to our knowledge of materials. A chapter on the general principles of design of the bow-girder is included, and will be of service to the practical designer, to whom a considerable portion of the volume will be sealed on account of necessarily complicated mathematical treatment. The authors may be congratulated on the success with which they have solved a very difficult practical problem.

Spectrum Analysis, applied to Biology and Medicine. By the late Dr. C. A. Macmunn. Pp. xiv + 112. (London: Longmans, Green and Co., 1914.) Price 5s. net.

THE late Dr. Macmunn belonged to a class of which British science does well to be proud: the class of men who, notwithstanding the arduousness of their professional labours, find or make time to engage in research. Born in Ireland and educated at Trinity College, Dublin, Macmunn practised medicine for twenty years at Wolverhampton, and during that period published his researches in the application of spectrum analysis to biology and medicine. The present work, as we learn from the preface by Prof. Gamble, was begun and continued between attacks of severe illness and was left in an unrevised state.

Dr. Macmunn was an early worker in the field and deserves the credit of the pioneer. Although no remarkable discovery attended his efforts, he contributed valuable observations on the nature of the various colouring matters both in animals and in plants. He demonstrated that the pigments of not a few animals contain chlorophyll: a demonstration confirmed in certain cases by the discovery of algæ living symbiotically in the tissues of these animals.

Although the professional man of science who specialises in this department of research may not need to consult this work, we welcome it and hope that it may be widely circulated and read, for it is a worthy record of the labours of one who loved research and ensued it with ardour and success.

The Geographic Society of Chicago, Bulletin No. 4. The Weather and Climate of Chicago. By Prof. H. J. Cox and J. H. Armington. Pp. xxv + 375. (Chicago: University of Chicago Press, 1914.) Price 12s. net.

MESSRS. COX AND ARMINGTON have made a statistical study of the climate of Chicago of extraordinary detail. The result is valuable as a book of reference, but cannot be described as easy reading, chiefly owing to one hundred and forty-five tables intercalated in the text. Records of temperature extend back to 1830 and of rainfall to 1843, but the series are not homogeneous, there being several changes even in the shorter period 1871 to 1911, which is adopted for normal values. Normals, however, are not regarded as so important as the occurrences of abnormal conditions and rapid variations which render the climate healthful and invigorating—and with a temperature range from -16° to $+103^{\circ}$ F. there is abundant room for rapid changes. The extremes would be even greater but for the near neighbourhood of

Lake Michigan, as is well shown by a study of the lake breezes, and by temperature records at different distances from the shore. The abnormal periods are further considered, not merely locally, but as part of the weather of the whole States, and this aspect is illustrated by reproductions of the daily synoptic charts, unfortunately sometimes so small as to be almost undecipherable. Full use is made of isopleth diagrams for exhibiting hourly variations; a feature with less to recommend it is the replacement of departures from normal temperature by accumulated departures, which are said to be "more vivid"—though it is not self-evident that an "accumulated" departure of $+1262^{\circ}$ conveys more to the mind than a mean departure of $+3\frac{1}{2}^{\circ}$.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

Experiments on Hay Infusions.

DR. BASTIAN'S interesting experiments suggest further considerations, particularly as to the osmotic effects of solutions of different strengths and temperatures. A solution of hay made at a higher temperature will probably be a stronger solution containing more soluble matter, and also more silicate from the glass. A solution kept for a fortnight may evaporate and become more concentrated. Does one concentration produce Zoogloea, and a greater concentration produce spores?

Am I right in thinking that the general effects of increasing concentration are crystallisation, precipitation, an increasingly dense protoplasm, a thickening cell-wall, and cell subdivision? Is free-cell formation another process brought about by increasingly concentrated solutions? Is dilution, and especially dilution with warm water, the necessary osmotic condition for bursting the cell-wall and liberating naked or amoeboid forms? Can we explain the phases of an organism in terms of its previous history and present conditions?

Where a change takes place in the population of a pond this may, of course, be due to individual transformations of tadpoles into frogs with rise of temperature, or it may be due to differential rates of increase or death, as when in a dry summer sticklebacks die and frogs survive. It is not quite easy to disentangle the transformation and the survival processes when the organisms are minute.

HUGH RICHARDSON.

Stocksfield-on-Tyne, December 31, 1914.

THE ASCENDING SPIRAL.¹

MANY years ago the author of this interesting and stimulating book became impressed with the widespread distribution of "spirals" in nature. He has persistently followed the clue in the hope of discovering the significance of this form, which is ever-recurrent, especially in the realm of organisms. Many others have been on

¹ "The Curves of Life. Being an Account of Spiral Formations and their Application to Growth in Nature, to Science and to Art; with Special Reference to the Manuscripts of Leonardo da Vinci." By T. A. Cook. Pp. xxx + 479. (London: Constable and Co., Ltd., 1914.) Price 12s. 6d. net.