rone, and therefore develops a sodium hunger because it cannot retain sodium. However, as the story develops in the chapter on hormonal regulation of salt intake, aldosterone or the mineralocorticoid deoxycorticosterone increases salt ingestion when given alone. Since salt appetite occurs with or without mineralocorticoids, they alone cannot be the triggers of it. Angiotensin II, acting centrally, is another hormonal candidate for salt-appetite induction, particularly as angiotensin and mineralocorticoids are synergistic in their effect on salt ingestion. Sex steroid hormones are also implicated because females develop salt hunger during pregnancy. Within the brain the female "enhanced avidity for sodium" is hypothesized by the author to depend on the medial amygdala for its expression. Other hormones, including ACTH, glucocorticoids, and atrial natriuretic peptide, are considered here and there in the book but have been less well studied with respect to salt ingestion.

The review of brain circuitry underlying sodium hunger is mostly based on lesion studies. The most compelling of these are in decerebrated rats, those with the anterior third-ventricle lesions and those with bilateral amygdala damage. There is obviously much more detail to be worked out, and it remains for future studies to match hormone receptor distribution with greater precision in defining circuits.

This little book is a good introduction to the topic and a handy, up-to-date review. It will be useful for students interested in learning about the psychophysiology of motivation and for researchers looking for a highly palatable update on the behavioral search for the taste of salt.

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The Serpentine Problem

The Ecology of Areas with Serpentinized Rocks. A World View. B. A. ROBERTS and J. PROCTOR, Eds. Kluwer, Norwell, MA, 1991. x, 427 pp., illus. $229. Geobotany, 17.

The geological term *serpentine* correctly applies to a group of only three polymorphic minerals—lizardite, antigorite, and chrysotile—but the word has been used much more widely by geobotanists to include all ultramafic rocks with a significant serpentine content. Soils derived from such rocks have attracted the interests of pedologists and plant ecologists for more than a century because of their wide global occurrence (from the arctic to the tropics) and their very variable chemical and physical properties. Few generalizations about their chemical nature can be made other than that they are rich in ferromagnesian minerals and are of relatively low silica content; often they are also low in calcium (relative to magnesium) and major nutrients (such as nitrogen and phosphorus) and have high nickel, chromium, and cobalt contents. Such soils can support both sparse and closed vegetation, which may include both endemic species having very restricted distribution and widespread species. It is the interplay of soil chemistry (potential element deficiencies, imbalances, and excesses) and physical conditions that has dominated the thinking of plant ecologists in their attempts to explain the distribution of plants on and their adaptations to serpentine soils. For all these reasons the "serpentine problem" has become the focus of much ecological and evolutionary research.

All these issues are addressed in this compilation. As its title suggests, the book presents a global view of serpentine vegetation, with sections on North America (the United States and Canada), Europe (the British Isles, Portugal, Italy, the Balkans), the tropical Far East and Japan, Africa (Zimbabwe and South Africa) and Australasia (Western Australia and New Zealand). Although variable in scope, depth, and presentation, the 16 chapters provide good insight into serpentine vegetation on a regional scale. All are profusely illustrated and extensively referenced. Several are the first comprehensive accounts of serpentine vegetation for their areas (for example, sections on Newfoundland, Portugal, Japan, and New Zealand); others bring together much disparate information (on North America, the British Isles, and the tropical Far East). An introductory chapter on the geology of serpentinized rocks opens the discussions.

The strength of this work lies in its broad geographic coverage. There are, however, some serious omissions, notably South America, Cuba, the Middle East, and Turkey. A further weakness stems from the over-long gestation period of this book—it has taken more than six years to appear. As a result, several of the chapters are now somewhat out of date. Despite this, the book will become a standard reference for all those interested in soil-plant relationships and will provide a stimulus for further research in this aspect of biogeography and geobotany.

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Phasing Techniques

Direct Methods of Solving Crystal Structures. HENK SCHENK, Ed. Plenum, New York, 1992. x, 445 pp., illus. $115. NATO Advanced Study Institute series B, vol. 274. From an institute, Erice, Italy, April 1990.

In diffraction experiments the x-ray intensities of crystallographic reflections can be measured, but the phases of the amplitudes, which are necessary for complete determination of the underlying crystal structure, cannot be. This is the famous "phase problem" in x-ray crystallography, and for nearly half a century it was common dogma that this phase information could not be retrieved from the data and was lost forever. That all changed in 1947 when David Harker and John Kasper, working at the General Electric research laboratories in Schenectady, stumbled upon a mathematical relationship, known as Schwartz's inequality, in a textbook and recognized that it could be employed to determine the phases of small groups of reflections, provided their normalized diffraction amplitudes were sufficiently large. This discovery encouraged others to investigate further, culminating in 1985 when the Nobel Prize in Chemistry was awarded to Herbert Hauptman and Jerome Karle in recognition of their work in developing direct phasing techniques. Today it is fairly routine to use direct methods to determine the crystal structure of compounds containing as many as 50 to 100 carbon, nitrogen, and oxygen atoms, and researchers no longer have to introduce heavy atom markers to simplify the phasing process. At the present time, researchers are engaged in efforts to devise more powerful direct phasing techniques that would allow routine determination of larger "light-atom" structures, perhaps even small proteins.

The present volume is a collection of 47 papers from the most recent of a series of meetings on direct methods that began in the 1970s. The first quarter of the volume is devoted to introductory lectures on the subject; as a collection these chapters lack the coherence and polish that a single author could have imparted. Crystallographers who regularly use direct methods, however, will find the volume valuable for keeping abreast of the majority of more recent developments in this subject area. Indeed, some of the papers deal with procedures that were under development at the time of their presentation at the meeting. These include Sheldrick's phase-annealing procedure, the SAYTAN and SQUASH procedures developed by the York group, Hauptman's minimal function technique,