MACROSCOPIC MODEL OF TISSUE GROWTH

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The macroscopic method of tissue growth is developed in the presented paper. The model of the permanent isotropic growth is studied in detail. In the framework of such model we obtain the time-dependence of the rate of the tissue growth. It is shown that the number of cells $N(t)$ increases according to the law:

$$N(t) \propto t^{\alpha}, \qquad 0 \leq \alpha \leq 3 \quad , \tag{1}$$

where t is the time variable.

We should note the strongest growth a tissue $dN(t) \propto t^3$ is sufficiently more slow than exponential one which is generally held to take place in cell division. There is no exponential law $exp(kt)$ in considered situation since it describes the tissue growth when all daughter are separated so that them succeeding division goes on independently.

It follows from Eq.(1) that the time growth of the number of cells of the tissue $N(t)$ is varied from the law t^0 to t^3 The spices of the law depends strongly on the factors which determine sufficiency or deficit of the substrates needed to generate a cell. Such rather wide spectrum of the growth laws corresponds to the observed irregularity of tumor development [1]. There are both the stage of a decease when it is hardly any growth of a tissue (the latent stage) and the stage when active growth of a tumor occurs (the "hurricane"tumor [1].

In the case of the strongest growth the tissue Eq.(1) gives $N(t) \simeq t^3$.

As a rule, a single cell, in average, divides once in 24 hours. Calculating the tissue growth during this period, provided that a tumor has already developed for one year, we have found:

$$\frac{\Delta N(t+\tau)}{N(t)} \approx \frac{3\tau}{t} \approx \frac{9}{355} = 0.025, \tag{2}$$

where τ and t are equal 3 and 355 twenty four hours, respectively.

The obtained increasing of the number of cells is likely corresponds to the case of the so called "hurricane"tumor when the fraction of growth is about 20 per cents or less than whole cells of a tumor [1].

The latent stage of a tumor is likely to describe by Eq.(1) when $\alpha \leq 1$ since in this case the derivative $dN(t)\ dt$ decreases with increasing time variable t.

References.

1. N.M.Anichkov, I.M. Kvetnoy, S.S.Konovalov. The Biology of Tumor growth (in Russian). S.-Perersburg, 2004.