

dog and the bicycle occurs: say, an image of a dog riding a bicycle, or being run over by one. This produces better recall of the second word bicycle when cued with the first, than does the creation of separate images of dog and bicycle or than an attempt simply to remember the words.

This, then, is the background of Neisser and Kerr's experiments. Subjects were given a series of twenty-four descriptive sentences, asked to form visual images of what was described in each, and to rate each image for vividness. For eight of the sentences the scene could be pictured directly, for example, "A harp on the top of the torch of the Statue of Liberty". For eight there was a connection between the two objects, but one that could not be captured in a single picture because of concealment; so the corresponding sentence would be "A harp inside the torch of the Statue of Liberty". For the remaining eight there was no direct connection, for example, "Out of one window I can see a harp and out of the other I can see the Statue of Liberty".

The second experiment of Neisser and Kerr provided some obvious controls for complexity and length of the sentences, and added a condition in which there was minimal luminous contrast between the two objects to be identified, for example, a piece of coal in a dark windowless cellar. The subjects were not warned in either experiment that they would have a recall test, but Neisser and Kerr found that when cued with the context given in each sentence (for example, the torch of the Statue of Liberty which for any one subject would occur in only one of their twenty-four sentences) subjects were able to recall the other object mentioned in the sentence equally well whether the image were pictorially possible, or when the object was concealed, or when there was low visual contrast between the object and its context. For disconnected images, however, recall was substantially worse, and there was furthermore no correlation between either time taken to form the image or its vividness when the sentences were first presented, and its recall subsequently.

Neisser and Kerr conclude that the mnemonic power of images depends upon their being representations of spatial relationships, not upon their possibilities for comprising a good 'picture' as such. The lack of decrement in the poor visual contrast images, for example, coal in a cellar, seems to be one point of contradiction with the rules of the ancient art of memory, which proposed that the loci in which images were to be placed must be well lit.

Just as interesting as the use of visualisation in memory are the implications that this kind of investigation

has for perception and thinking. Neisser and Kerr do not fail to relate their findings, that visual images are three-dimensional representations of layout rather than two-dimensional pictures of scenes, to an understanding of visual perception. When one sees, one does not experience retinal pictures as such, but the spatial layout of the environment. What they might also have pointed out, but did not, is that human beings seem to possess specialised and powerful mechanisms for reasoning about spatial relationships. They form the basis of visual perception and Helmholtz referred to them as processes of "unconscious inference". In the Renaissance the ancient art of memory became transformed from a process of simply recording static images to a method that actually allowed the powerful mechanisms of spatial conceptualisation and inference to help one to think. Perhaps soon one may also look forward to some experimental exploration of this aspect of the uses of imagery.

Interaction between pineal and pituitary glands

from our Steroid Biochemistry Correspondent

THE pineal gland has been studied intensively in recent years and the view is growing that this gland can affect several endocrine functions in the body. It is known to inhibit reproductive functions in mammals. Although the mechanisms by which the pineal acts are not fully understood, it is thought that light, and possibly other factors such as cold, stress or other hormones, act on it to decrease the synthesis of melatonin and/or serotonin by inhibiting specific enzymes needed for the formation of these compounds. Production of melatonin in the pineal is stimulated by darkness and inhibited by light. Several questions about the synthesis, secretion and transportation of melatonin and its effect on different endocrine glands, however, remain unresolved. Do these compounds act peripherally at specific sites or is their main site of action within the brain affecting trophic hormone release? Are they secreted into both the blood stream and cerebrospinal fluid?

Further information relating to some of these questions has now been provided by Seibel and Schweisthal (*Acta endocr., Copnh.*, **74**, 434; 1973), who used the golden hamster to study the relation between the pineal and other endocrine glands. Although melatonin or serotonin have not yet been isolated

from the pineal gland of the hamster, this animal has the advantage in studies of the effects of changes in environmental lighting and pinealectomy, that the changes in the gonads are much greater than in the albino rat.

The mean weights of testes and seminal vesicles of hamsters blinded by bilateral enucleation were significantly lower than those of control, pinealectomised or blinded and pinealectomised animals, but could be increased by melatonin, whereas after hemi-castration, pinealectomy with hemi-castration or with hemi-castration and blinding there was a significant increase in the mean weight of the testes. Mean testicular weight was not altered by bilateral enucleation combined with hemi-castration suggesting an interaction between the pineal antigonadotrophic substances and the pituitary gonadotrophins, but was reduced on treatment with melatonin and serotonin.

No significant changes in the weights of the adrenal or pituitary were found in any experimental conditions except in the group which underwent all three operative procedures and were also treated with melatonin. These results differ from those obtained in the rat where regression of the adrenals occurs after blinding. The increased uptake of iodine-131 observed in blinded animals could be reduced by melatonin treatment. After parabiotic union in males, whether one or both animals were blinded, there was a significant decrease in testicular weight indicating that the pineal antigonadotrophic substance was carried through the blood.

These investigations show an interaction between the secretions of the pineal and those of the pituitary. Melatonin is known to depress secretion of luteinizing hormone most probably by an effect on the hypothalamus. So does serotonin which will also depress secretion of follicle stimulating hormone and the relations between these two biogenic amines needs clarification.

Genetic manipulation

from a Correspondent

GENETIC manipulation by the biologist has, in the past few years, become an area of great controversy and increased research activity. This has led, in some cases, to workers trying to jump on the genetic engineering bandwagon when their results are only minimally applicable to the field.

Levy, Snyderman, Ladda and Lieberman (*Proc. natn. Acad. Sci., U.S.A.*, **70**, 3125; 1973) attempt to show that a genetic deficiency can be temporarily