

Dr M. Raff and its specificity for killing only T cells had been established. This regimen completely suppressed the initial response in primed deprived mice (Fig. 2). After additional injections of MSH, only small amounts of antibody appeared (0.3–1% of the amount found without anti- θ treatment); this indicated that although most of the 70 ng of antigen was carried by macrophages^{11,12} the 150,000–600,000 T lymphocytes present in the peritoneal exudate played a major role in the reconstitution.

A more direct approach was used to detect B cell proliferation in T-deprived mice exposed to MSH. One month after priming, spleen lymphocytes from these mice were analysed for their ability to fix ¹²⁵I-MSH of high specific activity¹⁴. In unprimed deprived mice the number of lymphocytes bearing more than fifty molecules of MSH (0.7%) was similar to the number of MSH specific B cells found in normal animals (0.8%)¹⁴. The number found in primed deprived mice (3.3%) was close to the number of B lymphocytes found in primed mice (3.1%)¹⁴.

In conclusion, T-deprived mice, although unable to make a circulating antibody response when challenged with MSH, were able to develop B-type memory as shown by: (a) a rapid antibody response, comparable with a secondary response in normal animals, after reconstitution with thymocytes and a single injection of antigen (Fig. 1), and (b) an increased number of antigen binding cells in the spleen similar to the number of B lymphocytes in primed mice not deprived of T cells. Similar results have been obtained using tetanus toxoid as antigen with a shorter interval (1 month) before reconstitution, rather than 3 to 4 months as in our experiments (personal communication of N. Willcox and J. H. Humphrey). Owing to the uncertain number of T cells in deprived mice (2 to 10% of the usual amount)^{15,16} it is not clear whether B memory develops in the absence of T cell interaction or whether B memory without triggering of antibody secretion comes about by low numbers of T cells. The use of nude mice¹⁷ may help to resolve the question of whether B lymphocyte memory is completely independent of T help; in this case T lymphocytes would play a role only in differentiation of B memory cells into antibody secreting cells.

The reason for the increased antibody levels obtained by addition of very small amounts of MSH (0.3 ng) to thymocytes for reconstitution is not known but could be due to the triggering of the few competent T cells present in the thymocyte population¹⁸.

The reconstitution of thymus deprived mice with PE cells after uptake of MSH was peculiarly efficient. Here also, priming of the T-deprived mice had a dramatic effect on both the kinetics and the amplitude of the anti-MSH response. This reconstitution was due to T cells since anti- θ serum and complement abolished the effect. The number of T cells transferred was low, however (150,000 to 600,000 cells and in some cases as little as 15,000 to 60,000); hence these T cells function particularly efficiently as helper cells. This may be due to selection in the peritoneal cavity of an MSH specific T cell population, although the PE cells were collected only 45 min after MSH injection. Another possibility is that interaction with macrophages is a mechanism by which T cells are activated and that the combination in a PE population of macrophage associated antigen and T cells is particularly suitable for T cell triggering.

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G. E. ROELANTS
B. A. ASKONAS

National Institute for Medical Research,
Mill Hill,
London NW7, and
Basle Institute for Immunology,
487 Grenzacherstrasse,
CH-4058 Basle

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- ¹ *Cell Interactions and Receptor Antibodies in Immune Responses* (edit. by Mäkelä, O., Cross, A., and Kosunen, T. U.) (Academic Press, London and New York, 1971).
- ² Askonas, B. A., Williamson, A. R., and Wright, B. E. G., *Proc. US Nat. Acad. Sci.*, **67**, 1398 (1970).
- ³ Jacobson, E. B., L'Age-Stehr, J., and Heraenberg, L. A., *J. Exp. Med.*, **131**, 1109 (1970).
- ⁴ Roelants, G. E., and Askonas, B. A., *Europ. J. Immunol.*, **1**, 151 (1971).
- ⁵ Davies, A. J. S., *Transplant. Rev.*, **1**, 43 (1969).
- ⁶ Askonas, B. A., Davies, A. J. S., Jacobson, E. B., Leuchars, E., and Roelants, G. E., *Immunology* (in the press).
- ⁷ Askonas, B. A., and Rhodes, J. M., *Nature*, **205**, 470 (1965).
- ⁸ Unanue, E. R., *J. Immunol.*, **105**, 1339 (1970).
- ⁹ Raff, M. C., and Owen, J. J. T., *Europ. J. Immunol.*, **1**, 27 (1971).
- ¹⁰ Takahashi, T., Old, L. J., McIntire, K. R., and Boyse, E. A., *J. Exp. Med.*, **134**, 815 (1971).
- ¹¹ Raff, M. C., *Nature*, **224**, 378 (1969).
- ¹² Unanue, E. R., and Askonas, B. A., *J. Exp. Med.*, **127**, 915 (1968).
- ¹³ Unanue, E. R., and Askonas, B. A., *Immunology*, **15**, 287 (1968).
- ¹⁴ Roelants, G. E., *Nature New Biology*, **236**, 252 (1972).
- ¹⁵ Raff, M. C., and Wortis, H. H., *Immunology*, **18**, 929 (1970).
- ¹⁶ Doenhoff, M. J., Davies, A. J. S., Leuchars, E., and Wallis, V., *Proc. Roy. Soc. Lond.*, **B**, **176**, 69 (1970).
- ¹⁷ Flanagan, S. P., *Genet. Res.*, **8**, 295 (1966).
- ¹⁸ Raff, M. C., *Nature New Biology*, **229**, 182 (1971).

Erratum

IN the article "Defective Translation in RC⁻ Cells" by Barry Hall and Jonathan Gallant (*Nature New Biology*, **237**, 131; 1972), the following corrections should be made: in paragraph 6, lines 12, 14 and 15, ref. 6 should read ref. 5; under the sub-heading "Frequency of Errors in Translation", the fifth sentence should read "By the Poisson distribution, $0.3 = e^{-r}$, where r is the probability of an inactivating 'hit' or error per subunit . . .".

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