non-significant changes after glucagon; but the marked decrease of noradrenalin in comparison with the controls was observed after glucagon or oestradiol administration (Figure). About the same results were obtained by histochemical methods concerning the distribution of adrenalin and noradrenalin-storing cells.

The histological pattern shows the occurrence of an intense chromaffin hyperplasia after oestradiol administration. Simultaneous treatment with glucagon markedly reduced oestradiol-induced hyperplasia in the adrenal medulla.

Aldosterone administration induced a moderate stimulation of medullo-chromaffin hyperplasia. The most intense stimulation of the chromaffin hyperplasia was observed after concomitant administration of oestradiol and growth hormone (4); its appearance is that of a pheochromocytoma and hemorrhagic cyst.

Discussion. Our findings suggest that glucagon, aldosterone and growth hormone significantly influence the evolution of the oestradiol-induced chromaffin hyperplasia and the catechol amine content of the adrenal medulla of guinea-pigs. The administration of large doses of insulin induced in rats' and cats' adrenal medulla an exclusive depletion of the adrenalin; in dogs, i.v. administration of glucagon-free insulin induces a moderate increase in the catechol amine output. From our experiments, a progressive increase may be observed in the adrenalin content after glucagon, oestradiol, growth hormone and aldosterone administration in comparison with the controls, and a marked decrease in the noradrenalin content after glucagon, oestradiol, growth hormone and aldosterone administration. This variation runs parallel to the histological changes in the volume and structure of the adrenal medulla.

Résumé. La variation du taux des catécholamines (adrénaline et noradrénaline) et les modifications histologiques ont été étudiés après administration d'aldostérone, de glucagon et d'hormone de croissance sur l'hyperplasie médullo-chromaffine provoquée chez des cobayes par l'œstradiol.

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Association of Human Satellited Chromosomes

The ability for human satellited chromosomes to lie in close proximity to one another at metaphase has been observed by Harnden[1]. Shaw[2] further reported his observations in which chromosome No. 1 (Denver System) also formed a close association with the satellited chromosomes. Ferguson-Smith and Handmaker[3] defined this phenomenon, and later (1963)[4] showed the distribution between these chromosomes to be non-random, with a high frequency of associations between the short arms of the satellited chromosomes and specific regions of non-satellited chromosomes. Merrington and Penrose[5], by statistically analysing 62 cells, showed that the acrocentric chromosomes (which are usually satellited) tend to lie closer together than would be expected if the chromosomes were randomly arranged at metaphase. Frøland[6], in a study of 6458 cells, observed that the mean association per cell was 1.32 and that there was no difference between the age, sex, or karyotype of the subjects. Reitalu[7], in a more detailed study, showed that (a) only 6 satellited chromosomes out of the normal 10 took active part in satellite associations, (b) the chromosomes which exhibited this phenomenon were non-homologous chromosomes, and (c) the association frequency in the large and small acrocentric groups was the same.

Following this observation of Reitalu, the present study was undertaken to ascertain (1) whether or not all ten acrocentric chromosomes took part in associations, (2) whether or not homologous chromosomes took part in the association, and (3) to calculate the frequency with which individual and homologous chromosomes took part (if indeed they did) in satellite association.

The criterion used for the definition of satellite association is the same as that described by Ferguson-Smith and Handmaker[3].

Materials and methods. For this study, data were obtained from a total of 300 cells which were karyotyped. These cells were all obtained from blood leucocyte cultures set up by the methods described by Bishun et al.[8] and Robinson et al.[9], with some minor modifications. The metaphase cells selected were the best spread, with good morphology and with the modal chromosome complement of the patients. These were the cells usually

Table I. Frequencies of different chromosomes

Single chromosomes					
Chromosome No.	13	14	15	21	22
Frequencies (%)	11.2	10.9	11.2	14.7	9.6
Homologous chromosomes					
Frequencies (%)	6.02	8.9	5.7	15.8	6.3

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Table II. Pooled results. Ages ranging from 2 days to 75 years. Both male and female cells are included; also cells with normal and abnormal karyotypes

