Table 2. RESULTS OF TWO EXPERIMENTS WITH MICE
It has been shown in similar experiments (not presented here) that 75 mg and less of EQ only gives partial protection

Treatment				Mortality-rate
Iron (mg/kg)* on day 0	Test substance†			
	Preparation	mg/kg	At time (h)	
100–300	—			19/22
200–1,000	TO	20	−24	0/20
400–500	TO	20–60	0	45/45
200–400	—			28/30
1,000	DPPD	50	0	10/17
1,000	DPPD	100	0	3/18
1,000	DPPD	200	0	1/18
1,000	EQ	100	0	0/16
1,000	EQ	200	0	0/16
1,000	EQ	400	0	0/17

* Intraperitoneally. † Subcutaneously.

have been reviewed recently[4]. The slow action of vitamin E relative to EQ is in accordance with results of distribution studies using α-tocopherol labelled with carbon-14 and EQ[5]. It was shown there that per orally administered tocopherol reached peak concentrations in skeletal muscles and other tissues of rats after 24 h. EQ showed maximum levels already after ½ h. Piglets and mice which have received lethal iron doses in the order of those used in our experiments start dying after 4–6 h, and peak-mortality occurs at about 12 h. It is conceivable that EQ, but not tocopherol, given at the same time as the iron, reaches the sensitive targets in time to protect from the deleterious effects of the latter.

An important consequence of the related observations is the possibility of simultaneous administration of EQ and iron preparations in order to prevent intoxication in animals with a latent vitamin E-deficiency.

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GENETICS

A Preliminary Estimate of the Number of Human Genes

RECENT results of molecular genetics enable us to estimate the number of human genes, if certain assumptions are made. The following data are available:

(1) The α-chain of human hæmoglobin contains 141, the β-chain contains 146 amino-acids, corresponding to a molecular weight of about 17,000 each[1]. Assuming a triplet code[2,3] this means that the α- and β-chains are determined by 423 and 438 nucleotide pairs, respectively. According to 'Svedberg's law'[4], many proteins consist of sub-units of the same order of magnitude (molecular weight of about 17,500). Hence, the assumption seems to be warranted that one average structural gene might have a length of about 450 nucleotide pairs.

(2) The weight of one haploid human chromosome set in human spermatozoa is about $2{\cdot}72 \times 10^{-12}$ g. Granulocytes contain about $6{\cdot}23 \times 10^{-12}$ g; lymphocytes contain about $5{\cdot}84 \times 10^{-12}$ g (ref. 5). Extensive examinations have shown that the DNA content is constant in all resting cells of one species, which have the same number of chromosome sets, and depends on the degree of polyploidy[5,6]. The assumption seems to be justified that most of the DNA works as genetic material, even if in some cells minor fractions with other functions might possibly be present[7]. In the following calculations the total amount of DNA in a haploid human chromosome set is estimated to be about 3×10^{-12} g.

(3) Usually the genetic variants of human hæmoglobins differ in one amino-acid substitution only[1,8]. One structural gene can only produce one single type of genetically determined polypeptide chain. As much as we know, this applies for other genetically determined proteins as well. This means that the genetic information for these structural genes can only be present once. Any degree of polyteny for these loci in the germ cells is highly unlikely. As has been mentioned, however, the DNA content of diploid cells is about twice the content of (haploid) spermatozoa. We assume that the total genetic information is only present once.

As can easily be calculated, a nucleotide pair with one adenine, one thymine, two deoxyribose, and two phosphate residues has a weight of $1{\cdot}025 \times 10^{-21}$ g, whereas a nucleotide pair with guanine and cytosine residues weighs $1{\cdot}027 \times 10^{-21}$ g. The difference can be neglected, and 1×10^{-21} g can be accepted as a good approximation. Hence, the total haploid chromosome set (3×10^{-12} g) contains $\approx 3 \times 10^{9}$ nucleotide pairs. Assuming 450 nucleotide pairs for one average structural gene, we arrive at an estimate of $\approx 6{\cdot}7 \times 10^{6}$ structural genes per haploid chromosome set.

This estimate is disturbingly high indeed, and hence a different way of reasoning might be appropriate. In the giant chromosomes of certain Diptera which show a high degree of polyteny, evidence has been brought forward that the bands are functional units of protein synthesis. Within these bands one single chromatid thread has an average length of $\approx$ 50,000 nucleotide pairs[9]. This estimate of a 'gene-length' is about a hundred times higher than the estimate based on the protein data, and would lead to $\approx 6 \times 10^{4}$ units of this type for the haploid human genome. It is in much better accordance with the very crude assumptions made so far[10]. The question as to the difference with a factor of about 100 between the two estimates remains to be answered.

In my opinion, the answer might be that the systems of higher order which are connected with structural genes in operons and regulate their activity[11] might occupy a much larger part of the genetic material than the structural genes which produce the polypeptide chains required for synthesis of enzymes and other functional proteins. The argument will be presented in greater detail later[12].

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VIROLOGY

Inter-graft Transmission of Cytoplasmic Male Sterility

GRAFT transmission of cytoplasmic male sterility in *Petunia*[1–3] has many similarities to graft transmission of plant viruses[3]. As yet, however, the entity responsible for the sterility has not been isolated or identified. In this communication, we report results of investigations