Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Letters to the Editor

VIRUSES AND GASTROENTERITIS

SIR,—We have been interested by recent papers and correspondence on the virus-like particles observed by electron microscopy in the fæces of patients with gastroenteritis. Parvo or picorna-like viruses have been found in association with gastroenteritis in adults, and experiments in volunteers show that they can cause the disease.[1] Reo-like viruses have been found in the fæces of small children,[2-4] and, though Koch's postulates have not been fulfilled, there is strong epidemiological evidence that these viruses are responsible. Adenovirus-like particles have also been found although none could be cultivated.[5] Other workers have described a variety of other "virus-like" particles in acute intestinal infections, occurring in various parts of the world, and also in healthy individuals and in chronic conditions such as tropical sprue.[6-14]

In a small study in this hospital, we have found reo-like viruses and, in one case, adenovirus, as reported by Flewett's group.[5,12] However, specimens were also examined which came from young children in the Gambia who had diarrhœa and acute nutritional failure. These contained particles resembling coronaviruses, myxoviruses (similar to those described by Baker's group [13]), reoviruses, and also hitherto undescribed virus-like particles, approximately 35, 45, and 100 nm in diameter. In a few cases immuno-electron-microscopy indicated that antibody was present in the patients' convalescent serum. Some samples contained several different types of particles. On the face of it, these publications show that with the electron microscope one can detect many viruses in fæces which are missed by conventional virus diagnostic tests.

It seems, therefore, probable that, like respiratory infections, acute "non-bacterial" gastroenteritis may be due to a multiplicity of organisms and these may differ in different age-groups and areas. This is, however, very far from being proved in most of the instances just cited; some of the particles may not be viruses, or, if they are, they may be growing in bacteria or be ingested rather than being produced by the intestinal epithelium. They may be carried chronically as well as over short periods, and we suspect that they are often clinically silent as are the enteroviruses which we isolated from almost all our African patients. The diarrhœa may also be due to other organisms such as toxigenic strains of *Escherichia coli* which do not belong to recognised pathogenic serotypes and which are readily overlooked.[15] Until these points have been clarified in each case, there is really no justification for considering these objects as viruses which are associated with, let alone causing, gastroenteritis.

We would urge that in planning and reporting investigations the following points be noted to accelerate the collection of solid facts and to reduce confusion and the number of inconclusive publications:

(1) Outbreaks in a closed community or in families may offer some of the best opportunities for studying organisms in a relatively simple situation—i.e., with fewer irrelevant or "carried" viruses and a better chance of relating the test results to the occurrence of disease.

(2) Care should be taken to collect material for suitable comparisons—at the least one needs specimens from clinically normal members of the same group and from patients after they have recovered.

(3) Paired sera from patients and if possible from normal subjects are valuable to demonstrate the existence of an immune response by electron microscopy and support the association between the disease and the occurrence of an infection.

(4) We suspect that no-one has yet found a really good way of maintaining intestinal epithelium in culture, and this is why attempts to grow these "new" viruses in organ cultures have had only limited success.[16]

A steady effort is therefore needed to find a laboratory system for maintaining cells which have the virus susceptibilities of the villous epithelium. When the viruses can be grown and cultured in vitro the solution of many other problems will be greatly accelerated.

S. PATTERSON
J. PARRY
T. H. J. MATTHEWS
R. R. DOURMASHKIN
D. A. J. TYRRELL.

Clinical Research Centre,
Watford Road,
Harrow, Middlesex HA1 3UJ.

Dunn Nutritional Laboratory,
Milton Road,
Cambridge CB4 1XJ.

R. G. WHITEHEAD
M. G. M. ROWLAND.

28 nm PARTICLES IN FÆCES IN INFANTILE GASTROENTERITIS

SIR,—We have presented evidence (July 19, p. 124) for a new virus associated with infantile gastroenteritis, and this

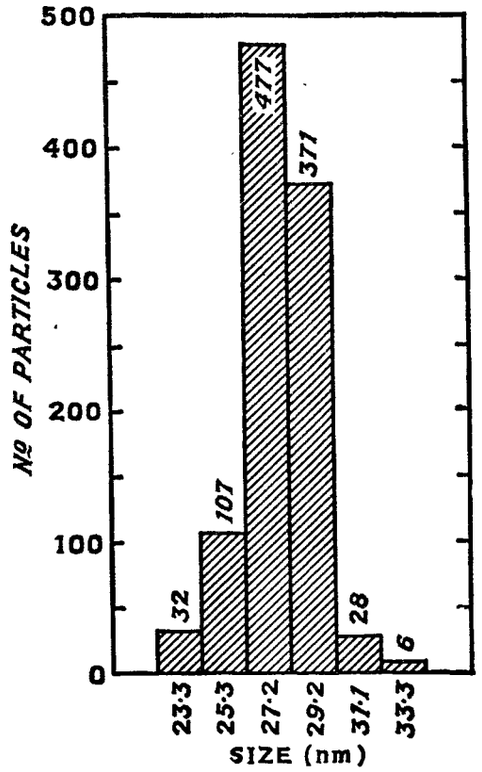

Fig. 1—Histogram of sizes of 1021 astrovirus particles.

1. Kapikian, A. Z., Wyatt, R. G., Dolin, R., Thornhill, T. S., Kalica, A. R., Chanock, R. M. *J. Virol.* 1972, **10**, 1075.
2. Bishop, R. F., Davidson, G. P., Holmes, I. H., Ruck, B. J. *Lancet*, 1973, ii, 1281.
3. Flewett, T. H., Bryden, A. S., Davies, H. *ibid.* p. 1497.
4. Middleton, P. J., Szymanski, M. T., Abbott, G. D., Bortolussi, R., Hamilton, J. R. *ibid.* 1974, i, 1241.
5. Bryden, A. S., Davies, H. A., Hadley, R. E., Flewett, T. H., Morris, C. A., Oliver, P. *ibid.* 1975, ii, 241.
6. Paver, W. K., Caul, E. O., Ashley, C. R., Clarke, S. K. R. *ibid.* 1973, i, 237.
7. Flewett, T. H., Bryden, A. S., Davies, H. A. *J. clin. Path.* 1974, 27, 603.
8. Appleton, H., Higgins, P. G. *Lancet*, 1975, i, 1297.
9. Schoub, B. D., Koornhof, H. J., Lecatsas, G., Prozesky, O. W., Freiman, I., Hartman, E., Kassel, H. *ibid.* p. 1093.
10. Madeley, C. R., Cosgrove, B. P. *ibid.* 1975, ii, 124.
11. McNulty, M. S., Curran, W. L., McFerran, J. B. *ibid.* p. 78.
12. Flewett, T. H., Bryden, A. S., Davies, H., Morris, C. A. *ibid.* 1975, i, 4.
13. Mathan, M., Mathan, V. I., Swaminathan, S. P., Yesudoss, S., Baker, S. J. *ibid.* p. 1068.
14. Tomkins, A. M., Wright, S. G., Bird, R. G., James, W. P. T. *ibid.* 1975, ii, 36.
15. Sack, D. A., Merson, M. H., Wells, J. G., Sack, R. B., Morris, G. K. *ibid.* p. 239.
16. Wyatt, R. G., Kapikian, A. Z., Thornhill, T. S., Sereno, M. M., Kim, H. W., Chanock, R. M. *J. infect. Dis.* 1974, **130**, 523.