To conclude, in the chapter on the Relation of the Crustacea to Man we miss any adequate account of the valuable lobster fisheries of the old and new worlds, or of the laborious experiments which have been made to rear the young of this much-prized crustacean, and which in America have finally led to success.

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Qualitative Chemical Anaysis. A Laboratory Guide. By W. W. SCOTT, A.M., chief chemist, Baldwin Locomotive works, formerly Professor of Chemistry, Morningside College, New York. D. Van Nostrand Co. 1910. $1.50 net.

A Course in Qualitative Chemical Analysis. By CHARLES BASKERVILLE, Ph.D., F.C.S., Professor in the Department of Chemistry of the College of the City of New York, and L. J. CURTMAN, Ph.D., Instructor in the Department of Chemistry of the College of the City of New York. The Macmillan Co. $1.40 net.

We have in these two books further additions to our already long list of works on qualitative analysis.

The first contains a discussion of the ionic hypothesis, the mass law and other physical chemical principles with their applications to qualitative analysis, followed by a systematic study of the detection and separation of bases and acids, methods of analyzing an unknown substance and tables containing special data. The best methods of separation have been selected and a very valuable addition made in the form of notes on each group. In these notes the reasons for the various reactions used and the precautions recommended are discussed, thus enabling the student to work intelligently and not, as is so often the case, merely mechanically. This book can be recommended as an excellent laboratory guide to qualitative analysis, especially if the principles discussed in the theoretical part are applied to the reactions studied.

In the second work special emphasis is placed on the quantitative discrimination of the substances detected by qualitative methods of analysis as a preparation for quantitative analysis. In selecting methods of analysis those have been preferably chosen which they think can be most readily used by the student; especially if they give rise to precipitation tests which will enable the student to approximate the amounts present. As in the other work, explanatory notes have been introduced.

An objection the reviewer would make to this book is the almost complete absence of any applications of the present theories of solution and the mass law to the reactions of qualitative analysis. Although the statement is made in the preface that these matters are usually presented in lectures in general chemistry and may be taken up in lectures on qualitative analysis, they do not apply these in this book; but retain the molecular reactions and the theory of the formation of complex compounds in place of the methods which are now so generally taught.

J. E. G.

SPECIAL ARTICLES

CHANGES IN CHEMICAL ENERGY DURING THE DEVELOPMENT OF FUNDULUS HETEROCLITUS

ALTHOUGH at present it is hardly possible to do more than give a brief report of progress, nevertheless, the results which have been obtained from the calorimetric study of the beginning and end stages in the development of *Fundulus heteroclitus* harmonize so completely with the results gotten by Tangl and Farkas in the case of the chick and silkworm, respectively, that a brief account of the work appears warrantable at this time.

Omitting many details of technique, the methods employed in this study were as follows: The eggs of *Fundulus,* immediately after artificial fertilization, and the larvæ immediately after hatching, were dried at 40° C. This portion of the work was carried on at the Marine Biological Laboratory at Woods Hole, to whose director, Professor Frank R. Lillie, I am indebted for the use of a room. The material, which had been previously carefully counted, was then preserved in the dry state in ordinary phials until used for the chemical

and calorimetric analyses which were carried out in Budapest.

Determinations of the chemical energy—heat combustion—in known quantities of the material were made by means of the bomb calorimeter, strictly according to the rules of modern calorimetry. Small (practically, between 15° and 25° C.) calories were recorded. Concerning the applicability of thermochemical methods to the study of embryogenesis, nothing need be said at present except that indirectly the work of Rubner and others, while directly that of Tangl and his students, can leave no doubt on this point.

Comparison between the fertilized egg and the hatched embryo of *Fundulus* disclosed a discrepancy in chemical energy which can be in no wise interpreted as an analytical error. Thus briefly summarizing the results, it was found that

	Calories
1,000 fertilized eggs of *F. heteroclitus* contained	3,264
1,000 hatched larvæ of *F. heteroclitus* contained	2,550
Transformed during development	710

If loss of energy during development is to have any special significance from the standpoint of embryology, it must be shown that no substances rich in chemical energy diffuse out of the egg during the period under discussion. This seems to be true of *Fundulus,* for the nitrogen content of the egg remains constant up to the 240th hour, and probably for the whole developmental period. In the case of the frog also, no substances appear to diffuse out of the egg, for the ash content remains the same from the beginning of the development to the end. The same thing has also been proved for the trout, the chick and the silkworm (Tangl and Farkas). The only alternative therefore seems to be that the discrepancy in chemical energy between the end and beginning stages of development is due to the transformation of chemical energy into heat, or other forms, and not to the diffusion of energy-containing substances out of the egg.

