that it satisfies, and the same general procedure has to be followed, but with additional hurdles posed by the nonlinearity. Both in the linearized nonstationary theory and the case of the full Navier–Stokes equations, certain energy equalities and inequalities appear to play a significant role. In the latter case, there are differences even between the two-dimensional and three-dimensional cases: sometimes additional conditions are required in the $n = 3$ case to prove the existence of weak solutions. We note that theory is developed for a completely general domain Ω. This means that it applies to arbitrary, unbounded, non-smooth domains. It is on this account that the restriction to the lower dimensions appears in the nonlinear case.

I should point out some of the strengths and weaknesses of the book. Although a fair amount of background is needed on the part of the reader, there is no doubt that the author has attempted to present a unified and self-contained account of the theory. The book is well written and not unnecessarily wordy. There is an up-to-date bibliography and a nice index. And where proofs are given, there are enough details that a reader with the proper background will be able to follow the argument. In my opinion, the author has succeeded in what he set out to do. My main complaint is that often the proofs and the lines of argument do not seem to be properly motivated. For example, when a weak solution is defined, no reasons are given as to why that definition has been chosen. When a particular space is chosen for some variable, we are not told the basis for this choice. This will certainly be a stumbling block for the non-expert. Another small problem with the book is that at times, as pointed out earlier, the order of presentation is not the natural order.

Who would benefit from reading this book? Certainly, a mathematician who wishes to know what the important issues concerning eq. (1) are and what has been achieved, would find this an excellent source. Equally, a mathematically-minded student, with a good grounding in analysis and who has decided to work in this area, or the teacher who wants to teach a course on this material would find this a valuable text. Not so obviously, the book would be of use to a dedicated teacher of analysis or functional analysis, who wishes to show his students that analysis really does have applications outside pure mathematics. The closed graph theorem, the Fisher–Riesz theorem, the fixed point principle, Fubini's theorem, the Hahn–Banach theorem, Hölder's inequality, the Leray–Schauder principle, the Riesz representation theorem and many other classic theorems are routinely used in this work. Will not a bright young student be better motivated to study analysis, if he sees the 'practical' use of what he is learning? I will now conclude with a possibly even more shaky suggestion. I think there are ideas in this book which may possibly suggest certain methods of actually obtaining rational or good approximate solutions to specific fluid-dynamic problems. To derive this benefit, however, one would have to take the trouble to learn at least the rudiments of a different language. It may well be worth it. I think Sohr has built a bridge that connects the practising fluid dynamicists to the mathematical fluid dynamicists and, hopefully, it will be used.

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Ecological Stoichiometry: The Biology of Elements from Molecule to the Biosphere. Robert W. Sterner and James J. Elser. Princeton University Press, 41 William Street, Princeton, NJ 08540, USA. 2002. 439 pp. Price: US$ 29.95.

Ecology as a science was once thought not refutable by the criterion of conjecture and refutation of Karl Popper; some even thought it was a weak science full of tautologies and circular reasoning. Any scientific theory should provide for a method to test it. In physics, the same notion prevailed about relativity – a remarkable theory; but when proposed, not enough experimental proof was available. However, one is not free to propose any type of theory – by any stretch of imagination and hope it would be proved right some day. In physics, experimental proof may be delayed, but a theory may be popular because of strong mathematical proof that may exist for it. These arguments are there in the book under review but not in sufficient detail. For example, the classic case often cited but not found in the book, is Clements concept of a climatic climax. Clements predicted that ecological succession always leads to a mono-climax determined by a particular kind of climate.

Ecological succession always ended in a form of dominant vegetation representing the mono-climax. If a mono-climax were not found, Clements would have said: 'If we wait long enough we would get it'. This theory of mono-climax is a weak one because it gets expanded to accommodate observations not predicted by it when first proposed. May be the next edition of the book can take care of such serious lacunae in the first chapter. Despite all this, one cannot help falling in love with the book for its sheer clarity and directness, and the refined experimental approach to the problem of ecological stoichiometry. The ideas have been presented lucidly from the point of concepts and definitions.

There have been attempts to develop the ideas and the main theme of the book from as far back as 1913, when Henderson published his *Fitness of the Environment*. It was considered a classic then on the elemental composition of living things. The first work on ecological stoichiometry as a concept proper was by Redfield in 1958, which became eponymous as Redfield ratios, while the latest on the subject is Reiner's in 1986. The book has its relevance from many other angles too, be it global warming or the greenhouse effect, the stable concentrations of CO_2 and O_2 in our atmosphere, nutrient cycling in aquatic ecosystems and many more. Reading the book has been like going through a journey where landscapes generate a veritable kaleidoscope of ideas and concepts. Each organism could be viewed as a stable steady state, either converting O_2 to CO_2 or vice versa. After all, for the ecosystem homeostasis is just the resilience of a system. Each ecosystem, including the whole biosphere, could be viewed similarly. The concepts of energetics of ecosystem and non-equilibrium thermodynamics developed by Ilya Prigogine could be applied to them, as amply exemplified in chapter 7 of the book under review. The book abounds in conceptual models that can be employed in physiology and evolutionary biology as well. For researchers and students, the volume is invaluable as a reference book. There is surfeit of useful information. Have a look at this passage in chapter 8: 'The concentration of oxygen has remained within bounds of 15 to 35% for the past 500 million years'. Since the residence time of oxygen in the atmosphere is 4000 years, its concentration has held steady for 1,00,000 turnovers. In chapter 5, there is a model called TER (threshold elemental ratio), which is based on the Leibig's law of minimum. In plant physiology, it is known as Blackman's law of limiting factors. If one calls these concepts tautologies, they are the most welcomed ones, for they represent as much a conceptual advance as the much-needed repetition of ideas necessary to clarify our stand on many contentious issues. Explanatory and predictive power of science has been enhanced by such tautologies since the time of Aristotle. It makes sense to know that stoichemistry itself is a tautology, a refined statement of the law of definite proportions. Little did anyone realize that this tautology, like a paradigm shift, could produce an empirical formula of man! The book is full of such formulae for organisms spanning an entire evolutionary scale (chapters 3 and 4). The section on biological chemistry (chapter 1) has some interesting facts from Lotka (1925). Here, a comparison of the elemental composition of the earth's crust is given from which a disproportionate abundance of C, N and P in the human body is apparent.

