those who favoured early surgery whenever bleeding occurred in patients with suspected ulcers. As so often happens when opinions differ widely, we have now come to adopt the middle road of advising operation in patients who continue to bleed, or in whom bleeding recurs while in hospital, especially if they are more than 50 years of age. These are the patients who are especially prone to die unless the source of haemorrhage is dealt with surgically.[6] It is important to note that one must judge the results of any method of treatment not from the operative mortality (excessively high in the conservative group, comparatively low in the hands of those who operate at the least excuse) but from "seeing that the largest possible number of cases who enter bleeding leave the hospital alive."[7]

As to the operative treatment itself, there has been a noticeable change in surgical fashion in recent years. At one time emergency surgery for haematemesis signified a partial gastrectomy, yet there has been an increasing tendency to regard the correct operation as the least procedure that will save life. If the patient has a chronic gastric ulcer a gastrectomy will indeed provide rapid control. For the duodenal ulcer, dissection and closure of the duodenal stump in these circumstances is often a difficult procedure, and here there is much to be said for pyloroplasty, with underrunning of the ulcer under direct vision, supplemented by vagotomy.[8 9]

If an ulcer is not obvious at laparotomy and no other cause can be found a "blind" gastrectomy may often miss a high superficial bleeding ulcer with the disastrous consequence of further, often fatal, haemorrhage.[10] In such cases many surgeons are turning to direct inspection of the gastric mucosa through a wide gastrotomy,[11 12] which usually reveals the acute or subacute ulcer.

In the *B.M.J.* this week Dr. Anne Banning and her colleagues present at page 781 an interesting account of their experience with 223 cases of upper gastro-intestinal haemorrhage. Forty-nine of them required emergency surgery because of the criteria outlined above. In 21 instances no ulcer could be found on palpation, but 19 showed an acute ulcer at gastrotomy, which could then be controlled by underrunning. The two remaining patients had no obvious source of bleeding, and haemorrhage did not recur after laparotomy. A follow-up of six months to several years in this group gave no evidence of the development of chronic ulceration, nor did any of the patients require subsequent surgery.

There is a need to evaluate the thorough emergency investigation of patients with gastro-intestinal haemorrhage, since surgeons hate what has irreverently been termed a "blind date with a haematemesis." Failure to determine the exact pre-operative diagnosis should not, however, delay the surgeon from operation on a patient who is continuing to bleed, since he can die equally well from a small superficial erosion as from the most penetrating chronic peptic ulcer.

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[3] Tanner, N. C., and Desmond, A. M., *Postgrad. med. J.*, 1950, **26**, 253.
[4] Chandler, G. N., Cameron, A. D., Nunn, A. H., and Street, D. F., *Lancet*, 1960, **2**, 507.
[5] —— and Watkinson, G., ibid., 1953, **2**, 1170.
[6] Jones, F. A., *Brit. med. J.*, 1947, **2**, 441, 477.
[7] Tanner, N. C., *Proc. roy. Soc. Med.*, 1950, **43**, 147.
[8] Dorton, H. E., *Ann. Surg.*, 1961, **153**, 378.
[9] Farris, J. M., and Smith, G. K., ibid., 1960, **152**, 416.
[10] Tibbs, D. J., *Brit. med. J.*, 1960, **2**, 1346.
[11] Markby, C. E. P., *Brit. J. Surg.*, 1965, **52**, 685.
[12] Starzl, T. E., and Sanders, R. J., *Surg. Gynec. Obstet.*, 1963, **116**, 121.

Gall and Neurology

That a valid biological theory can be based at first on erroneous data is one of the paradoxes of scientific discovery. Such was the case, however, with F. J. Gall, the subject of Dr. Macdonald Critchley's article at p. 775 of the *B.M.J.* this week. Gall was the founder of phrenology, which, although an important forerunner of the modern theory of cortical localization, was founded on false assumptions. But Gall's threefold place in the history of neurology rests on his contributions to our knowledge of the function and anatomy of the brain as well as on the invention of phrenology.

