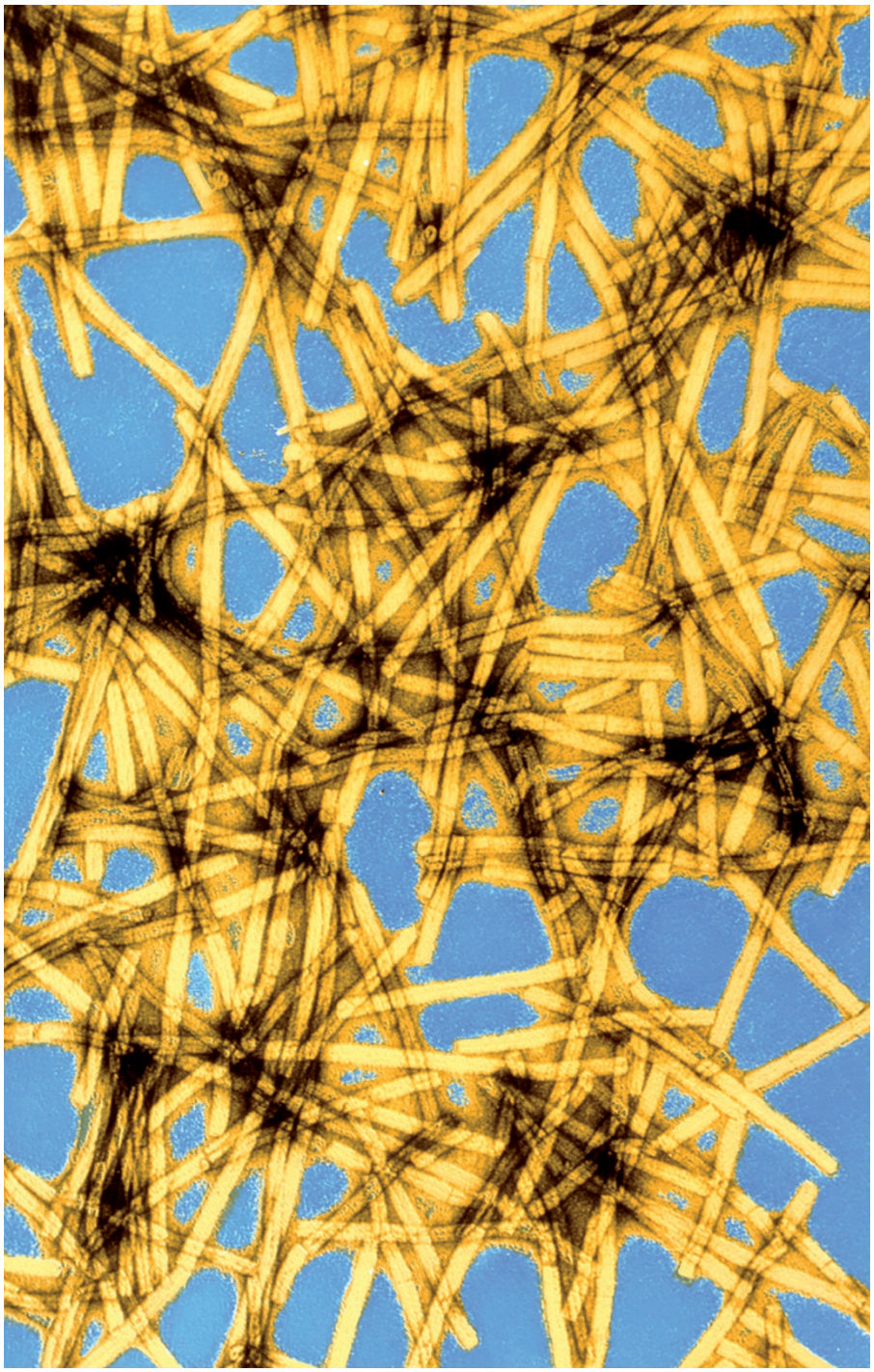
VIROLOGY

Potent tiny packages

Carl Zimmer's primer on viruses entertains, but reveals little about their basic traits, says **Robin Weiss**.

J. BURGESS/SPL



Rods of tobacco mosaic virus were first seen in 1939 using an electron microscope.

