93. *Measurement of Deoxyribonucleic Acid (DNA)
by Means of Feulgen-Microspectrophotometry
in Benign or Malignant Atypical-
epithelium of Stomach and
in Gastric Tumors**

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The diagnosis of gastric cancer is a matter of prime importance and of special difficulty, both clinically and pathologically, because there are some cases which lie on a borderline of malignant and normal tissues.

The results of the DNA-measurement in normal and malignant tissues indicate that, in a number of cases, the amount of DNA per cell-nucleus is higher in cancer tissues than in the normal ones. Further, malignant tissues showed a much larger scatter of DNA-content from cell to cell than normal tissues did and in many cases of carcinomas, DNA values vary from hyperdiploid to tetraploid range.^{1,2,3,5)}

The present study deals with the DNA-content of cell-nuclei in benign or malignant atypicalepithelium of the stomach and in gastric tumors with special regard to the relationship between histopathological pattern and the DNA-content.

Nine cases under study are as follows: one case of rather benign, two cases of benign or malignant, three cases of rather malignant atypicalepithelium of the stomach and three cases of gastric tumors. Non-malignant pyloric gland cells were used as control subjects. Pathological features and characteristics of malignancy of each case are summarized in Table I.

The technical procedure for DNA-measurement is essentially the same as that reported in the previous paper except that the tissues were fixed with 20% formol.⁴⁾

On the basis of the histopathological pattern, the specimens here concerned are classified into four categories as follows:

Group 1: a specimen referred to as 0-3338 is a rather benign atypicalepithelium. Group 2: two cases, 0-5446 and 0-5572, are characterized by an atypicalepithelium, being difficult to determine

*) This paper is dedicated to Professor Sajiyo Makino, Zoological Institute, Hokkaido University, Sapporo, in honor of his sixtieth birthday, June 21, 1966.

Table I. List of ten human atypical epithelia of the stomach under study with a summary of DNA data and pathological pattern

Specimen	DNA amount	Ploidy range from DNA	Pathological pattern	Remarks
control	1099.6	prob. 2n	pyloric reagon	normal
0-2161	1890.8	near -4n	atypical epithelium (+)	rather malignant epith.
0-3338	1136.1	hyper-2n	" (-)	rather benign epith.
0-4564	2116.3	near -4n	" (+)	rather malignant epith.
0-5446	1092.5	near -2n	" (±)	benign or malignant epith.
0-5572	1885.3	hypo -4n	" (±)	"
0-5586	1102.8	near -2n	" (+)	rather malignant epith.
0-5814	2335.9	hyper-4n	adenocarcinoma	
0-5924A	1862.2	hypo -4n	"	polype carcinoma
0-5924B	1754.8	"	"	

whether they are benign or malignant in nature based on the pathological examination. It seems to the author that they lie on the borderline between malignant tissue and normal one. Group 3: contains 3 cases designated as 0-2162, 0-4564, and 0-5586 which are characterized by rather malignant epithelium of the stomach. Group 4: includes cases, 0-5814, and 0-5924 A—B, which are carcinomas of the stomach, particularly 0-5924 B being polyp carcinoma.

The results of the DNA measurement in the above specimens are shown Fig. 1. The DNA value of the normal human pyloric cells exhibited a marked peak at 1.0–1.2 arbitrary units, and 60% of cells in this range showed small deviation. Based on the DNA amount of individual nuclei, the specimens are grouped as follows: Group 1 containing 0-3338, 0-5446, and 0-5586 was characterized by the DNA value almost the same as the diploid value. The modal peak of DNA value in these specimens was over 30 to 40% with fairly narrow deviations.

Group 2 includes two cases of carcinomas, 0-5924 A and B, and one case of the tissue (0-5572) in which the malignancy was difficult to estimate. The DNA value in this group was significantly higher than that of the diploid value, lying in a hypotetraploid range with wider deviation than Group 1.

Group 3 containing two cases, 0-2162 and 0-4564, was characterized by a rather malignant atypical epithelium. The DNA value was remarkably higher than that of the 2n value, lying near-tetraploid range with 30 to 45% peaks. The deviations are wider than the former.

The specimen, 0-5814, was designated as group 4: this case was characterized by a malignant epithelium of the stomach histopatho-

DNA amount's of atypical epithelium and gastric cancer

Fig. 1. The histograms indicating relative amount of DNA in one specimen of the normal pyloric gland and nine specimens of atypical epithelium of the stomach and gastric tumors.

logically. The DNA-content was of a hypertetraploid range in most cells showing wide deviations.

The relationship between the histopathological pattern and the DNA-content of cells in atypical epithelium of the stomach is shown in Table I. In reference to data in this table, it is apparent that in most cases, diagnosis and the pattern of the DNA-content is in agreement with each other.

The specimens 0-5924 and 0-5814, carcinomas of the stomach, seems to be of tetraploid nature on the basis of their DNA values. A rather malignant specimens, 0-2161 and 0-4564, showed the DNA amount in a tetraploid range. This value seems to correspond to the pattern of carcinoma. Specimen 0-5586 had the DNA value in near-diploid range with rather wider deviation than the control specimens. In specimens 0-5446 and 0-5572 in which it was difficult to estimate the malignancy, 0-5546 showed the DNA value in diploid range with rather wide deviations, while the other exhibited a malignant DNA-content in hypotetraploid range.

In the light of the above evidence obtained in this study, it is evident that the results of the histopathological examination generally supplemented those of the DNA measurement, except one case (0-5586) in which no such agreement could be observed.

On the basis of the present results, it appears that the degree of malignancy of tissues could be evaluated by the DNA-content in cell-nuclei.

Summary: Information was obtained that the results of histopathological examinations could be evaluated by the DNA-content of cell-nuclei.

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