"Es sind dies eben Dinge, die sich wirklich gegenwärtig nicht, ohne gegen das Postulat der Objektivität zu sündigen, mit wenigen Worten abtun lassen. Ein Blick auf Casparis Literaturverzeichnis, das mehr als ein halbes Tausend Abhandlungen umfasst, wird Ihnen zeigen, dass ich darin recht tue" (pp. 475–476).

In conclusion the reviewer is tempted further to quote the judgment of von Fürth respecting the duty of an investigator to correlate his own experiences so that they afford a logical summary of his undertaking. Thus in referring to the myriad of details published in recent years by London and his pupils on the physiology and chemistry of the digestive functions von Fürth remarks:

"Ich bin ehrlich genug, um offen einzugestehen, dass ich mich einer Würdigung dieser ungeheuren Fülle von sicherlich sehr verdienstvollen Einzelbeobachtungen nicht gewachsen fühle. Eine solche wird wohl erst dann möglich sein, wenn London selbst sich einmal der Mühe unterzieht, dieselben im Zusammenhange kritisch zu verarbeiten und seine leitenden Gedanken, die auf so viele Publikationen verteilt sind, dass der Aussenstehende den Zusammenhang verlieren muss, hervorzuheben. Es ist dann zu hoffen, dass sich aus diesen und anderen Arbeiten, welche verwandten Zielen zustreben allmählich ein abgerundetes Bild des Eiweissabbaues im Darme in seinen einzelnen Phasen gestalten wird" (p. 71).

To those who wish to orient themselves in the changing aspects of physiological research, particularly its chemical manifestations, the lectures by von Fürth will surely serve as a stimulating guide. Books of this type are rare.

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Alternating Currents and Alternating Current Machinery. By D. C. and J. P. Jackson. New York, The Macmillan Company, 1913. Pp. viii + 968, 521 text figures. Price, $5.50.

This new edition of a well-known work furnishes one of the best general treatments on the subject of alternating currents, as did the first edition in 1896. Rewritten and expanded to twice its former size, it forms a very complete and, on the whole, well-balanced treatise. The work is attractive, the style easy and the illustrations, many of them diagrammatic, are instructive. Descriptive and mathematical discussions are combined throughout, and examples from practise are used to illustrate theory.

Attempting to cover so much in a single volume assigns a formidable task to both author and reader. Although on the whole satisfactory, the treatment might to advantage have been made more systematic; the book would not have suffered by being more condensed. The chapters on synchronous machines (185 pages) and on transformers (155 pages) approach special treatises on these subjects. The latter would be improved by complete rearrangement, the discussion of mutual induction forming not so suitable an introduction to the transformer, in a book of this kind, as would a discussion of diagrams and equivalent transformer circuits that are discussed later in the chapter. The discussion of power and power factor is particularly satisfactory and complete.

That the authors omitted many historical footnotes seems unfortunate. Such notes not only serve to give credit where it may be due, but they make possible for the reader a more detailed study of special subjects than the limited description of any one text will permit. The footnotes retained (and these are not a few) prove their value. The authors refer in their preface to the intentional omission of many notes on the ground that they are unessential for undergraduates. But the scope of the book justifies no such limitation; its field is much wider than the undergraduate class-room. The book should find many readers whose undergraduate days have long since passed. The authors are to be thanked for its production.

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Petrographisches Vademekum. Second edition. By E. Weinschenk. Freiburg im Breisgau and Saint Louis, Mo., Herder Pub-

lishing Company. 1913. Pp. viii + 210; 1 plate; 101 figures in text. Price, ninety cents.

This little volume presents in an interesting manner those facts concerning rocks which are of interest to the student of general geology. The author has in mind a pocket manual which may be of service in the field. The treatment is from the standpoint of the macroscopic properties of rocks and is thoroughly modern. The book is well printed. The illustrations are excellent.

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SPECIAL ARTICLES

THE CULTIVATION OF TISSUES FROM THE FROG

IN a series of experiments on the culture *in vitro* of tissues of the frog it was found that several kinds of tissues show a marked outgrowth after being kept for a few days in lymph or plasma. Small pieces of the tissues were mounted according to the usual method in hanging drops of the culture medium and sealed with vaseline in hollow slides. Cells may remain alive under these conditions for several weeks.

Spleen, bone-marrow and pseudothyroid give rise to a fringe of outwandering cells resembling leucocytes which extend farther and farther into the surrounding medium. Larger connective tissue cells wander out later, and both types of cells exhibit amœboid changes. Small pieces of tissue may almost entirely disintegrate into wandering cells.

The epithelial cells of the skin extend generally as a broad thin sheet of tissue. The cells move out in contact with the cover slip or the lower surface of the drop. Individual cells of the epidermis may become isolated and creep out alone, but there is a marked tendency for the cells to keep together in a continuous membrane. In a previous paper on the movements of the ectodermic epithelium of amphibian larvæ[1] it was shown that the ectoderm cells actively creep out by an amœboid movement of the very thin and transparent protoplasm of their free borders. The method by which sheets of epithelium extend in the adult frog is essentially the same as in the embryo or larva.

In several cases black pigment cells were seen to isolate themselves and wander out along the cover slip or lower surface film of the drop. In some cases, especially in the smaller pigment cells, the changes in form were fairly rapid. Pseudopods were thrust out and retracted very much as in the common amœba, and in some instances the cells were seen to migrate nearly across the field of the microscope. The processes of the pigment cells of the adult, unlike those of the larvæ, may be nearly transparent, and they usually are so when first formed; frequently, however, they are very soon invaded by pigment granules. Outwandering cells may show branching processes characteristic of the expanded melanophores of the frog's skin. The change in form of the pigmented mass within the cell is due in part to changes in the outline of the whole cell and in part to the flowing back and forth of pigment granules within the cell processes. There is a measure of truth, therefore, in both the rival theories of the changes of the chromatophores in the skin of the frog.

In some preparations the peritoneal epithelium wandered out in the form of a sheet of tissue considerably greater in area than the original preparation. For the most part the extension consisted of flattened cells arranged in a single layer and showing a hexagonal contour like the cells of the shed cuticle. Many of these cells were furnished with cilia which beat actively for two weeks. The ciliated cells frequently became amœboid and wandered free from the rest, sending out fine processes several times the original diameter of the cell. Sometimes the processes branched repeatedly. One would not suspect these cells to be derived from ciliated epithelium were it not for their tuft of beating cilia, and the fact that one can actually observe their transformations. Follicle cells of the testis may creep out and give the appearance of giant amœbæ.

Fuller details of the behavior of various

[1] Univ. of Calif. Pubs. Zool., 1913.