LETTERS TO THE EDITORS

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Electron Microscope Studies of Normal and Malignant Tissues of High- and Low-Breast-Cancer Strains of Mice

THE consistent finding, by means of the electron microscope, of roughly spherical particles of various sizes but mostly of the order of 200–300 Å. in diameter in extracts of tumours, lactating breast tissues, and other tissues of high-breast-cancer-strain mice and their absence in low-breast-cancer strains was reported in *Nature* two years ago¹; and shortly afterwards² it was reported that similar particles were to be found in extracts of milk of the C3H high-cancer strain. In the latter communication, it was further shown that it was possible by ultra-centrifugation of tumour extracts to obtain a supernatant apparently free from particles, and it was also reported that the test hybrid mice inoculated with particle-containing extracts described in the first communication had developed mammary tumours, indicating that such extracts were biologically active.

The present position as regards mice injected with extracts tested in the electron microscope prior to our centrifugation experiments is summarized in the accompanying table.

SUSCEPTIBLE HYBRID MICE INJECTED WITH EXTRACTS TESTED IN THE ELECTRON MICROSCOPE

	Extracts with particles present	Extracts with particles absent
No. of mice still alive at the earliest tumour appearance	221	185
No. of tumours	71	7
Average tumour age (mths.)	14.4	18.2
Average age of mice which died free from tumours (mths.)	18.2	15.7
No. of mice still alive	30	36

As regards our earlier centrifugation experiments, the present position is that 13 mice out of 45 injected with sediment have so far developed tumours, while 3 out of 40 injected with supernatant have tumours; but this supernatant (after centrifugation for 1 hr. at 113,000 *g*) still contained a number of particles. In our later centrifugation experiments, however, tumours have developed in mice injected with sediments or with supernatants still containing particles, but no tumours, to date, have appeared in mice injected with supernatants apparently free from particles. It seems, therefore, almost conclusive now that the particles described by us do indeed represent the tumour-inducing agent.

A recent article by Graff *et al.*³, entitled "Isolation of Mouse Mammary Carcinoma Viri's", describes particles obtained directly from the milk of the Paris RIII strain of mice in which mammary carcinoma is frequent; but makes no mention of our published findings. Their electron micrographs are similar to some of our earlier pictures which we discarded as being unlikely to be a true representation of the tumour-inducing agent; for it was only after fat extraction (either by treating the desiccated tissues with petroleum ether in the cold or by means of a micro-Soxhlet apparatus with petroleum ether boiling below 40°) and treatment with trypsin that our present satisfactory photographs were obtained. In

these the particles (still active) are so sharply defined that it is clear that much, if not all, of the apparent variation in size is due to aggregation, and often symmetrical aggregation, of smaller units. That our pre-treatments have not inactivated the agent is shown by our biological results. Neither are the particles artefacts, for distilled water extracts of fresh tissues are also found to contain them.

It is to be noted, too, that Graff and his colleagues appear not yet to have obtained and tested supernatants free from their particles.

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¹ Passey, R. D., Dmochowski, L., Astbury, W. T., and Reed, R., *Nature*, **160**, 565 (1947). (See also *Biochim. Biophys. Acta*, in the press).

² Passey, R. D., Dmochowski, L., Astbury, W. T., Reed, R., and Johnson, P., *Nature*, **161**, 759 (1948).

³ Graff, S., Moore, D. H., Stanley, W. M., Randall, H. T., and Haagen-
sen, C. D., *Cancer*, **2**, 755 (1949).

⁴ Reports (1948–49) of the Yorkshire Council of the British Empire
Cancer Campaign, p. 5.

Ground-Wave Propagation Across a Land/Sea Boundary

No useful analytical solution has yet been given for the propagation of vertically polarized radio waves over a non-homogeneous earth. On one hand, Grünberg¹ and other Russian authors have started analytical work on the right lines, but seemingly without being able to arrive at any reasonable answers; on the other, Millington² has suggested a practical graphical procedure, based on the general features that a rigorous solution would be expected to possess. Millington's method ignores phase relationships altogether; but recent experimental work indicates that it gives a good estimate of field-strengths^{3,4,5}.

I have now been able to show that the case of a single land/sea boundary for a flat earth may be adequately treated by an integral equation method allied to that recently introduced into diffraction theory^{6,7}. In particular, the two-dimensional problem illustrated in Fig. 1 can be solved exactly. In this model the sea has been replaced by a perfectly conducting, semi-infinite plane sheet; and the transmitter *T* is a vertically polarized line-source (parallel to the boundary *O*) which, together with the receiver *R*, we shall for convenience take at ground-level. Essentially, we have here a generalization of the classic Sommerfeld half-plane diffraction problem; and

Fig. 1