

is lacking. As a matter of fact, pathology and therapy have of late years made such rapid strides that the physician can, in the majority of instances, give reason for the therapeutic faith that is in him. For this we have to thank both the research activity of the scientific laboratories and the keen and critical observations of our better clinics.

The introduction of new therapeutic methods and new drugs can scarcely be expected from now on to be arrived at by accident, or through pure empiricism. Every new therapeutic agent should, as Magnus¹ has emphasized, be thoroughly tested in the laboratories as regards its activity and its dangers, and, later, in the organized clinics, before it is introduced into general medical practice. Best results in clinical experience must ever remain the final and crucial test of every form of therapy.

CONTRIBUTIONS TO THE KNOWLEDGE OF FOREST PRODUCTS.

INTRODUCTION.

BY ROLAND E. KREMERS.

It seems generally true that a people's interest in forests and the care which they bestow on their available timber is in inverse proportion to their national resources. As the history of our country repeatedly shows, our former abundant forests have been largely wasted until now we face an acute shortage at no very distant date.² But even while the wanton destruction of our forests was at its worst, there were far-sighted men who warned the nation of inevitable consequences, and who appealed to European conditions and experiences for their justification. Through such men the now well-known conservation movement was established. This resulted not only in the awakening of general interest, but also in the strengthening of remedial tendencies, notably the development of National Forests and of the present Forest Service, better forest management, and more active reforestation. But whatever the means employed, the chief end of the conservation movement as applied to forestry was timber. In certain sections there has been compromise with other interests and resources, especially in the West where mining and grazing have striven with forestry for priority.

The need for forest conservation is quite generally admitted at present, but there is not the same agreement as to how it shall be practiced or as to its urgency. Yet it seems not at all unlikely that in no very distant future there will be important problems other than timber supply connected with forest areas. These regions will have to do their share in giving employment to labor and in the distribution of population; more and more they will become important as recreation areas and as health resorts. In fact, it is stated that silviculture in the broadest sense is the first and highest development of land utilization, closing the progression of hunting, lumbering, grazing, tillage especially for grains, and tree crops as civilization develops.³

¹ R. Magnus, *Allgemeine Pharmakotherapie*, in Krause and Garré: *Lehrbuch der Therapie der inneren Krankheiten*, Jena, 1, 71-143, 1911.

² For a comprehensive statement of the politico-economic phases see "The United States Forestry Policy," by John Ise, Yale Univ. Press, New Haven, 1920.

³ J. Russell Smith, "Industrial and Commercial Geography" (Holt & Co., New York, 1913), p. 656.

The fact that present American forest practice looks to the timber crop as almost the sole source of revenue has its disadvantages in spite of being a safe investment. Particularly when the project has to begin with reforestation, it is a long-time investment and that is not overly attractive to capital in a country that is scarcely out of the exploitation stage. Hence it seems desirable to find means of deriving some sort of annual return from forest areas in order to reduce the overhead, even if it should not be possible to pay the interest on the investment.

In order to accomplish this end, other products than mature timber must be found. Up to the present, the so-called forest industries, the naval-stores industry and the wood distillation industry have almost competed with lumbering in wanton destructiveness. The more recent paper pulp industry is said to be more conservative because the installation is much less mobile. But all of them use more or less mature timber. This problem of studying and of developing non-timber forest products has seemed to the author and his students a most interesting source of materials for studies in organic and plant chemistry. The forest as a whole will be studied for whatever chemical products it may yield. The investigations are being carried on in the belief that any and all contributions to scientific fact will ultimately reap their practical benefit when their interrelations have been sufficiently understood. But it is just these interrelations which will be most carefully considered with a view to formulating a sequence of products for each month of the year. And when the desired plants have been sufficiently studied so that they can be grown with as much assurance as any other crop then we shall have a new forest management which will rank as an agricultural-chemical industry.

The easiest approach seems to be through the drug plants about many of which something is already known. It is because of these intimate relations to pharmacognosy and pharmaceutical chemistry that the series of papers, "Contributions to the Knowledge of Forest Products," growing out of the studies in the Vanderbilt Laboratory for Organic Chemistry, will be published for the present in this JOURNAL.

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CONTRIBUTIONS TO THE KNOWLEDGE OF FOREST PRODUCTS.

I. THE PREPARATION OF *p*-AMIDO-THYMOL FROM *d*-LIMONENE.*

BY A. C. GRAYBEAL AND R. E. KREMERS.

Limonene is an important constituent of many volatile oils. Although isomeric with pinene and very frequently associated with it, limonene does not have the same importance in the oils of the Coniferae that pinene has. In fact it is, broadly speaking, true that where one predominates the other is recessive, and that pinene characterizes the oil from the oleoresin whereas limonene is more characteristically found in the leaf and twig oils. As the latter are valued for their content of borneol or terpineol or esters of these alcohols, it seemed of interest to consider possible methods for the chemical utilization of the less valuable limonene.

The reactions chosen for study had all been previously recorded separately in the literature.

* Abstracted from a thesis presented by A. C. G. to the Graduate School of Vanderbilt University in partial fulfillment of the requirements for the degree of M.S., June 1921.