Viruses propagate in every kind of living organism and, despite being so tiny, amount to around 5% of the world's biomass. Viruses that infect algal blooms, for example, induce the calcification of their hosts and are thus responsible for the white cliffs of Dover in Britain, and other carbon sinks. Acclaimed science writer Carl Zimmer celebrates the versatility of these agents in a dozen entertaining essays in his latest book, *A Planet of Viruses*, which accompanies the World of Viruses educational website (www.worldofviruses.unl.edu).

Each essay deals with a different virus, ranging from those in bacteria and plants to scourges such as smallpox, severe acute respiratory syndrome (SARS), influenza and West Nile virus. There is food for thought here for all, even a seasoned virologist like me. Zimmer's writing grabs one's interest, but is marred by a lack of attention to detail. It would be a more attractive little volume if it were half as long again, because many of the essays end just when they become interesting.

Zimmer begins with the observation in 1898 by the Dutch microbiologist Martinus Beijerinck that the tobacco mosaic disease of plants was caused by "a contagious living fluid". Dmitry Josifovich Ivanovsky is ignored in the account — even though he had also isolated and propagated tobacco mosaic virus from filtered plant sap six years earlier — because he thought it must be a bacterial disease. The property of transmission through a filter too fine for bacteria to pass through became the defining feature of a virus, thanks to Beijerinck but also to Friedrich Loeffler and Paul Frosch, who reported the filterable nature of foot-and-mouth disease in the same year.

Zimmer omits the marvellous subsequent discoveries using tobacco mosaic virus: its crystallization from the 'living fluid' by Wendell Stanley in 1935; its composition as protein wrapped around RNA by Norman Pirie and Frederick Bawden in 1936; the first visualization of virus particles through the electron microscope by Gustav Kausche, Edgar Pfannkuch and Helmut Ruska in 1939; and the first demonstration, by Heinz Fraenkel-Conrat in 1955, that RNA alone can reconstitute infection. One of the most fascinating tales of twentieth-century science is how viruses opened up molecular biology, but you won't find it here.

A Planet of Viruses
CARL ZIMMER
University of Chicago Press: 2011. 109 pp. £13, $20

This year marks the centenary of Peyton Rous's demonstration that a cancer in chickens can be transmitted by a filterable agent. Zimmer's essay 'Rabbits with ▶

Horns' recalls Rous's pioneering work on tumour viruses, before introducing Richard Shope's discovery of the rabbit papilloma viruses, to which the essay title refers. Harald zur Hausen and colleagues discovered human cervical papilloma viruses in 1983; the vaccines that target them to protect women against cervical cancer were licensed in 2006. Thus, 100 years of tumour virology paid off. Rous may have had to wait longer than any other Nobel laureate to win his prize in 1966, whereas zur Hausen's 'incubation period' was a mere 25 years.

Owing to Zimmer's puzzling reluctance to delve into molecular virology, we have to wait until the end of the last and best essay, on the giant mimiviruses — discovered only in 1992 — to learn that some viruses have RNA genomes instead of DNA. No other replicating systems carry their genes in the form of RNA, as do polio, measles, influenza and most plant viruses. Some viruses have double-stranded RNA, whereas others are single-stranded; some viruses carry a single RNA or DNA molecule, and others have segmented genomes like the different chromosomes of higher organisms. Neither of the two chapters on retroviruses mentions reverse transcription — by which the RNA genome is turned into DNA before inserting itself into host DNA — even though the most potent anti-HIV drugs are designed to block this process.

Perhaps Zimmer thinks such facts are too difficult for his readership, but I view avoiding them as dumbing down. Which viruses evolved from bacteria, and which are more likely to have emerged as sets of genes that escaped from their hosts? Are some viruses relics from an RNA-based world, or are they relatively modern parasites derived from other living systems? Zimmer eventually raises the last question, but to my mind, the fascination of viruses is their enormous molecular and evolutionary diversity as much as their pervasiveness in the environment.

Concern for accuracy seems to have suffered as Zimmer becomes an ever more prolific writer. Some virologists' names are wrong, for instance, as are some other simple facts.

