LIVES ARE FLOWING IN ONE INDEPENDENT CHAIN

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ABSTRACT : Mainly nineteen cellular entities take place in mainly thirty chemical reactions in a cell. The cell is divided into two when the cellular entities are doubled at a time. In this way growth process takes place in a living body.

From the equations of cell-generation-time it is proved that lives are not flowing in more than one independent chain.

INTRODUCTION, FORMULATION AND SOLUTION OF THE PROBLEM

Growth is a basic property of biological species, and growth coupled with cell-divisions leads to an increase in population. In F. Heinmets1 we see that the rate constants K_1, K_2, K_n are taken to be constants throughout the whole generation time of cell. When the value of one rate constant is decreased then other equations will balance it and obviously the value of other rate constants will be changed. Therefore we cannot use the conception of rate constants. Hence the author has modified the model of F. Heinmets1 in a different way. The author has rearranged the Table as follows :-

Terminology and Symbols

Pools :-

P_e extra-cellular nutrient pool

P_i General intra cellular metabolic pool.

P_a Amino acid pool for protein synthesis.

P_n Nucleotide pool for RNA synthesis.

Enzymes :-

E Total protein.

E_n Enzymes which convert internal pool (P_i) into RNA precursors.

E_a Enzymes which convert internal pool (P_i) into amino acid.

E_p RNA polymerase for messenger RNA (M) synthesis.

E_t Enzymes which convert external pool (P_e) into internal pool (P_i).

Rate constant Kn, Ka and Kt determine what fraction of total protein represents respective enzymes.

Genes :-

G_e Genes for messenger RNA (M) synthesis.

G_p Gene for messenger RNA (MP) synthesis.

G_b Gene for the synthesis of RNA fraction ribosome.

G_c Gene for transport RNA (C) synthesis.

Messengers :-

M Messenger (RNA) for protein (E) synthesis.

Mp Messenger (RNA) for Ep synthesis.

B' RNA fraction of ribosome.

B Ribosome.

C Transport RNA

N Ribosome & messenger complex for protein (E) synthesis.

Np Ribosome and messenger complex for Ep synthesis (template).

N Inactive state of N.

N'p Inactive state of NP.

Si Metabolite which converts templates N and Np into inactive state.

Si' Metabolite which converts inactive template N and NP into active state.

K_1...Kn various rate constants.

