tance from a common ancestor is explanatory of form). Much of his presentation here draws heavily on the language of dynamical systems theory and the "new sciences of complexity" associated most closely with the Santa Fe Institute in New Mexico.

Complexity theory looks for commonalities among the relatively abstract systems susceptible to computer modelling, seeking 'generic forms' that may emerge out of synchronic brews of interacting components. One problem with this view is that real physical and biological systems are made of distinct kinds of materials. If assemblages of electrons, protons and neutrons, or liver cells or ants, have any generic forms in common, they are unlikely to be the most significant properties of these systems. In several of the examples discussed (for example, a mechanochemical model of vertebrate limb devexperimentally elopment that was disconfirmed several years ago) there is not enough attention given to the specificity of the materials under consideration.

Goodwin concedes that living systems are distinguished from nonliving systems, no matter how complex, by the presence of "powerful particulars that give them the capacity to regenerate and reproduce their own natures under particular conditions". So we are brought back, despite the author's intentions, to genes and history as the distinguishing characteristics of organisms. Whatever the evolutionary origin may have been of particular organismal forms (and the dynamical processes discussed here are a good bet for many of them), the present-day developmental realization of these forms must depend greatly on an accumulation of nongeneric molecular circuitry.

As Goodwin turns his attention from developmental biology to animal and human behaviour and to social ecology, he proposes a "science of qualities", as distinct from, and complementary to, the "science of quantities", which, he suggests, has prevailed since Galileo. Qualities in his terminology are the "expression of an integrated whole", but they then become conflated with quality as value, as in "quality of life". This is particularly evident in the contrast he draws between the healthy and environmentally correct Hunza people of Himalayan Pakistan and some messed-over populations in technologically advanced Western societies. While Goodwin makes some telling points about the irrelevance of genetics in accounting for cultural difference, societies, like organisms, are laden with their various histories. Concerning the means of liberation from such constraints, he has little to say.

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Myths dispelled

John Mann

The Consumer's Good Chemical Guide. By John Emsley. W. H. Freeman/Spektrum: 1994. Pp. 374. £18.99, \$24.95. To be published in the US on 27 October.

CHEMISTRY and chemicals receive a bad press. The very word 'chemical' now has a certain malevolence, conjuring up fears about pesticide residues in food, pollution of rivers and the atmosphere, or harmful drugs. Chemists must indeed take the blame for the invention of tetraethyllead, chlorofluorocarbons and nerve gases, to name but a few. But lest we forget the positive contributions of chemistry, it is worth noting that more than 20 million people died from bacterial infections contracted during the great 'flu epidemic of 1919. The value of antibiotics to health is thus obvious. Add to this the large proportion of agricultural production (around a third) lost to the ravages of insects, weeds and disease, and the continuing need for insecticides, herbicides and fungicides becomes self-evident. The benefits of chemistry to our health (drugs), nutrition (agricultural chemicals and food additives) and quality of life (plastics, dyestuffs, paints, synthetic fabrics, perfumery, chemicals and so on) are legion.

John Emsley has attempted to dispel the myths and perceived problems surrounding everyday chemicals while emphasizing their importance. The first half of the book is almost wholly positive. particularly the first two chapters on perfumes and sweeteners. The secrets of Chanel No. 5, Charlie and other wellknown brands of perfume are at least partially revealed, and human scents and aphrodisiacs are not forgotten. All of the main synthetic sweeteners are discussed and he convincingly debunks Yudkin's claim that sucrose is "pure, white and deadly". He also dispels fears about saccharin, and makes clear comparisons between the risks associated with everyday chemicals and the much greater risks associated with smoking or driving.

In a chapter on alcohol, he covers the fundamental chemistry of brewing and gives sound advice, based on knowledge of alcohol metabolism, on how to avoid hangovers. More good news derives from evidence that modest drinkers have, on average, less incidence of coronary heart disease, lower cholesterol levels and fewer colds. Many of the myths about cholesterol, fats and fibre are revealed in the following chapter. I was unaware that Denis Burkitt (of Burkitt's lymphoma fame) rediscovered the beneficial properties of fibre in the late 1960s when he noted that Africans rarely suffered from

colon or rectal cancers because of their high intake of fibre (Hippocrates originally recommended wholemeal bread in 400 BC). The chemistry of successful dieting is also discussed. Drugs make a brief (perhaps too brief) appearance in a chapter on painkillers, with the risks again clearly matched against the benefits. For example, there was an estimated 1-in-25,000 chance of dying from the disgraced (but highly effective) antiarthritis drug Opren, yet a 1-in-60 chance of dying from surgery associated with joint replacement and a 1-in-5 chance of dying from the long-term effects of smoking.

The benefits of chemistry become a little harder to sustain in the succeeding chapters, although Emsley sings the praises of plastics, especially PVC (polyvinyl chloride). He emphasizes the dangers of relying too much on animal tests, exemplified by the enormous disparity in dioxin toxicity between guinea pigs and other mammals. He gives a frank and fair account of all of the accidents involving the release of dioxins, but also reveals that these chemicals are produced in vast amounts in such natural processes as forest fires. But he does not mention the possible long-term effects on fertility of PCBs (polychlorinated biphenyls), DDT (dichlorodiphenyltrichloroethane) and so on, which are only now being revealed.

There is much irrational fear about nitrates in drinking water, and run-off from rivers rarely provides as much dietary nitrate as do green vegetables (up to 3,000 parts per million in spinach) or Perrier water (17 milligrams per litre). But there is no room for complacency: levels of nitrate in rainwater have increased dramatically since the invention of the motor car, which has also increased the concentration of carbon dioxide (and other gases) in the atmosphere. Emsley is convinced that global warming is not due to carbon dioxide, although he does not mention the effects of chlorofluorocarbons on the ozone layer, a much more serious result of our use of chemicals.

Emsley does not shrink from introducing chemical terms and principles where necessary, but the general reader should have no problem with these chemical asides. For those who like to see chemical structures, there is a glossary at the end of the book.

This accessible and entertaining book deserves to be widely read by the general public, and contains much information that will be of use to those who teach elementary chemistry courses. It may also persuade those journalists and environmentalists who persistently misrepresent chemicals to give chemistry the credit it so richly deserves.

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