Age group	Cells examined	Associations observed	No. 13	No. 14	No. 15	No. 21	No. 22
New-born to 10 years	84	77	21 single 6 homol.	21 single 10 homol.	22 single 4 homol.	36 single 15 homol.	16 single 2 homol.
11–20 years	72	72	16 single 4 homol.	21 single 5 homol.	19 single 6 homol.	24 single 13 homol.	18 single 9 homol.
21–40 years	114	93	29 single 6 homol.	23 single 9 homol.	23 single 3 homol.	21 single 18 homol.	28 single 7 homol.
41–75 years	30	24	5 single 3 homol.	4 single 4 homol.	7 single 3 homol.	9 single 4 homol.	2 single 2 homol.
Totals	300	266	71 single 19 homol.	69 single 28 homol.	71 single 16 homol.	93 single 50 homol.	61 single 20 homol.

Total number of chromosomes involved in the associations is 631. Average number of chromosomes per association is about 2.

selected from the total amount counted for the patient, as a representative chromosomal constitution. Photographs were usually taken under oil immersion objective with a 35 mm camera. Prints of approximate magnification $\times 2500$ were made of the chromosomes, which were then cut out and, following as closely as possible the criteria set out by the Denver Human Chromosome Study Group (1960) and the London Conference (1963), were stuck on a card in their respective groups.

The greatest possible care was taken with the karyotyping of the cells, and usually all karyotypes in this laboratory were checked by three individuals. In the majority of the karyotypes no difficulty was met in identifying chromosome members of different groups. The identification of the acrocentric chromosomes, on which the present study was very much dependent, absorbed a lot of attention, and a great deal of time was spent trying to identify individual pairs of these chromosome groups. We found a significant variation in the sizes of the three pairs of chromosomes. Normally No. 15 was the smallest with No. 14 larger and No. 13 the largest of the group. This criterion has been used in the karyotypes to distinguish between these chromosomes and also Nos. 21 and 22. Data were obtained from a routine set of patients, their karyotypes being constructed without this study in mind.

Results. Results were divided into four distinct groups according to age. The result obtained from each Table for each age group was rather small, hence the results were pooled as shown in Table II. The average association per cell was 0.88 as compared with 1.32 observed by FRØLAND from over 6000 cells.

The frequencies of each individual member of the acrocentric group were 71 in 631 (11.2%) for chromosome No. 13, 69 in 631 (10.9%) for No. 14, 71 in 631 (11.2%) for No. 15, 93 in 631 (14.7%) for No. 21, and 61 in 631 (9.6%) for chromosome No. 22. The frequencies for the homologous chromosomes were 6.02% for No. 13, 8.9% for No. 14, 5.7% for No. 15, 15.8% for No. 21, and 6.3% for chromosome No. 22. The results are tabulated in Table I for comparison.

For the single chromosomes the frequencies appear to be equal except in the case of No. 21 which occurs with a higher frequency. The homologous pairs also occur with equal frequency except No. 21 again, which occurs with a frequency twice as great.

These results show that the individual acrocentric chromosomes occur with a greater frequency in satellited associations than in the homologous chromosomes. For single and homologous chromosomes the frequencies in each group are the same except in the case of No. 21.

Conclusion. Provided that our identification of these chromosomes is correct, the present study shows that all the acrocentric chromosomes do participate in satellite associations. Also non-homologous, single, and homologous chromosomes all take part in exhibiting this phenomenon, and the frequencies for single and homologous chromosomes from each group is equal, except for No. 21. All these observations are in disagreement with the data published by REITALU. This discrepancy must have arisen, no doubt, from the identification of the individual chromosomes. For an investigation of this sort to be undertaken, attempts must be made to identify the individual chromosomes. We consider the degree of error in identification must be the same as in REITALU's observations, hence the difference in results could be due to techniques by which the chromosomes were prepared.

The significance of satellite association has been discussed by FERGUSON-SMITH and HANDMAKER[3]. Data are now presented to show that homologous chromosomes, as well as the non-homologous chromosomes, may be involved in satellite association and non-disjunction, chromosome breaks, and translocations.

Résumé. On présente ici les résultats de l'examen de trois cents cellules humaines métaphasées afin de démontrer que dans le karyotype humain, tous les acrocentriques ont une part active dans l'association des satellites. Les chromosomes acrocentriques homologues aussi bien que les chromosomes acrocentriques non-homologues laissent voir ce phénomène avec des fréquences relativement hautes.

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