TABLE -- I

1. r_1x_1 of E_p+r_2x_1 of P_n = r_3x_1 of E_pP_n
2. r_4x_2 of B+r_5x_2 of E = r6x2 of B
3. r_7x_8 of GB+r_8x_3 of Pn = r_9x_3 of GB+$r_{10}x_3$ of B
4. $f_{11}x_4$ of GC+$r_{12}x_4$ of P = $r_{13}x_4$ of GC+$r_{14}x_4$ of C
5. $r_{15}x_5$ of GP+$r_{16}x_5$ of P = $r_{17}x_5$ of GP+$r_{18}x_5$ of Mp
6. $r_{19}x_6$ of Ge+$r_{20}x_6$ of Ep P = $r_{21}x_6$ of Ge+$r_{22}x_6$ of Ep+$r_{23}x_6$ of M.
7. $r_{24}x_7$ of B+$r_{25}x_7$ of M = $r_{26}x_7$ of N.
8. $r_{27}x_8$ of B+$r_{28}x_8$ of Mp = $r_{29}x_8$ of Np.
9. $r_{30}x_9$ of C+$r_{31}x_9$ of P = $r_{32}x_9$ of C Pa.
10. $r_{33}x_{10}$ of N+$r_{34}x_{10}$ of CPa = $r_{35}x_{10}$ of B+$r_{36}x_{10}$ of C+$r_{37}x_{10}$ of M+$r_{38}x_{10}$ of B
11. $r_{39}x_{11}$ of NP = $r_{40}x_{11}$ of CPa = $r_{41}x_{11}$ of B+$r_{42}x_{11}$ of Mp+$r_{43}x_{11}$ of C+$r_{44}x_{11}$ of Ep
12. $r_{45}x_{12}$ of M=$r_{46}x_{12}$ of Pn.
13. $r_{47}x_{13}$ of Mp = $r_{48}x_{13}$ of Pa
14. $r_{49}x_{14}$ of B = $r_{50}x_{14}$ of Pi
15. $r_{51}x_{15}$ of C = $r_{52}x_{15}$ of Pi.
16. $r_{53}x_{16}$ of E = $r_{54}x_{16}$ of Pi.
17. $r_{55}x_{17}$ of Ep = $r_{56}x_{17}$ of Pi.
18. $r_{57}x_{18}$ of Pe+$r_{58}x_{18}$ of Ei = $r_{59}x_{18}$ of Pi+$r_{60}x_{18}$ of Et.
19. $r_{61}x_{19}$ of Pi+$r_{62}x_{19}$ of En = $r_{63}x_{19}$ of Pn+$r_{64}x_{19}$ of En.
20. $r_{65}x_{20}$ of Pi+$r_{66}x_{20}$ of Ea = $r_{67}x_{20}$ of Pa+$r_{68}x_{20}$ of Ea.
21. $r_{69}x_{21}$ of Ep+$r_{70}x_{21}$ of C = $r_{71}x_{21}$ of EpC.
22. $r_{72}x_{22}$ of E+$r_{73}x_{22}$ of Pi = $r_{74}x_{22}$ of Epi.
23. $r_{75}x_{23}$ of Ep+$r_{76}x_{23}$ of B = $r_{77}x_{23}$ of EpB.
24. $r_{78}x_{24}$ of Np+$r_{79}x_{24}$ of Si = $r_{80}x_{24}$ of N'p.
25. $r_{81}x_{25}$ of N'p+$r_{82}x_{25}$ of Si = $r_{83}x_{25}$ of Np.
26. $r_{84}x_{26}$ of N+$r_{85}x_{26}$ of Si = $r_{86}x_{26}$ of N.
27. $r_{87}x_{27}$ of N'+$r_{88}x_{27}$ of Si = $r_{89}x_{27}$ of N.
28. $r_{90}x_{28}$ of N = $r_{91}x_{28}$ of Pi.
29. $r_{92}x_{29}$ of Np = $r_{93}x_{29}$ of Pi.
30. $r_{94}x_{30}$ of Pi = $r_{95}x_{30}$ of X.

Where r_1, r_2........r_{95} are constants. The equations of Table 1 are written on the understanding that the quantitative measure of the entities in a reaction are one to another in constant ratios. These constants are r1, r2.....etc. which can be calculated. These are independent of the rate constants which are not fixed. Therefore the defect of F Heinmets[1] is eliminated in this model.

Let the measure of the functional entities.

Ep, Pn, Ep, B', B, C, M, Mp, N, N'p, Pa, CPa, E, Pi, EpC, EpB, Epi, respectively initially be

$X_{31}, X_{32}, X_{33}, X_{34}, X_{35}, X_{36}, X_{37}, X_{38}, X_{39}, X_{40}, X_{41}, X_{42}, X_{43}, X_{44}, X_{45}, X_{46}, X_{47}, X_{48}, X_{49}$.

Since it is assumed that all functional entities are approximately doubled after one generation time of the cell, therefore we get the equations of Table 2.