In the 1790s Gall asserted that mental functions were located on the brain surface in areas or "organs" which could be palpated through the skull. But the concept of cerebral localization began with Galen in the second century A.D., who argued[1] that sensory and motor functions have different sites. Until the seventeenth century mental processes were located in the ventricular system,[2] and it was Willis[3] who placed them in solid parts of the brain, including the cerebral cortex. Moreover, the influence on Gall of contemporary physiognomy,[4] the French sensationalists, and of German empirical psychology[5] must also be taken into account. Against this background Gall's opinions become less unique but not less important. In essence he was seeking an empirical integration of the psychological and anatomical knowledge of his day, but his method of localizing mental faculties was not experimental, critical, or statistical. Thus the cerebellum as the sex "organ" is a strange idea; before we dismiss it, however, we should recall the genital atrophy in Holmes's cases of familial cerebellar degeneration.[6] Gall's "organ" of language is of special importance because using incorrect observations he placed it in the frontal lobes, and it was this more than any other part of his system which guaranteed the survival of his basic idea. In the 1840s phrenology ceased to be acceptable to scientists, mainly because of the adverse opinion of the French physiologist P. Flourens[7] and because of the excesses of the phrenologists themselves. Nevertheless, Gall's fundamental concept of local brain function was kept alive in France and it led eventually to the famous debate in Paris in 1861, when the cerebral speech "centre" was initiated.[8 9] Gall had made the correct conclusion but from the wrong data. The modern theory of cortical localization grew from the work of Hughlings Jackson and the electro-physiologists of the 1870s. Although division of the cortex into many functional areas is no longer acceptable and further modifications may be necessary, the theory is still to some extent valid, and one of its important sources was the phrenology of Gall.

The second reason for acclaiming Gall's work is his influence on the development of neuro-anatomy. Although most of the claims made for his individual achievements

[1] Galen, *De usu partium*, VIII, 6.
[2] Sudhoff, W., *Die Lehre von den Hirnventrikeln*, Dissertation. Leipzig. 1913.
[3] Willis, T., *Cerebri anatome*, London, 1664, Cap. XI, p. 136.
[4] Delaunay, P., *Progr. méd., Paris*, 1928, **55**, 1207, 1237, and 1279.
[5] Bentley, M., *Psychol. Mongr.*, 1916, **21**, 102.
[6] Holmes, G., *Brain*, 1907, **30**, 466.
[7] Flourens, P., *Examen de la phrénologie*. Paris. 1842.
[8] Stookey, B., *J. Amer. med Ass.*, 1963, **184**, 1024.
[9] Walker, A. E., *Bull. Hist. Med.*, 1957, **31**, 99.
[10] Ackerknecht, E. H., and Vallois, H. V., *Franz Joseph Gall, Inventor of Phrenology and His Collection*, Madison, Wisconsin. 1956.
[11] Hollander, B., *The Revival of Phrenology; the Mental Functions of the Brain*. London. 1901.
[12] Watson, H. C., *Statistics of Phrenology*. London. 1836.
[13] Temkin, O., *Bull. Hist. Med.*, 1947, **21**, 275.

cannot be substantiated, he inspired many to look more closely at the nervous system, and the controversies he aroused were themselves productive. He claimed that the chief purpose of phrenology was to advance brain anatomy, and he stressed the importance of examining the nervous system from the cord upwards. Perhaps he was responsible for the interest of Magendie and Bell in the origins of the spinal roots. In addition his interest in the skull and in psychological traits stimulated the growth of anthropology, craniology, psychology, and criminology.[10]

Finally there is the phrenology of Gall, which still exists to-day, represented in Britain by the British Phrenological Society, Inc. Ever since Flourens denounced the phrenologists, they have been fighting a losing battle in trying to defend Gall's tenets and to equate them with advances in physiology.[11] But the heyday of the phrenological movement was in the 1820s and 1830s, when in Britain, as elsewhere, societies, lecture courses, and publications flourished.[12] Its repercussions were also felt outside medicine—on philosophers, literary men, educators, and political writers.[13] Thus the association of phrenology with socialism in this country is of considerable interest, and phrenology as a social force in the nineteenth century has been underrated.

But to assess Gall's role in the history of neurology he must, as Critchley concludes, be judged apart from phrenology. When this is done his threefold contribution is seen to be of significance.

Which Colorimeter?

