difference between the molecular ion and the peaks in the spectrum with the composition of the amino acids.

Work is in progress on the MS-902/Argus 500 system recently installed at the University of Liverpool to extend the scope of amino acid sequence determination of peptides by mass spectroscopy. This system is capable of recording a complete high-resolution spectrum in 25s and immediately producing a paper tape of the accurate masses.

This rapid scanning capability may, in principle, be utilized to obtain sequential spectra of mixtures

(R. A. W. Johnstone & D. W. Payling, personal communication), and hence in the case of peptide derivatives to obtain amino acid sequences of the individual components.

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IMMUNOGLOBULIN DISCUSSION GROUP COLLOQUIUM ON 'GENES AND ANTIBODIES'

Gene Expression of Immunoglobulins

By B. PERNIS. (*Cattedra Di Immunologia, Università Degli Studi Di Milano, Milan, Italy*)

Genetic Control of the Antibody Response

By E. S. LENNOX. (*The Salk Institute, San Diego, Calif. 92112, U.S.A.*)

It should be possible by finding suitable mutants to reveal steps in the pathway of the immune response and perhaps to decide whether the many antibody specificities arise by a somatic generation of diversity. To this end, we have screened many strains of inbred mice for their ability to make antibodies against several strains of influenza virus. Several differences have been found among the mouse strains, and genetic crosses have been made to elucidate the genetic control. In addition, there are very big differences of response among individuals of the same inbred strain.

Some of the findings are as follows:

(1) Strain DBA-2 responds to injection of virus WSE by making only macroglobulin (immunoglobulin M) antibody. In response to other virus strains it does make immunoglobulin G in addition. This defect in specific immunoglobulin G production is controlled by a single gene or close cluster of genes. On second injection strain DBA-2 does make immunoglobulin G antibodies, and hence the block in primary response is at some regulatory step.

(2) Response of F₁ hybrids between two strains that respond poorly is significantly better than either parent. This would seem to indicate multi-genic control of the immune response, a hardly surprising result.

The possible uses and limitations of these kinds of experiments will be discussed.

Genetics of Human Immunoglobulins

By J. B. NATVIG. (*Research Institute of Immunology and Rheumatology, Rikshospitalet University Hospital, Oslo, Norway*)

The four γ G and two γ A heavy chain subclasses show different antigenic and biochemical structures related both to the Fc and Fd parts of the heavy chains. In addition, studies on Gm and Am (Kunkel, Smith, Joslin, Natvig & Litwin, 1969; Vyas & Fudenberg, 1969) genetic markers show that these γ G and γ A subclasses are related to genes of at least six different cistrons. Sensitive haemagglutination inhibition systems have become available for studying antigens that are subclass specific, as well as others shared by some, but not all, subclasses. Many of these antigens, particularly those studied for γ G, are isotypes present in all normal sera. For example, 'non a' and 'non g' (Natvig, Kunkel & Joslin, 1969) are shared by three and two subclasses respectively. However, although present in all γ G2 and γ G3 proteins, 'non a' is only found in Gm(a-) γ G1 proteins. Thus within γ G1 'non a' is antithetic to Gm(a). Further, its distribution completely matches that of the previously described 'non a' peptide (Frangione, Franklin, Fudenberg & Koshland, 1966). 'Non g' is present in all γ G2 proteins, but only in Gm(g-) γ G3-globulins. Thus within γ G3 'non g' is antithetic to Gm(g).

In contrast with these isotypes, the allotypes are present only in some sera and are confined to certain proteins within one particular subclass. Heavy-chain allotypes are known for four subclasses: γ G1, γ G2, γ G3 and γ A2. Most of these markers reside in the Fc portion, but two Fd markers, Gm(f) and Gm(z), are known. The 'non a' and 'non g' markers, the Fd and Fc subclass-specific antigens and the Gm and the Am allotypes have proved useful for studying γ -globulin structure and synthesis. Their