given to all the factors involved. At present many of these factors of biologic systems are unknown or little studied and their complexity renders explanations of the reactions extremely difficult. As stated above, it is known that the skin is a factor in the reactions of such preparations of nonspecific proteins as Aolan. The present findings confirm the statements of the previous publication and warrant to a still greater extent the serious consideration of the skin as an organ in specific therapy.

The conclusions from the above work are:

(*a*) Of the three routes for the administration of insulin, a specific therapeutic agent, the increasing order of efficacy is (1) intravenous (2) subcutaneous and (3) intradermal. These results agree with those obtained from the study of certain nonspecific substances.

(*b*) Because of these findings the skin offers a new medium of administration for both specific and nonspecific agents which should engage the attention of investigators.

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THE VALUE OF MICROANALYTICAL METHODS AND EXAMPLES OF THEIR APPLICATION.*

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The microscope continues to increase in importance as a working tool of the analyst, and microanalytical methods are taking a prominent place in the solution of laboratory problems. Unfortunately, the microscope has not always been as important as other instruments of precision and microanalytical methods have not received the recognition which they deserve. As such methods continue to justify their value in the solution of laboratory problems they are being more widely applied, and the trained microanalyst is demonstrating the value of his specialized experience.

In the early history of the microscope the microanalyst's field of activity seemed restricted to the microscopical identification of plant ingredients. For that reason he has needed chiefly a strong foundation in botanical subjects, particularly those relating to plant anatomy and histological structures. The microscopy of vegetable foods and drugs therefore became his largest field of activity. As time went on his field of usefulness broadened to include microchemical technique and the application of optical-crystallographic methods to the identification of small quantities of crystalline material. His expert knowledge became valuable where only small quantities of materials were available and the necessity arose for the conservation of the unknown substance for further tests. In the course of their work microanalysts may often be called upon to employ the following methods of attack.

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The Microscopical Identification of Plant Ingredients.—The microanalyst must readily detect differences in structure and properly valuate their importance for identification purposes. The microscopical examination of pyrethrum (insect) powder is a case in point. Such a product is often sophisticated, by substituting for it other flowers or the stems of the plant. Only a microscopical examination can disclose the presence of flowers other than pyrethrum or of the stems. Furthermore a distinction is often made commercially between powders ground from closed flower-heads (immature) and those ground from mature flower-heads (open flowers). Pyrethrum powder pulverized from mature flower-heads is characterized by the presence of a large amount of tissues from the mature fruits or achenes. On the other hand, powder ground from immature flowers will show very little of the fruit tissues and will contain a large quantity of pollen. The trained eye will readily identify such tissues. If they form the greater proportion of the sample, the analyst can at once draw conclusions as to the nature of the original material.

Microchemical Tests.—Microchemical tests are invaluable in microanalytical work and in many instances are rapid and accurate means for identifying small amounts of material. Methods are described in the literature. Although such tests have limitations soon shown by experience, in trained hands they will furnish valuable clues to the identity of a substance. Unfortunately, the results of a microchemical test often tell only half the story. For instance, the chemical identification of an admixture of sodium and potassium salts may be very difficult when two or more acid radicals are present. Microchemical tests cannot furnish any information as to the combination of the sodium and potassium with the acid radicals.

Optical-crystallographic Methods.—The analyst often needs to identify small quantities of crystalline material which cannot be wasted in making many qualitative tests. An examination of this material mounted in a suitable liquid may soon establish its identity. For example, it was necessary to establish the identity of crystalline material, the odor of which, to be sure, was somewhat indicative of its nature. Additional and more trustworthy tests, however, were necessary to make certain of the nature of the substance and a determination of the optical properties was made. The petrographic microscope readily identified the substance as vanillin in the course of half an hour.

Quantitative Microscopy.—This branch of microanalytical work has its limitations although it is surprising what accurate and trustworthy results may be obtained on certain classes of products by experienced workers. Carefully prepared standard reference samples containing known amounts of the suspected ingredient and as nearly identical as possible in fineness of powder with the product under examination are essential. Various workers have used different methods of attack. Some have used diluents while others have used certain diagnostic elements as a criterion for a certain amount of material. Much work remains to be done along this line.

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