One of the problems faced by the laboratory worker is the choice of the best equipment for a particular job. What is "best" is often difficult to define, and the invasion of the British market by foreign manufacturers has led sometimes to an almost embarrassingly wide range of equipment. It is rarely possible for a potential customer to test several different products for an adequate period, and too often choice is governed by cost, appearance, skilful advertising literature, and personal knowledge limited by chance experience. This situation has led the Association of Clinical Biochemists into an interesting new venture, which has resulted in their first scientific report.[1] The subject of this is colorimeters—a basic piece of laboratory equipment, in the design of which a flow-through cell has been substituted recently for the standard cuvette. This modification has done much to speed up colorimetric estimations such as that of blood sugar.

The report, reminiscent of the Consumer Research Association's publication *Which?*, provides a critical assessment of four commercially-available colorimeters with flow-through cells, and also includes a critical account of methods employed in testing colorimeters. One possible defect of the report is that it is confined to only four of the available instruments and that only two of each were tested. It will be no surprise to laboratory workers that no clear recommendation for a "best-buy" was made, for "each of these instruments has good and bad features, none of them being as good a combination of colorimeter and flow-through cell as we believe desirable and possible." Prices differed by as much as £30, and yet the cheapest instrument had desirable features lacking in the most expensive. Appearance, outlay, simplicity of controls, setting of the zero and infinity ends of the scale, reading of the scale, stability, constancy of response, sensitivity, carry-over of solutions, maintenance, and instruction manuals were some of the points discussed, and some or all of these instruments were found wanting under all these headings.

This report is directed, of course, to the clinical chemist, but the clinician can learn from it too. It is a warning to him that the chemist can achieve only the standard of accuracy that his instruments allow, that no figure issued is absolute, that results from different laboratories on the same specimen cannot be expected to agree absolutely, and that each laboratory must have its own range of normal values for a given estimation. Furthermore, since some instruments can produce an error up to 20% if an adequate warming-up period is omitted, patience in awaiting results, especially for emergency procedures at night, will be repaid by greater accuracy.

An important question, prompted by this report, is why the instruments are so imperfect in this age of technology. Manufacturers should not bear all the blame. A multiplicity of instruments—and hence limited sales of a given model—favours high prices, yet the price has to be in keeping with the restricted laboratory budget. Not least the customer himself, by his uncritical acceptance of the present standards, is in default. Greater co-operation between manufacturer, designer, and user is a lesson still to be learned—not only in laboratory technology.

[1] Association of Clinical Biochemists Scientific Report No. 1. *Colorimeters with Flow Through Cells. A critical assessment of four instruments*, 1965. (Obtainable from Mr. J. T. Ireland, Biochemistry Laboratory, Alder Hey Children's Hospital, Liverpool 12. 13s. 6d.)

Sequelae of Thorotrast

Twenty-seven years ago an annotation in this journal entitled "Is Thorotrast Safe?" drew attention to conflicting evidence about possible late effects from the use of this contrast medium.[1] Thorotrast is a suspension of particulate thorium dioxide, a radioactive substance which is taken up by cells of the reticuloendothelial system, and thus, after having served its purpose, remains permanently deposited in the liver, spleen, and bone-marrow. Its early uses included hepatolienography, enough being injected to render the liver and spleen radio-opaque, and its commonest use was for arteriography. It was also sometimes used to outline the cerebral ventricles. As we pointed out at that time both G. Roussy, C. Oberling, and M. Guérin[2] and F. R. Selbie[3] had shown that Thorotrast was carcinogenic in rats and mice respectively. The idea of exposing patients to a distant danger of such a nature for the sake of a skiagram was abhorrent to many minds, but the reality of the danger was not generally accepted, and complacency was encouraged by the finding of W. M. Yater and E. R. Whitmore[4] that patients subjected to hepatolienography were unaffected four to six years later.

From time to time individual reports of late sequelae of this procedure have appeared, but the final answer to our

[1] *Brit. med. J.*, 1938, **1**, 903.
[2] Roussy, G., Oberling, C., and Guérin, M., *Bull. Acad. Méd. (Paris)*, 1934, **112**, 809.
[3] Selbie, F. R., *Lancet*, 1936, **2**, 847.
[4] Yater, W. M., and Whitmore, E. R., *Amer. J. med. Sci.*, 1938, **195**, 198.
[5] da Silva Horta, J., Abbatt, J. D., da Motta, L. C., and Roriz, M. L., *Lancet*, 1965, **2**, 201.