[8] P. E. CARSON, S. J. SCHRIER AND R. W. KELLERMEYER, *Nature*, 184 (1959) 1293.
[9] A. RIMON, I. ASKENAZI, B. RAMOT AND C. SHEBA, *Biochem. Biophys. Research Communs.*, 2 (1960) 138.
[10] P. A. MARKS AND A. SZEINBERG, *Federation Proc.*, 19 (1960) 193.
[11] D. DANON, A. NEVO AND Y. MARIKOVSKY, *Bull. Research Council Israel*, 6E (1956) 36.
[12] H. N. KIRKMAN, H. D. RILEY JR. AND B. B. CROWELL, *Proc. Natl. Acad. Sci. U.S.*, 46 (1960) 938.

Received January 24th, 1961

Clin. Chim. Acta, 6 (1961) 586-589

A micromethod for the determination of pH and P_{CO_2} in human cerebrospinal fluid*

With the Astrup apparatus[1] which is used for the microdetermination of pH and P_{CO_2} in whole blood we have determined the pH and P_{CO_2} of cerebrospinal fluid (CSF). The CSF was obtained from patients with different neurological diseases but without respiratory alterations. As all other chemical tests showed no abnormalities, the acid–base composition of the samples may also be considered as normal.

CSF (0.2 ml) was sampled under anaerobic conditions by placing two times a 0.1-ml glass capillary tightly over the puncture needle followed by rapid sealing of both ends with plastic clay. The pH was measured in duplicate with a capillary micro-glass electrode at 38°. Two parts of the remaining fluid were equilibrated with two gas mixtures

TABLE I

VALUE OF pH, P_{CO_2} AND d log P_{CO_2}/dpH OF HUMAN CEREBROSPINAL FLUID

No.	*Puncture*	*pH CSF*	P_{CO_2} *CSF mm Hg*	d*log* P_{CO_2}/d*pH*
1	L	7.300	55.0	— 1.025
2	L	7.300	51.1	— 1.061
3	L	7.321	51.5	— 1.075
4	L	7.330	41.5	— 1.041
5	L	7.345	44.9	— 1.061
6	L	7.300	50.4	— 1.061
7	L	7.376	42.6	— 1.025
8	L	7.345	49.8	— 1.045
9	L	7.400	44.3	— 1.035
10	L	7.360	41.6	— 1.043
11	L	7.315	48.0	— 1.061
12	L	7.300	49.5	— 1.071
13	L	7.350	41.4	— 1.070
14	S	7.360	46.0	— 1.053
15	S	7.378	33.6	— 1.079
16	S	7.375	38.1	— 1.080
17	S	7.357	31.3	— 1.070
Mean		7.354	44.8	— 1.056
S.D.		0.030	6.5	0.018

L = lumbar S = suboccipital

* The authors are very grateful to the Neurological Department (Head: Prof. Dr. W. SILLEVIS SMIT) for providing the CSF.

of known CO_2 content and the pH of these equilibrated samples was measured. The values were plotted in a pH–log P_{CO_2} graph and a straight line was drawn on which the actual P_{CO_2} was found. The results are shown in Table I.

The value of d log P_{CO_2}/dpH can be predicted as follows. According to the Henderson–Hasselbalch equation

$$pH - pK_1' = \log HCO_3' / \alpha P_{CO_2}$$

or

$$pH + \log \alpha K_1' = \log HCO_3' - \log P_{CO_2}$$

Differentiating with respect to pH and rearranging

$$d \log P_{CO_2}/dpH = -(1 + d \log \alpha K_1'/dpH + d \log HCO_3'/dpH$$

The value of d log HCO_3'/dpH is proportional to the protein content and inversely proportional to the HCO_3' content[2]. As the protein content of CSF is about 1/20 × the plasma protein content and for normal plasma d log HCO_3'/dpH equals —0.13[2], the mean value of d log HCO_3'/dpH of CSF will equal 1/20 × —0.13 = —0.006. This term is small as compared with —1, and variations of the former due to different HCO_3' concentrations will not influence the value of d log P_{CO_2}/dpH of CSF to a measurable degree.

SEVERINGHAUS[3] found for true plasma dpK_1'/dpH = —0.044 assuming α to be constant. Thus d log $\alpha K_1'$/dpH = +0.044. As we found about the same value in protein-free bicarbonate solutions, it may be concluded that the inconstancy of log $\alpha K_1'$ equally applies to the bicarbonate system in CSF. Therefore the predicted value of d log P_{CO_2}/dpH = —(1+0.044) —0.006 = —1.050, and is independent of protein and HCO_3' concentrations.

The value found experimentally for d log P_{CO_2}/dpH does not differ significantly from the predicted value. The determination of P_{CO_2} may be simplified by assuming a fixed value d log P_{CO_2}/dpH = —1.05 and measuring the pH of CSF before and after equilibrating with only one gas mixture of known CO_2 pressure.

Departments of Lung and Heart Diseases,
State University Hospital,
Utrecht (The Netherlands)

A. N. P. VAN HEIJST
B. F. VISSER
A. H. J. MAAS

[1] P. ASTRUP, *Lancet*, 278 (1960) 1035.
[2] B. F. VISSER AND A. H. J. MAAS, *Clin. Chim. Acta*, 5 (1960) 850.
[3] J. W. SEVERINGHAUS, *J. Appl. Physiol.*, 9 (1956), 197.

Received January 23rd, 1961

A possible source of error in the detection of urobilinogen

The routine procedures used in the diagnosis of hepatic dysfunction commonly include an examination of the urine for bile pigments. It is usual to test for the presence of bilirubin or its breakdown product urobilinogen, the presence of which is regarded as significant evidence of abnormal hepatic function. In a recent