the hearts with artificial solutions is attended by contractions, while blood and its mixtures produce no such effect; and (2) if two strips of cat's ventricle, one cut so as to include a considerable part of the anterior coronary artery, and the other cut from the anterior lateral margin of the right ventricle so as to include no large vessels, be suspended and irrigated with the artificial solutions, the strip containing the coronary artery soon exhibits strong tonus upon which contractions may be superposed, while a little later the other strip begins to contract more or less irregularly and without any change in tonus. It may be observed in this connection that a strip of thoracic aorta may exhibit a deportment similar to that of the ventricular strip containing the coronary artery.

From these observations we conclude that, with hearts under the conditions of our experiments: (1) It is highly improbable that the production of a rhythmical beat is dependent solely upon the constituents of any one of the artificial solutions employed; that these solutions alone are not sufficient to initiate or sustain efficient beats of the heart. It has been shown in this and other laboratories that such solutions are inadequate to restore or even to sustain the activities of the reflex nervous centers of mammals. We have found the addition of a certain amount of blood necessary to render these solutions efficient. (2) For the production of the efficient rhythmical beat of the isolated heart, pressure or circulation of a suitable medium in the coronary vessels is necessary. Injection of blood or its dilutions into the coronary veins is attended by much the same phenomena as have been recorded for injections into the coronary artery, the principal differences being the somewhat lower optimum pressure and the lower pressure necessary for the production of delirium cordis. The character of the beat may differ somewhat in the two cases. As the pressure in the veins necessary to produce rhythmical beats is in all probability higher than that normally present, the mechanism which initiates the normal rhythmical beat must be sought elsewhere. In further support of this view may be mentioned the fact, as determined by inspection, that, on injecting into the coronary artery, the beat begins before much blood appears in the coronary vein, although the beats are weak before the complete establishment of the coronary circulation. In suitable preparations, in which the rhythm is slow, the coronary artery, or the tissue immediately surrounding it, has been observed to pulsate, and the beat to spread from the coronary vessels over the heart.

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May 25, 1906.

NOTES ON ORGANIC CHEMISTRY.

ESTERIFICATION OF TERTIARY AND UNSATURATED ALCOHOLS.

Not long ago there was given, in this journal, an account of some recent improvements in the methods of preparing esters.[1] Although these are of undoubted value, yet the subject, as a whole, can not be said to be in a very satisfactory state because there are no methods, of general applicability, capable of furnishing a good yield of the esters of tertiary and unsaturated alcohols. The primary cause of the difficulty is the greater sensitiveness of these classes of alcohols, which results in the production from them of other compounds, such as unsaturated hydrocarbons or tarry products, in relatively large quantity. This behavior is further accentuated by the fact that the velocity of their reaction and their equilibrium points are both very low. Whereas, in the case of propyl alcohol, if 46.5 per cent. is esterified in one hour and 66.8 per cent. is esterified before equilibrium is attained, these values become 26.5 and 60.5 per cent., respectively, for secondary propyl alcohol, and for *tertiary*butyl alcohol, 1.5 and 6.6 per cent. The figures speak for themselves and demonstrate how great, relatively, is the opportunity for change to take place in the tertiary alcohol by the action of the high temperature or of the mineral acid or other 'catalyst' that may be present.

[1] Science, XXIII., 712 (1906).

The Grignard reaction, since its discovery a few years ago, has been extremely productive of valuable results and appears to be capable of rendering service in this case also. An ingenious application of it, described recently by J. Houben,[2] constitutes an important advance towards the solution of the general problem described above. The process consists of the following stages: Magnesium, an alkyl haloid and absolute ether are allowed to react in the ordinary manner, to give the Grignard reagent; if ethyl chloride is employed the action may be represented by the equation: $Mg + C_2H_5Cl \rightarrow MgClC_2H_5$. The ethylmagnesium chloride is mixed with the alcohol to be experimented with and there results a hydrocarbon and magnesium alkyloxy chloride; with *tertiary*butyl alcohol the reaction would be: $C_2H_5MgCl + (CH_3)_3COH \rightarrow (CH_3)_3COMgCl + C_2H_6$. The ethane, of course, escapes. The last step consists in adding acetic anhydride to the above product, which results in the formation of *tertiary*-butyl acetate and magnesium acetochloride:

$$(CH_3)_3COMg + (CH_3CO)_2O \rightarrow (CH_3)_3COCOCH_3 + CH_3COOMgCl.$$

The preceding method has already led to the synthesis of a variety of acetates of geraniol and of terpin series, such as terpin diacetate; the resulting compounds are closely allied with some of the odoriferous materials of plants, and their further study promises results of importance and value. The method also gives good service in the esterification of phenols.

Benzylmagnesium chloride, $C_6H_5CH_2MgCl$, may be used in place of the ethyl derivative, but curiously enough, the corresponding bromides or iodides can not be employed; with the former the yield is poor and with the latter the reaction is practically inhibited, except in the case of saturated alcohols, for which, however, the bromides are preferable. The results of a more extended investigation of this subject will be awaited with interest.

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[2] *Ber. d. Chem. Ges.*, **39**, 1736 (1906).

RECENT VERTEBRATE PALEONTOLOGY.

Extinct Mammals of Patagonia.—The third part of the first volume of the *Annales de Paléontologie* under the direction of Dr. Marcellin Boule, professor of paleontology in the Museum of Natural History of Paris, has just been received. It contains the conclusion of Professor Albert Gaudry's review of the fossils of Patagonia, in which this distinguished paleontologist presents the most clear and interesting account of the mammalian life, especially in the Eocene, Oligocene and Lower Miocene. Summaries of the geological results obtained by Hatcher, Ortmann, Tournouer, are given, together with a discussion of the environment of the remarkable succession of mammalian life. This is by far the clearest and most interesting presentation we have yet had of the development of this peculiar fauna. The author is a strong believer in the existence of an Antarctic continent; in fact he regards this fauna as the fauna of such a continent. He observes that Patagonia serves to give us a clear idea of its geographical extent by its climate, remarking 'that if Patagonia is not a part of an Antarctic continent its paleontological history is altogether incomprehensible.' It is interesting to contrast this statement with one recently made to the writer by Sir John Murray to the effect that he found no evidence whatever sufficient to convince him even of the existence of such a continent.

Eocene Mammalia of Northern Africa.—By far the most important paleontological event of recent times was the discovery in 1900 of the ancient fauna of the Fayûm. This is the lake province of Egypt, a district occupying a depression in the desert to the west of the Nile Valley opposite Wasta, a small town about fifty-seven miles south of Cairo. From time to time since this discovery Messrs. Beadnell, of the Egyptian Geological Survey; Dames, of Berlin; Stromer, of Munich; Fraas, of Stuttgart, and especially Andrews, of the British Museum of Natural History, have been presenting short contributions to our knowledge of this fauna. We have now received 'A Descriptive Catalogue