Six thousand male and 6,241 female in-patients of mental hospitals and 966 female out-patients of a psychiatric clinic in Scotland have been examined by N. Maclean *et al.* (*J. Med. Genet.*, **5**, 65; 1968). Using a method designed to detect additional *X* chromosomes they took cells from the mouth and examined them for sex chromatin. Blood cell and skin cultures from those patients who had extra chromatin bodies in these cells were further examined. Of the 6,000 males, nineteen were *XXY* and five were *XY*, *XXY* mosaics; and of the 7,207 females twelve were *XXX*, two were *XX*, *XXX* mosaics and two *XO*, *XXX* mosaics. The proportion of abnormalities found was significantly greater than that found by the same authors in sample surveys of newborn babies. Many mental patients are mentally defective rather than mentally ill, and a high proportion of chromosome abnormalities was found among these people. Schizophrenics were found to have about twice as many chromosome abnormalities as a sample of newborn babies; but the frequency of chromosome abnormalities among schizophrenics did not differ significantly from the frequency found among the residual mental hospital population when schizophrenics, epileptics and the mentally deficient were excluded. Most *XXX* females had normal genitalia and menstruated normally, so that their mental abnormality cannot simply be a result of hormonal imbalance. Testicular atrophy occurs after puberty in *XXY* males and this may be an additional factor leading to mental disturbance.

Comparison of the chromosomes of this mentally ill adult population with the chromosomes of the newborn is, however, beset with difficulties. We do not know what the life expectancy of chromosomally abnormal babies is, nor whether the frequency of chromosomal abnormalities in those born between 1879 and 1944 (when the inmates of mental hospitals in this sample were born) is the same as the frequency of chromosomal abnormalities among the newborn in the 1960s, when the sample survey was made. Nevertheless, it seems likely that additional *X* chromosomes predispose towards mental illness, or are correlated with other factors such as difficult births which cause brain damage leading to mental illness.

RADIOBIOLOGY

Sulphydryl Protection

from our Radiobiology Correspondent

It has long been known that some of the most effective radioprotective agents are those which contain sulphydryl groups, such as cysteine and cysteamine. Explanation of their effect usually supposes that the biological effect of radiation is a consequence of the production of free radicals in vital biological molecules. Many of these free radicals are produced by loss of hydrogen atoms, either following direct ionization or by the attack of radicals formed by the radiolysis products of water. The sulphydryl group is then thought to restore the original molecule by transfer of a hydrogen atom; the resulting free radical RS· has a negligible biological effect.

Until recently this theory could be tested only indirectly—for example, by using electron spin resonance to study the radicals formed in the presence and absence of a sulphydryl radioprotector. But pulse radiolysis has made possible the observation of rapid reactions occurring after irradiation of solutions containing sulphydryl groups. Adams (*Curr. Topics in Radiat. Res.*, **3**, 35; 1967) found a strong transient absorption at 415 nm after pulse radiolysis of solutions containing cysteamine. By irradiating a mixture of cysteamine and methanol, he was able to observe the reaction between the SH group and the radical CH_2OH· formed by attack of OH· radicals on methanol. The repair of the radical CH_2OH· took place after the irradiation with a time constant of several microseconds. Although rapid on an ordinary time scale, this reaction is very slow when compared with the time required for production of the radicals. A rather similar experiment has now been reported by Davies, Ebert and Shalek (*Intern. J. Radiat. Biol.*, **14**, 19; 1968) using a mixture of cysteine and lysozyme.

Radioprotection by sulphydryl compounds is interrelated with sensitization by oxygen. The theory of hydrogen atom transfer can be extended to include this by supposing that oxygen and the sulphydryl group compete in attacking the biological free radical, and that, whereas the SH group can restore the original biological molecule, oxygen makes the damage permanent. This type of competition reaction, involving oxygen and another chemical species able to reconstitute free radicals, is likely to be the mechanism explaining the sensitizing effect of oxygen which is so widely observed in radiobiology. It is gratifying therefore that Davies, Ebert and Shalek were able to observe directly the competition between cysteine and oxygen for the primary radicals formed in the lysozyme and could measure the rate constants for the two reactions. It must be noted, however, that the concentration of cysteine at which the competition could be observed most clearly was very different from that used in biological experiments such as those of Dewey (*Radiat. Res.*, **19**, 64; 1963).

These findings are an encouraging sign of convergence between radiobiology and radiation chemistry. One of the principal motives for research in radiation chemistry has been the hope of providing explanations for radiobiological effects. But in practice the two subjects have seemed to diverge, with the chemists concentrating on relatively simple systems and the biologists becoming more involved in the complexities of living matter. Pulse radiolysis has provided another valuable link which we must hope will be rapidly strengthened.

MOLECULAR BIOLOGY

Mitochondrial Nucleic Acids

from our Cell Biology Correspondent

The mitochondrial nucleic acid industry seems to be flourishing, and the latest issue of *Proc. US Nat. Acad. Sci.*, a sure guide to the fashionable, contains five papers on various facets of the subject. Two of them deal with the anatomy of mitochondrial DNA. Thus Avers *et al.* (**61**, 90; 1968), who have previously shown that mitochondria from haploid yeast *Saccharomyces cerevisiae* contain predominantly open or super-coiled circular DNA but that filamentous DNA molecules predominate in an isogenic petite strain, have now extended these observations to diploid strains. Although the proportions of circular and linear molecules