the steepening of each in-nested valley-head beneath the less steep floor of the next upstream valley is repeatedly and consistently shown.

The existing features of the Limousin or westernmost and simplest division of the region, where the Eogene plain on the crystallines is little dislocated by fractures and is wholly free from volcanic additions, receive the best description. The surface is almost ideally plain over certain areas; elsewhere it is either surmounted by heavy-bodied residual mounts or trenched by later-carved valleys. Where the beveled marginal covering strata are weak, they are in some localities worn away so as to reveal in their foundation a part of the ancient, post-Hercynian plain, which makes a small angle with the Eogene plain of the central area. The Eogene plain slopes with the fall of the old rivers that drained it, and the rivers are therefore classed as "consequent"; but in a sense quite unlike that originally given to the term by Powell. The eastern and southern divisions of the region are so elaborately fractured that their description, not illuminated by simplified diagrams, is obscured in a multitude of technical details which a foreign reader must find difficult to apprehend. Indeed, nearly the whole volume is arduous reading, because of the frequent mention of local features—Coiron, Forez, Margeride—as if they were universally known, as well as because of repeated and unexplained references to geological formation—Lutitienne, Sannoisienne, Stampienne—and to names of insignificant towns—Cusset, Charray, Panouval—and streams—Truyère, Sumène, Alagnon—for which no location is intimated in general terms. One must regret that so competent a study of so interesting and instructive a region is not presented in a form more easily understood by others than French specialists.

W. M. DAVIS

SPECIAL ARTICLES

THE EFFECT OF COD LIVER OIL ON THE DELAYED COAGULATION TIME FOLLOWING EXPERIMENTAL OBSTRUCTIVE JAUNDICE

BLOOD coagulation is delayed in both clinical and experimental obstructive jaundice. The cause of this delay has been studied by many investigators. King and Stewart[1] observed a delayed blood coagulation *in vitro* when bile pigments were added to the blood. They interpreted this delayed blood coagulation of jaundiced animals as due to insufficient available calcium. Further evidence for the existence of a functional calcium deficiency is found in the work of Lee and Vincent[2], Walters and Bowler[3], Kirk and King[4].

Calcium chloride and parathyroid extract have been reported to be of value in the preparation of jaundiced patients for operation and also of value in controlling hemorrhages from various causes.[5, 6, 7, 8] In some previous work the author reported favorable results in the treatment of symptoms of thyro-parathyroidectomized dogs by using cod liver oil in addition to a mixed diet (1928a) and also cod liver oil and yeast (1928b).[9] It would seem that if cod liver oil is of value in this calcium disturbed condition, it might be of value in mobilizing calcium in obstructive jaundice and consequently in reducing the coagulation time. Before this work was completed, an article appeared by Liu[10] in which he showed that cod liver oil increased both fractions of the serum calcium, the diffusible and the non-diffusible. The former increased more than the latter. This adds to the rationality of using cod liver to hasten blood coagulation in jaundiced animals in which diffusible or available calcium is low.

Blood was drawn from the external saphenous vein or heart of dogs, and the coagulation time was determined by the method of Lee and White.[11] It was found that more accurate and consistent results could be obtained by using ten mm tubes instead of eight mm, as used by Lee and White. The tubes and syringe were washed with soap and water and rinsed with normal saline. To insure accuracy, four tubes, each containing 1 cc of blood, were used and the average coagulation time of the four determined. The calcium estimations were made by the Kramer and Tisdall method, modified by Collip and Clark.[12]

After having determined the normal coagulation time, the common bile duct was doubly ligated and

[1] King, J. H., and Stewart, H. A., *Journ. Exp. Med.*, xi, 673, 1909.

[2] Lee, R. I., and Vincent, B., *Arch. Int. Med.*, xvi, 59–66, 1915.

[3] Walters, W., and Bowler, J. P., *Surg., Gynec., Obst.*, 39: 200, 1924.

[4] Kirk, P. L., and King, C. G., *J. Lab. and Clin. Med.*, 11: 921, 1926.

[5] Walters, W., *Surg., Gynec., Obst.*, 33: 651, 1921.

[6] Grove, W. R., and Vines, H. W. C., *Brit. Med. J.*, 791, 1922.

[7] Cantarow, A., Craven, W. R., and Gordon, B., *Arch. Int. Med.*, 38: 502–509, 1926.

[8] Gordon, B., and Cantarow, A., *J. A. M. A.*, 88: 1301–1302, 1927.

[9] Brougher, J. C., *Am. Journ. Physiol.*, lxxxiv, 583, 1928(a). In press (1928b).