During the developmental period, 384 hours, during which 1,000 eggs of *F. heteroclitus* lose 710 calories of chemical energy, larvæ are produced whose organic substance weighs in the neighborhood of 0.2 gram. If now the amount of energy lost is divided by the amount of organic substance produced and multiplied by ten, $710/.200 \times 10$, we get 3.6 large (kilogram) calories—an amount which expresses the specific work of development, namely, the amount of chemical energy transformed during the production of one gram of organic substance of *F. heteroclitus.*

The further discussion of these results, as well as of many subordinate questions connected with them, must be reserved for the future, when I shall report upon work of the same kind now in progress on other forms, but not sufficiently advanced to warrant description. The results of Tangl on the chick, however, and of Farkas on the silkworm are highly suggestive, for the specific work of development (Entwicklungsarbeit) of the dry substance (*i. e.,* organic substance + ash) in the case of the former is 3.8 kilogram calories and of the latter 3.1. In consideration of the fact that the errors of observation and analysis are concentrated on these end figures and embodied in them, the almost complete identity of the results for these widely divergent forms,

Fundulus	3.6[1]	(organic substance)
Chick	3.8	(dry substance)
Silkworm	3.1	(dry substance)

is a strong argument in favor of Tangl's hypothesis expressed two years ago, namely, that the specific work of development (Entwicklungsarbeit) is not a function of phylogenetic position, but the embryogenetic formation of living substances widely divergent in organization seems to be connected with an equal expenditure of chemical energy.

In conclusion, I wish to acknowledge with

[1] Owing to the presence of sea salts in my material, I am unable at this time to calculate the corresponding value for the dry substance of *Fundulus.* Unless the ash diverges very widely from the expected, however, the specific work of development of 1 gr. of dry substance will be in the neighborhood of the value given for the organic substance.

gratitude my great indebtedness to Professor Francis Tangl, director of the Royal Hungarian Institute for Animal Physiology. The unusual generosity with which he placed at my disposal equipment and experience has alone made possible results which otherwise would have been quite beyond my reach.

OTTO C. GLASER

ROYAL HUNGARIAN INSTITUTE FOR ANIMAL PHYSIOLOGY,
BUDAPEST, November 20, 1911

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
SECTION F

MEETINGS of Section F were held on Wednesday, December 27, the forenoon session for the reading of papers and the afternoon in joint session with the American Psychological Association. The following officers of the section were elected:

Vice-president and Chairman for next meeting—Professor William A. Locy.

Member of Council—Professor Edwin Linton.

Member of Sectional Committee for five years—Professor A. M. Reese.

Member of General Committee—Professor T. W. Galloway.

The following abstracts of papers have been received by the secretary of the section:

REESE, ALBERT M.: *Effect of Narcotics upon the Development of Hen's Egg.*

The paper is a preliminary account of the effect of certain reagents (alcohol, ether, chloroform, chlorotone and magnesium chloride) upon the development of the hen's egg. Alcohol was fatal in about 75 per cent. of the experiments; ether in about 35 per cent.; chloroform, chlorotone and magnesium chloride were almost universally fatal, though the fatalities in the last two cases were probably largely due to faulty technic.

LINTON, EDWIN: (1) *The Adult Stage of Dermocystis ctenolabri Stafford.* (2) *Trematode Sporocysts in an Annelid.* (No abstracts of these papers received.)

ROHRER, C. W. G.: *Observations on the Chestnut-worm.*

The chestnut-worm, or grub, is the larval stage of *Balaninus caryatrypes,* one of the Curculionidæ or nut-weevils. The "worm" winters in the earth, and issues forth in the spring as a small snout-beetle or weevil. A peck of chestnuts may contain as many as 5,838 worms. One chestnut may contain four or even more. The female, in laying eggs, first bores a hole with her snout through the growing chestnut-burr and into the nut. She then drops an egg into this hole, and pushes it to the bottom of the hole with her snout.

REED, H. D.: *The Occurrence of Dermal Poison Glands in the Nematognathi.* (No abstract received.)

SMITH, HUGH M.: *Notice of a Remarkable New Family of Pediculate Fishes.*

Among the fishes collected by the *Albatross* during the 1907–1910 expedition to the Philippine Islands is a deep-water pediculate from the coast of Celebes, which becomes the type of a new species, genus and family.

ROGERS, BURTON R.: *A New Method of Preserving Anatomical Dissecting Material of Large Animals.* (No abstract received.)

SMITH, MIDDLETON: *The Bowhead.*

Description of the whale; of the primitive implements used in its capture; of the method of killing and "cutting in" as practised by the Eskimo; and of the uses of its products.

CLARK, AUSTIN H.: *A Biological Contribution to the Paleogeography of Australia.*

The old continent of Australia included the present Australia, with New Guinea and the Aru Islands to the north and Tasmania to the south. Timor, Timorlaut, the Ki Islands, Ceram, Gilolo and the islands further west, the islands north of New Guinea, New Britain, New Caledonia, Norfolk Island, New Zealand and the islands further north and east have no relationship whatever with Australia, but form part of more or less marked subdivisions of the East Indian region.

The Australian coast line has subsided since the maturity of the true Australian crinoid fauna; this subsidence has been least on the southeast coast, the degree gradually increasing toward the west and with slightly greater rapidity toward the north; on the west coast there is a similar increase in the degree of submergence from the south to the north. The Australian crinoid fauna of to-day is in the midst of one of those faunal changes called by Cuvier a "cataclysm."

JOHNSON, M. E., and TORREY, H. B.: *Control of Color Differentiation in Frog Tadpoles.*

Experiments have shown that the amount of melanin developed in the skin of frog tadpoles varies with the kind rather than with the quantity of food. Among tadpoles growing at the same