TABLE - 2

1. $x_{31} = -r_1x_1+r_{22}x_6+r_{44}x_{11}-r_{55}x_{17}-r_{69}x_{21}-r_{75}x_{22}$
2. $x_{32} = -r_2x_1-r_8x_3-r_{12}x_4+r_{16}x_5+r_{46}x_{12}+r_{48}x_{13}+r_{66}x_{19}$
3. $x_{33} = r_3x_1-r_{20}x_6$
4. $x_{34} = -r_4x_2+r_{10}x_3$
5. $x_{35} = r_6x_2-r_{24}x_7-r_{27}x_8+r_{35}x_{10}+r_{41}x_{11}+r_{49}x_{14}-r_{76}x_{23}$
6. x_{36} = r14x4-r30x9+r36x1+r43x11-r51x15-r70x21
7. $x_{37} = r_{23}x_6-r_{25}x_7-r_{45}x_{12}+r_{37}x_{10}$
8. $x_{38} = r_{18}x_5-r_{28}x_8+r_{42}x_{11}-r_{47}x_{13}$
9. $x_{39} = r_{26}x_7-r_{33}x_{10}-r_{84}x_{26}+r_{89}x_{27}-r_{90}x_{28}$
10. $x_{40} = r_{29}x_8-r_{39}x_{11}-r_{78}x_{24}+r_{83}x_{25}-r_{92}x_{29}$
11. $x_{41} = r_{86}x_{26}-r_{87}x_{27}$
12. $x_{42} = r_{80}x_{24}-r_{81}x_{25}$
13. $x_{43} = r_{31}x_9+r_{67}x_{20}$
14. $x_{44} = r_{32}x_9-r_{34}x_{10}-r_{40}x_{11}$
15. $x_{45} = -r_5x_2+r_{38}x_{10}-r_{53}x_{10}-r_{72}x_{22}$
16. $x_{46} = r_{50}x_{14}+r\ {}^{2}x_{15}+r_{54}x_{16}+r_{56}x_{17}+r_{59}x_{13}-r_{61}x_{19}+r_{91}x_{28}-r_{65}x_{20}+r_{93}x_{29}-r_{73}x_{22}-r_{94}x_{30}$
17. $x_{47} = r_{71}x_{21}$
18. $x_{48} = r_{77}x_{23}$
19. $x_{49} = r_{74}x_{22}$

Since $x_{31}, x_{32}, ... x_{49}$ are fixed in an individual body and the ratios $r_1, r_2......r_{94}$ can be calculated therefore there are 30 variables $x_1, x_2......x_{30}$, and 19 equations.

There are 30 variables and 19 equations and hence 11 variables can be given arbitrary values satisfying the corresponding equations i.e degree of freedom is 11. Let the solutions make V vector space. Let the solutions of $x_1, x_2.....x_{30}$ during the whole life of an individual body make a vector space S. Then S is a subspace of V. Let the solutions of $x_1, x_2......x_{30}$ (during the whole life) of different organs, tissues, different parts of the body make solution vector spaces S_1, S_2.......etc. Then S_1, S_2.......etc. are subspaces of S and hence subspaces of V. Considering $X_{31}, X_{32}.....X_{49}$ these subspaces $S_1, S_2.......S_n$ and hence S can be studied and the relations of different organs, tissues with each other and with the whole body can be known.

The relative growth of different organs, tissues can be shown as constant for an individual body. For this reason, the individual body remains it's shape unchanged. For another individual body of the same species similarly the solution vector-spaces can be studied which is a subspace of V and similarity of growth and shape of the two individuals of the same species can be explained.

The solution spaces of other individual bodies of other species are also subspaces of V and hence similarities and dissimilarities of different individuals of different species can be studied in this respect. Since $x_{31}, x_{32}, ... x_{49}$ are fixed in an individual body and the ratios $r_1, r_2......r_{94}$ can be calculated. Therefore there are 30 variables $x_1, x_2......x_{30}$, and 19 equations.So 30-19 that is 11 variables can be arbitrary(d.o.f. is 11).We can choose 11 arbitrary variables in 30c11 ways.so number of possible species from one independent chain is 30c11.Sufficient time has passed after the start of life-process. Although many new species are yet to be discovered,in spite of that we can say in reality number of species can not be more than 30c11. So it can be concluded that lives are flowing in not more than one independent chain.

REFERENCE

Heinmets,F. – Mathematical Modeling in Simulation Process(1970)

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