In an analogous manner, radio waves in the ultra high frequency band above 300 Mc./s. can be used for communication over somewhat shorter, but still useful, distances of the order of 500 km., by forward scattering of the waves from irregularities in the troposphere at a height of a few kilometres. A similar use of high effective power, directive aerials and sensitive receivers is required but, on account of the higher frequency employed, a greater resulting bandwidth can be made available for normal radio telephony operation. Until more information is disclosed as to the scientific and practical results of the investigations in progress in various parts of the world, the full possibilities of communication systems based on the forward scattering of radio waves in the ionosphere and troposphere cannot easily be visualized. Further publication of the results of recent investigations in these fields will be awaited with interest by all those concerned with the future of radio communication.

VEGETATION OF THE ASSAM VALLEY

IN Vol. 9, No. 1, of *Indian Forest Records* (pp. iv + 87 + 4 plates. Delhi: Manager of Publications, 1954), J. B. Rowntree, formerly conservator of forests, Assam, writes on an "Introduction to the Vegetation of the Assam Valley". In 1938 Dr. N. L. Bor, on deputation among the head-hunters of the Aka Hills, Assam, wrote a detailed account of the vegetation of that area. A first attempt to classify the vegetation of India was made by Mr. (now Prof.) H. G. Champion in 1935 in "A Preliminary Survey of Forest Types in India and Burma". The area covered did not permit of great detail being given. The present work is an attempt to do the same for the whole of the Brahmaputra valley.

The object aimed at was to collect all the existing data on the subject, with additions from personal knowledge of all the communities described, especially

with respect to the *Dipterocarpus-Mesua-Michelia* association and the *Shorea-Sclivina-Lagerstroemia* pro-climax. To the north of the Brahmaputra the river runs practically north and south, and from the foot of the hills the land drops on a gentler slope. The hill areas are covered with forests; but, owing to the prevailing habit of shifting cultivation (*jhuming*), the climatic climax formation is but rarely met with, and the forest is mostly of secondary growth. In most of India this practice was stopped by the British Government; but this action did not extend to the remote Assam of those days. As in the case of Africa, so here; Mr. Rowntree states: "In olden times when the population was kept in check by wars and disease no great harm was done, but nowadays with the population increasing (in places at alarming rates) this is no longer the case". The *jhuming* rotation is becoming shorter and shorter, and in places is down to three years. As a result, the ground-cover appears to be retrogressing from tree growth to bamboos and finally to grass, the soil is decreasing in fertility and erosion increasing from year to year, with floods silting up valuable plain land.

The main reserved forests lie along the foothills with detached blocks on higher land in the plains. The tropical evergreen formation is in Upper Assam, and the *Shorea robusta* association in Lower Assam. Among biotic factors man, as has been shown, plays a predominant part, followed by animals, giant climbers and epiphytes, insects, soil algae, bacteria and earthworms.

Having disposed of the factors of climate, geology and soils and so forth, Mr. Rowntree, in a series of chapters, deals with the classification of the communities, the tropical *Cinnamomum-Amoora-Michelia* formation and its associates, the deciduous *Shorea* formation and other groups, grasslands and savannahs, and so forth. Appendixes give maps, and there are a few illustrations. To the forest officers and those interested in the flora of this little-known part of the world, the work should prove invaluable.

E. P. STEBBING

RELATIONSHIP BETWEEN CERTAIN COMPONENTS OF THE CYTOCHROME SYSTEM

By PROF. D. KEILIN, F.R.S., and DR. E. F. HARTREE

Molteno Institute, University of Cambridge

OF the components of a typical cytochrome system only cytochrome *c* has so far been isolated in a soluble and completely pure state. By a very simple procedure¹, cytochrome *c* containing 0.34 per cent iron can be obtained from heart muscle on a large scale, while further purification²⁻⁴ yields fractions with iron contents of 0.43-0.45 per cent. Although the properties of this isolated or exogenous cytochrome *c* are in general independent of the method of extraction and of the degree of purification, its catalytic activity, as determined with a heart-muscle preparation of cytochrome oxidase⁵, is much lower than that of the endogenous pigment present in this preparation^{4,6-9}. Furthermore, only exogenous cytochrome *c* combines with cyanide within the physiological range of pH¹⁰⁻¹⁴.

These differences between the two forms of cytochrome *c* appear to favour the view that it undergoes a marked change on extraction. However, two con-

siderations militate against this view. (1) Cytochrome *c* which has been obtained by a very mild method of extraction of washed heart-muscle mince with phosphate buffer has the same properties¹⁰ as the pigment obtained by the usual, more drastic, method¹. (2) The catalytic activity of the cytochrome system in a particulate heart-muscle preparation depends upon appropriate spatial distribution of all components of the system; in other words, upon an arrangement within the particles which assures their mutual accessibility. In this respect endogenous cytochrome *c* is more favourably placed for electron transfer reactions than is the exogenous pigment. That there is no essential difference between the exogenous and endogenous forms was demonstrated by a transformation of the former into the latter¹⁰. This was achieved by adding extracted cytochrome *c* to a washed heart-muscle mince previously made deficient in cytochrome *c*, and then