In a foreword to Peter Medawar's 1996 collection of essays, Stephen Jay Gould called this literary form "a weapon of wit and instruction". It would be difficult for any science writer to match Medawar or Gould; nevertheless, Zimmer's contributions fit this definition well. ■

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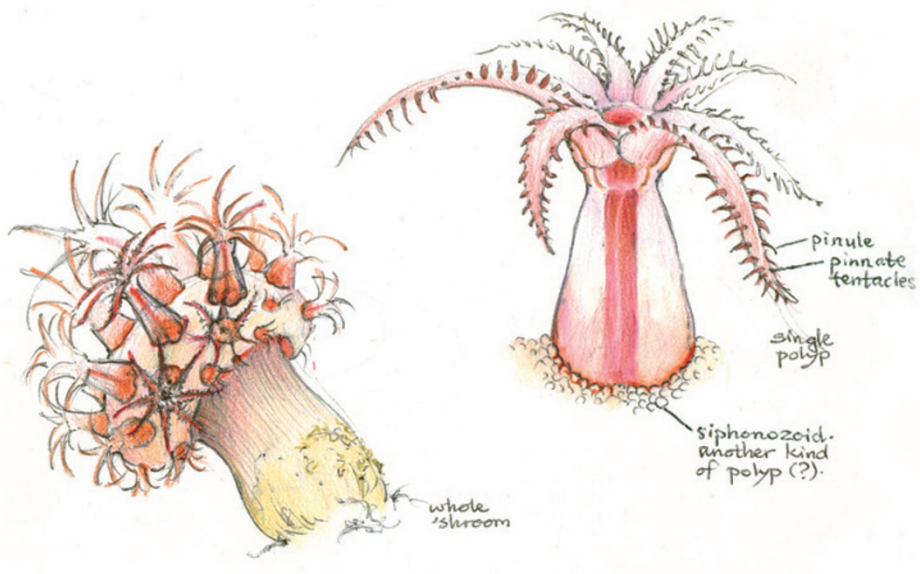


J. KELLER

A mushroom coral and one of its polyps drawn in the field by science illustrator Jenny Keller.

TECHNIQUES

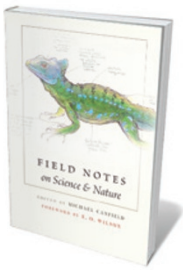
Records in the field

Good notebook skills are vital for documenting observations of the natural world, finds **Sandra Knapp**.

Field biology: the very words conjure up romance, danger, excitement. There is a thrill to fieldwork that makes lab-based scientists ask "How was your holiday?" when one returns from a stint outside. Many books have been written about the explorers of the past, transcribing their logs and journals, or fictionalizing their adventures. This volume is refreshingly different. Biologist Michael Canfield has compiled a set of essays not on researchers' travels, but on how they capture their experiences in their notes.

Field Notes on Science & Nature is an eclectic collection that crosses many disciplines, from geology, botany and zoology to art and anthropology. The variety of styles and records described are fascinating — field notes are very personal. Some of the contributors take notes entirely electronically, others in red pen in cheap notebooks. Others use pictures more than words.

Few of us have the artistic skills of Jonathan Kingdon or Jenny Keller, scientist-illustrators whose drawings alone make this book worth buying. But even the sketchiest sketch can call to mind a place or organism in a way no words can. I remember the field books of a friend with whom I worked in the tropical forests of Central America: an incredible mixture of description, sketches and taped-in leaves. Today, his seemingly chaotic collections evoke those places far better than my own lists. I learned from this, and started to sketch the plants I collected —flower and leaf shapes, plant forms and outlines appeared in my pages.



Field Notes on Science & Nature
EDITED BY MICHAEL R. CANFIELD
Harvard University Press: 2011. 320 pp. $27.95

The tradition has a long pedigree, encompassing notebook sketches by the great Victorian naturalists. My favourites are those of Henry Walter Bates, Alfred Russel Wallace and Richard Spruce, early evolutionists who mused on the page about why, as well as what and where. Keller's advocacy of standardized colour palettes in her essay harks back to the methods of eighteenth-century illustrator Sydney Parkinson, who accompanied Joseph Banks on Captain James Cook's voyage on HMS *Endeavour*, or the Austrian Bauer brothers, one of whom accompanied Captain Matthew Flinders on HMS *Investigator* a few decades later.

Parkinson drew and painted all of the plants that were collected, but for efficiency only coloured part of each (a practice recommended by Keller). He died on the voyage,

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