[10] Liu, S. H., *Chinese Journ. Physiol.*, i, 331, 1927.

[11] Lee, R. I., and White, P. D., *Am. J. Med. Sc.*, 145, 495, 1913.

[12] Clark, E. P., and Collip, J. B., *Journ. Biol. Chem.*, lxiii, 296, 1925.

sectioned. When jaundice was pronounced, a test was made as follows: Coagulation time was observed and 30 cc of cod liver oil (Lilly) were given in 300–400 cc of water by stomach tube. Blood coagulation was determined at two, four and twenty-four hour intervals.

The normal coagulation time varied from three to five minutes in nine dogs. The length of the coagulation time following the appearance of jaundice in the animals varied in the extremes from six and one half to fourteen minutes. The degree of jaundice was judged as slight, moderate and marked, depending on the intensity of sclerae pigmentation.

There was no marked change in serum calcium following common duct ligation, but the calcium did tend to decrease as jaundice increased. After the cod liver oil was given, the coagulation time returned to normal within four hours and was practically the same after twenty-four hours. In forty-eight to seventy-two hours, it was again delayed, but not to the extent that it had previously been. Snell *et al.* [13] observed that in some animals a spontaneous reduction in the coagulation time might occur late in the progress of the jaundice. Because this was noticed in a few animals, the tests here reported were made early after the onset of deep icterus.

While calcium and parathormone are both considered effective measures in the reduction of coagulation time in jaundice, it would seem from these results that cod liver oil might be just as effective and more practical than the others.

Repeated intravenous injections of calcium chloride or calcium lactate will produce an albuminuria and eventually nephritis. Parathyroid extract, if continued over a period of time, may deplete the bones of calcium. Cod liver oil has been shown here to consistently change a delayed coagulation time in obstructive jaundice to normal. The efficacy of cod liver oil in causing this change is probably based on its ability to increase the ionizable calcium.

In patients thus far observed having a delayed coagulation time from other causes than hemophilia, cod liver oil was efficacious in restoring normal coagulation time in four to six hours.

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CITRIC ACID INVERSION OF SUCROSE IN PLANT TISSUES

THE conventional method used for hydrolyzing sucrose in extracts of plant tissues has been that one using hydrochloric acid. More recently the use of invertase has found favor with many analysts, and directions for its use are found in the revised methods of the A. O. A. C. For reasons pointed out in an article[1] published in *Plant Physiology*, the use of hydrochloric acid with plant extracts is often of questionable value, and our experience here and some unpublished work of the senior author have taught us that it is very hard to secure satisfactory and consistent results using invertase. For these reasons we decided to try citric acid as a hydrolyzing agent for sucrose in plant extracts. Davis and Daish[2] had previously reported good results using citric acid and lately Harvey[3] has suggested its use with extracts from woody tissues containing a considerable quantity of glucosides. Since we could not find any results by comparing the three mentioned methods used on the same samples of plant extract, we decided to make such a study, and the brief results published below are typical of the ones we secured in this work. In the interest of briefness only a few typical examples, such as will illustrate the conclusions drawn, will be given.

The hydrochloric acid and invertase inversions were made according to the methods published in the A. O. A. C.[4] The citric acid inversion was carried out by adding 10 per cent. of C. P. citric acid to the sample, placing in a boiling water-bath for five minutes and then allowing it to stand over night, after which the sample was treated as in the hydrochloric acid procedure. The Shaffer-Hartman method[5] was used in estimating the reduced copper.

TABLE I
Percentage of Sucrose Present in Samples of Commercial Sucrose

Method of hydrolysis	Percentage of theoretical found
Citric acid	98.69
Hydrochloric acid	97.83
Invertase	97.05

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[1] Report of committee on methods of chemical analyses, "The Determination of Soluble Carbohydrates," *Plant Physiology*, II, 195–204, 1927.

[2] Davis, W. A., and Daish, A. J., "A Study of the Methods of Estimating Carbohydrates, Especially in Plant Products," *J. Agr. Sci.*, 5: 437–468, 1913.

[3] Harvey, E. M., "Phloridzin." Ore. Agr. Exp. Sta. Bull., 215, page 23, 1925.

[4] Association of Official Agricultural Chemists. "Official and Tentative Methods of Analysis," Second Edition, 1925.

[5] Shaffer, P. A., and Hartman, A. F., "The Iodometric Determination of Copper and Its Use in Sugar Analysis," *J. Biol. Chem.*, 45: 365–390. 1921.