kept above the upper limit of the pH level at which pepsin exerts proteolytic activity. However, both enzymes could act at different pH levels and pepsin may maintain and perpetuate the ulcer-producing process which may have been initiated by another enzyme. As regards the last mentioned explanation for the presence of band 2, it is theoretically possible that it could result from tryptic digestion from duodenal reflux. This enzyme could be active at the pH of the neutralized gastric contents. This, we feel, is unlikely because amongst the many specimens collected some showed slight to marked biliary reflux (these were excluded from the analysis) and the incidence of band 2 in this group was no higher than in the group that showed no evidence of biliary reflux.

REFERENCES

Part III In pernicious anaemia patients

EDITORIAL SYNOPSIS The electrophoretic pattern of the proteins in the gastric juice of patients with pernicious anaemia is compared with the pattern obtained in a group of controls in whom intragastric digestion of proteins has been prevented by intragastric neutralization of the gastric juice.

In patients with pernicious anaemia, band 5, which represents albumin, is increased, and band 4 and band C are decreased. The decrease in band 4 may be related to deficiency of intrinsic factor.

Though the manifestations of pernicious anaemia are predominantly haematological or neurological, it basically is a disease involving the gastric mucosa. The inability of pernicious anaemia patients to secrete acid was demonstrated initially by Cahn and Mehring (1886) and since then this observation has been adequately confirmed (Helmer, Fouts, and Zerfas, 1932; Kirsner, Nutter, and Palmer, 1940; Shay, Komarov, and Beck, 1950; Card, Marks, and Sircus, 1955; Callender, Retief, and Witts, 1960). As a result of the work of Castle and his colleagues (Castle and Townsend, 1929; Castle, Townsend, and Heath, 1930; Castle, Heath, and Strauss, 1931), it was demonstrated that the essential secretory abnormality in pernicious anaemia was not in acid secretion but involved the defective secretion of another substance essential for the absorption of vitamin B12, which they termed intrinsic factor.

It was felt to be of interest to compare the protein fractions in the gastric juice of a group of pernicious anaemia patients with a group of control patients. In this study, efforts were made to prevent changes in the juice of the control group consequent upon pH levels that made autodigestion possible. Previous studies have not taken this latter precaution and consequently the protein pattern observed in pernicious anaemia patients may have been more a reflection of the acid and or pepsin secretory failure than an inherently different protein pattern.

METHOD
The 24 controls were the same patients described in Part II. The five patients with pernicious anaemia were diagnosed on the basis of a macrocytic megaloblastic anaemia with histamine-fast achlorhydria to Kay’s augmented histamine test (Kay, 1953), and a complete response to vitamin B12 by injection. In three patients a Schilling’s test confirmed the presence of vitamin B12 malabsorption corrected by the administration of intrinsic factor; two of the patients with pernicious anaemia were being treated when the study was carried out.

The gastric juice was collected and electrophoresed according to the method described above. The patients were requested to expectorate all saliva and all specimens that showed evidence of biliary reflux were discarded. To standardize the technique both in the control and pernicious anaemia groups, frequent gastric lavage with sodium bicarbonate solution was performed in the pernicious anaemia patients, though this was not necessary to maintain the pH above 7 in this group.
RESULTS

The electrophoretic bands were defined as described in Part I.

A typical electrophoretic pattern from a series of controls is shown in Fig. 1 and that from a series of pernicious anaemia patients is represented in Fig. 6; the quantitative aspect of the various bands and their frequency in the group of 24 controls and the five patients with pernicious anaemia is given in Table II.

It is noted there are several statistically significant differences in the quantitative aspects of the various bands in pernicious anaemia patients: band 5 is significantly increased in pernicious anaemia patients; bands C and 4 are significantly reduced in pernicious anaemia patients.

DISCUSSION

Any studies of the protein fraction in gastric juice in pernicious anaemia patients must exclude the possi-

FIG. 6. Electrophoretic pattern of the proteins of gastric juice of four patients with pernicious anaemia.
The electrophoresis of human gastric juice

**TABLE II**

**COMPARISON OF ELECTROPHORETIC FINDINGS IN CONTROLS AND PERNICIOUS ANAEMIA PATIENTS**

<table>
<thead>
<tr>
<th>Band</th>
<th>Controls (24)</th>
<th>Pernicious Anaemia (5)</th>
<th>Differences between Controls and Pernicious Anaemia Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Frequency of bands</td>
<td>13</td>
<td>24</td>
<td>2</td>
</tr>
<tr>
<td>S.E.</td>
<td>4.7</td>
<td>4.4</td>
<td>7.0</td>
</tr>
<tr>
<td>Size of bands (mean)</td>
<td>0.9</td>
<td>0.5</td>
<td>1.4</td>
</tr>
<tr>
<td>Patient 1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Patient 2</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Patient 3</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Patient 4</td>
<td>0</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Patient 5</td>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>

*The figures indicating the size of each band are the percentage of the total protein-staining material on the electrophoresis strip in each band.

*Indicates patients receiving treatment.

N.S. = Not significant (P>0.05).

It is difficult to integrate the findings of the various workers who have studied the electrophoretic pattern in the gastric juice of pernicious anaemia patients; the divergent findings are apparently due to the different electrophoretic techniques. Using starch electrophoresis, Katzka (1959) found that instead of four major peaks and five minor peaks as he found in normal patients, the gastric juice of patients with pernicious anaemia showed a central fraction that represented almost all the protein staining material on the electrophoretic strip. Using horizontal paper electrophoresis, Glass (1961) found that the electrophoretic pattern was compressed, being made up of two to four central components, the two most rapidly moving anodal components and the cathodal component being absent. One would have expected the finding of Glass to be similar to ours, as autodigestion was absent in both studies and we have shown that gastric lavage with sodium bicarbonate solution (pH 9) does not alter the electrophoretic pattern of the gastric juice. The different findings may be due to the fact that Glass used vertical electrophoresis and Whatman No. 1 paper, whereas we used horizontal electrophoresis and cellulose acetate electrophoresis strips.

We are not able to determine the significance of the findings in patients with pernicious anaemia. The high albumin found could be a manifestation of the abnormal gastric mucosa, which could be more permeable to albumin, the increased albumin in the gastric juice in these patients having a similar significance as the albumin present in the urine in renal disease. It is interesting to note too that in a study of vitamin B12 binders in gastric juice, Gullberg (1960) found that these binders moved slightly less rapidly towards the anode than the band that migrated at the rate of human albumin. Consequently the decrease in band 4 found in the present study could be due to the decreased or absent vitamin B12 binders found in pernicious anaemia.

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