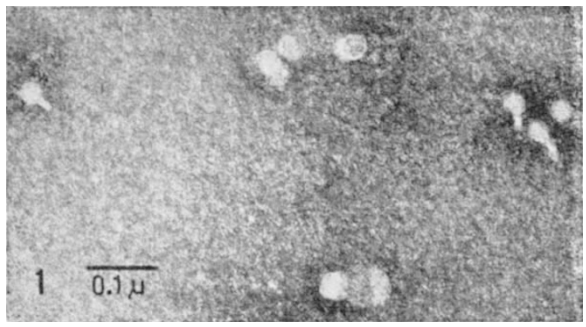


Fig. 1. Particles of a tick-borne encephalitis virus stained with PTA

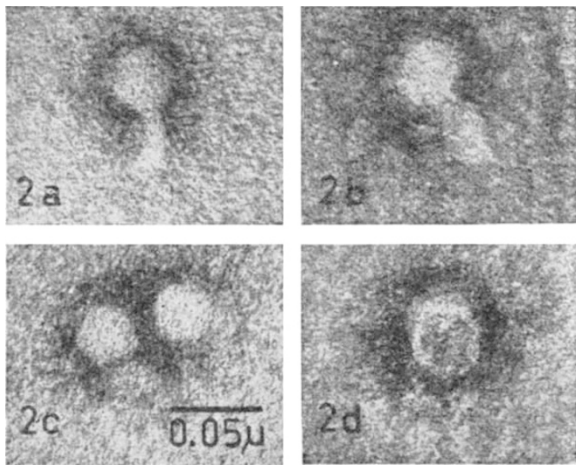


Fig. 2*a*. Particle with a curved tail. 2*b*. Particle with a bud-like bulb. 2*c*. Two spherical particles. 2*d*. Particle filled with PTA

Nine-tenths of the supernatant was discarded, and the pellet was re-suspended in the remaining part. After these centrifugations the evaporated preparation was concentrated five-fold in volume but hæmagglutinins were increased only four-fold. The virus, in an equal volume of 4 per cent phosphotungstic acid (PTA) containing 0·4 per cent sucrose, was sprayed on carbon-coated grids and, after air-drying, was examined with a Siemens Elmiskop I electron microscope at an original magnification of 29,000.

The particle size varied from 30 mμ to 40 mμ, the average being 36 mμ. About one-third of the particles had tail-like projections, some of which were straight, others slightly curved (Figs. 1 and 2*a*). The length of the tails varied from 16 mμ to 32 mμ; the width was mostly about 12 mμ. In some cases the heads and tail-like projections had the same electron density, but bud-like bulbs were also seen (Fig. 2*b*) and were mostly less dense than the heads. The particles were mainly spherical, but angular ones, hexagonal or pentagonal, were also seen (Fig. 2*c*). Some of them seemed to be filled with PTA (Fig. 2*d*). Structures similar to those described above were not observed in uninfected tissue culture fluids prepared in the same manner as the virus preparations.

Smith and Holt[7], using negative staining, demonstrated that the particles of another tick-borne encephalitis virus, strain '*TP* 21' of the Langat virus, obtained from a chromatographic fraction of mouse brain material, were roughly spherical, 32–37 mμ in size, and several particles appeared to have a triangular facet. Tail-like particles of an A-group arbovirus, 'WEE' virus, have previously been described by Sharp *et al.*[8] in unfixed preparations of the purified virus stored 16 days at +4° C.

Some recent work indicates that certain animal viruses may have a tail[9–11]. On the other hand, distortion in shape may be due to the conditions of preparing the virus for electron microscopy[12,13]. Further investigations are required to determine whether the tail-like projections described in the present report do exist under natural conditions or if they are produced in the preparation of the virus.

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[1] Clarke, D. H., *Symp. Czech. Acad. Sci.*, **3**, 67 (1962).
[2] Oker-Blom, N., Kääriäinen, L., Brummer-Korvenkontio, M., and Weckström, P., *Symp. Czech. Acad. Sci.*, **3**, 423 (1962).
[3] Sokol, F., Zelma, J., Libikova, H., and Rosenberg, M., *Symp. Czech. Acad. Sci.*, **3**, 113 (1962).
[4] Kovac, W., Kunz, Ch., and Stocklnger, L., *Arch. Ges. Virusforsch.*, **11**, 544 (1962).
[5] Brenner, S., and Horne, R. W., *Biochim. Biophys. Acta*, **34**, 103 (1959).
[6] Salminen, A., *Ann. Med. Exp. Fenn.*, **40**, 174 (1962).
[7] Smith, C. E. G., and Holt, D., *Symp. Czech. Acad. Sci.*, **3**, 98 (1962).
[8] Sharp, D. G., Taylor, A. R., Beard, D., and Beard, J. W., *Arch. Path.*, **36**, 167 (1943).
[9] Dalton, A. J., Haguenau, Fr., and Moloney, J. B., *J. Nat. Cancer Inst.*, **29**, 1177 (1962).
[10] Zeigel, R. F., and Rauscher, F. J., *J. Nat. Cancer Inst.*, **30**, 207 (1963).
[11] Sharp, D. G., and Bracke, E. C., *Virology*, **10**, 419 (1960).
[12] Elford, W. J., Chu, C. M., Dawson, J. M., Dudgeon, J. A., Fulton, F., and Smiles, J., *Brit. J. Exp. Path.*, **29**, 590 (1948).
[13] Bonar, R. A., Heine, U., Beard, D., and Beard, J. W., *J. Nat. Cancer Inst.*, **30**, 949 (1963).

## ARCHAEOLOGY

### Radiocarbon Dating of the Nok Culture, Northern Nigeria

An early occupation site was located at Taruga, south-east of Abuja, in Niger Province of Northern Nigeria in November 1960, and fourteen exploratory trenches were dug by me early in January, 1961, for the Federal Department of Antiquities. Figurines characteristic of the Nok style had been found by tin miners in sample pits close by, and many other figurine fragments were afterwards excavated *in situ* together with decorated pottery, querns, quartz hammerstones, iron slag and quantities of charcoal. Four, and in some places five, distinct layers were observed in a depth of about 4 ft.

Charcoal excavated from layer three was submitted for determination to Isotopes Incorporated of Westwood, New Jersey, with the following result:

| Isotopes Inc. Determination No. | Sample | Age (years B.P.) |
|---|---|---|
| I-1458 | Sample *B* Taruga | 2,230 ± 120 |

A date of 280 B.C. for an undisturbed Nok site containing abundant evidence of iron-working correlates satisfactorily with the original pre-radiocarbon date for the Nok Culture (based on geomorphological evidence) of the last four centuries B.C. The only other indisputably undisturbed wood specimen (excavated in a completely fresh condition with the bark still unscratched in the heart of the grey clay beds at Nok) gave a carbon date of 206 A.D. ± 50 years (*Y* 474). These two dates provide evidence of the survival of a single early iron age culture for nearly five centuries and there is at present no reason at all to believe that this did not begin earlier and survive later.

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