The evolutionary and phylogenetic speculations are not only interesting, but also powerful enough to stimulate further research. In plants, there is a plasticity of C : N : P ratios. In fact, biodiversity of animals with strict CNP homeostasis is linked to this plasticity of autotrophs. But, how has evolution achieved this? Authors conclude chapter 3 by stating that physiologies of energy generation and nutrient acquisition are decoupled to a large degree in autotrophs (what a profound statement!). Physical properties of matter have constrained the ways in which animals and plants can develop. The ideas can be developed further to complement the theme of the book. In development, organisms do not allow a common factor that scales both time and space to alter their body shape. Shape-invariant transformations are possible by altering the Cartesian coordinates of space alone, as seen in the isometric growth of some primitive organisms. A majority of vertebrates, including man show a disproportionate transformation of shape (no common scaling factor) and this type of growth is called allometric. In chapter 4, there is a reference to allometric N : P ratio in vertebrates. A common allometric pattern is the disproportionate increase in skeletal mass with body mass. The skeleton of a shrew is 5% of the total body mass compared to 27% of the total body mass in an elephant. Theoretical distribution of N : P in various organs for a mammal of 1 g and 1000 kg is given in chapter 4. This is the most interesting unpublished original data in the book. Central to the transformation of form is the mathematical concept of fractals. Each organ may represent a fractal and its own time-frame; for example, the life span of the kidney is 400 years compared to the life span of the entire human body (the calculation is done by the fractal theory). At a higher level than the organism, development may represent one trajectory and evolution, another. The rate of separation of these two trajectories is given by Lypanov exponents. These exponents put space and time coordinates on different footings, while the special theory of relativity puts them on equal footing – as a result, time scales independently from the space dimensions and thus each fractal will have its own time. This separation of space from time plays a key role in telescoping evolution into development – the basis of Haeckel's biogenentic law.

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Neuroscience: A Mathematical Primer. Alwyn C. Scott. Springer Verlag, GmbH & Co. KG, Tiegartenstraße 17, D-69121, Heidelberg, Germany. 2002. 351 pp. Price: Euro 59.95/US$ 49.95.

One would hesitate to suggest that the past decades have seen a decline in rigour in such a vibrant and exciting field as neuroscience. Nevertheless, it is somewhat startling to revisit classical mathematical methods applied to neurobiological problems, and realize how old-fashioned and quaint they appear in this era of ridiculously powerful personal computers. Indeed, there is also the rather alarming possibility that computational neuroscience itself may soon be perceived as unnecessarily fussy and old-fashioned to students of the internet era. What is the point of understanding compartmental approximations, and should they not be hidden under a glossy user interface so that users can better focus on the biological issues? Well, here in Alwyn Scott's book, are the real nuts and bolts of mathematical neuroscience; and computational as well as internet neuroscientists would do well to appreciate how much of their work rests on this foundation.

The apparent quaintness of mathematical methods in neuroscience arises from the fact that one trades human time and explicit mathematical assumptions for computer time and the hidden approximations in such programs. Nowadays, most scientists barely think about this trade-off – let the computer do the boring work, we say. This works for doing curve-fitting, but troublingly it also leads to more serious trade-offs in science. How many of us have reflected that we let the computer act as a censor when looking for interesting papers to read? In this book we see the power and also the limitations of the uncompromisingly rigorous approach, using mathematics to describe the functioning of neuronal systems. To a reader steeped in the more recent ambience of computational neuroscience, there is almost a subtext when reading the book: How would I do this computationally? What would be faster? What gives a deeper understanding?

The book leans heavily towards the mostly 'solved' problems of single-neuron function. Mathematically and computationally, neuronal biophysics is analysed by considering small cylindrical segments of the neuronal membrane, and examining the electrical properties of each segment. These properties include the 'passive' linear properties of resistance, capacitance and a battery formed from the build-up of ionic gradients across the membrane. This set of properties is equivalent to those of long insulated cables, and their analysis goes by the name of 'cable theory'.

The powerful computational functions of neurons arise from nonlinear effects due to voltage and ligand-gated ion chan-