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THE SEQUENCE OF NUCLEOTIDES

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A b s t r a c t

Graphic representation of the F.Crick's wobble hypothesis for the two most natural sequences of nucleotides is proposed.



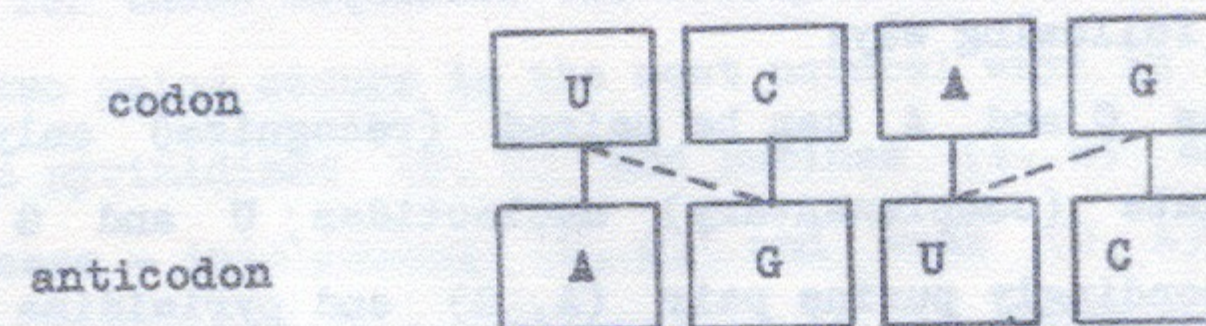
THE WOBBLE HYPOTHESIS AND
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B.G.Konopel'chenko, Yu.B.Rumer

In the paper [1] F.Crick has formulated the wobble hypothesis, i.e. the rules of correspondence between terminations (z) and (z') of codons (xy|z) and anticodons (x'y'|z') in the recognition of the codons by t-RNA.

In the present communication we propose a graphic representation of these rules for the two most natural sequences of the nucleotides (U, C, A, G and C, G, U, A).

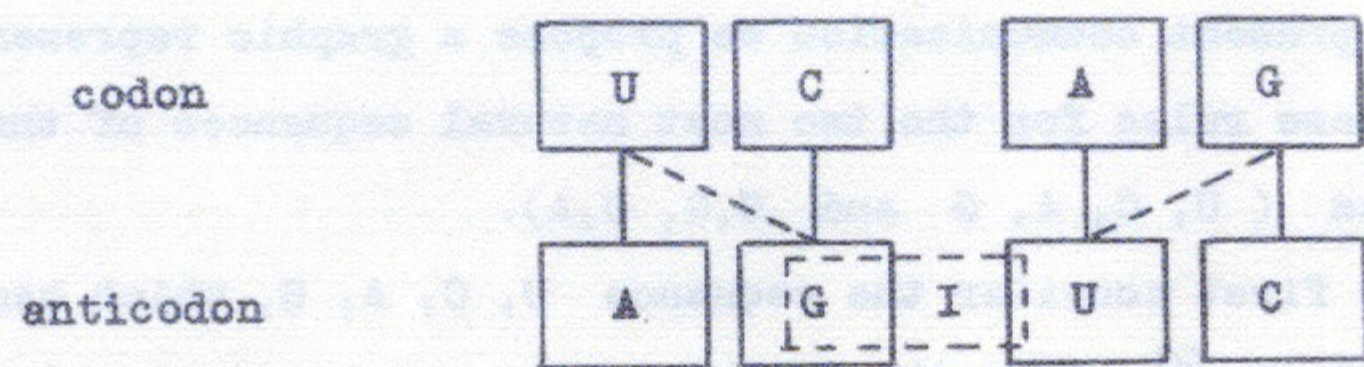
Let us first consider the sequence U, C, A, G, which has been chosen in [1]. Then the Crick's rules can be represented in the form



where the lines, which join the nucleotides indicate the possible pairings, i.e. possible "recognitions" of nucleotides in the interaction of codon and anticodon. Solid lines indicate the possible pairings of nucleotides in the roots (xy) and (x'y'). For the terminations there are possible additional pairings marked by broken lines. We note, that for the anticodon we have cho-

sen a conjugate (complementary) sequence. If one choose the same order of nucleotides for anticodon and codon then the scheme obtained will not be so simple.

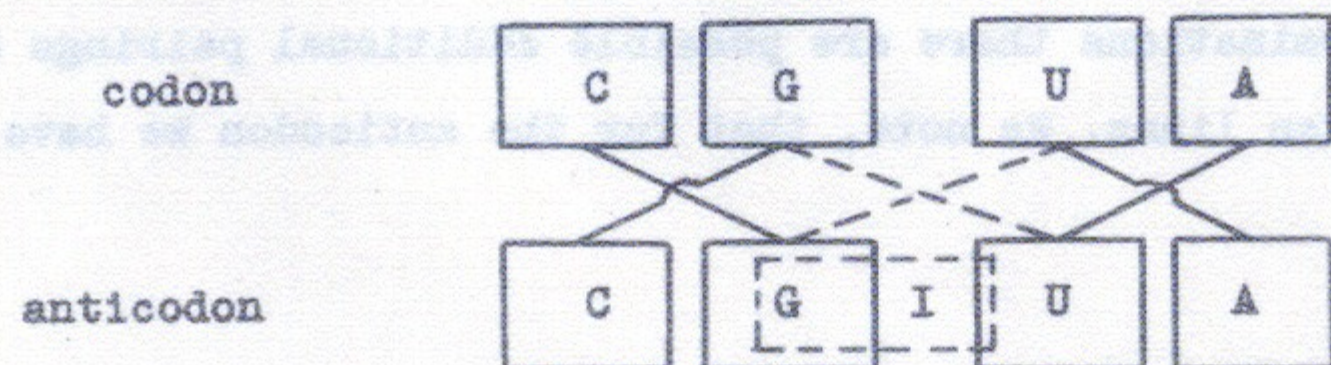
Besides nucleotides considered above in the anticodons there are found another nucleotides, for example Inosine (I). If one consider I as the mixture of G and U then Crick's rules can be represented in the form



The rules, represented here in graphical form can be formulated in the following way:

nucleotides C and A can be paired (recognize) only with the conjugate (complementary) nucleotides; U and G recognize correspondingly purine pair (A, G) and pyrimidine pair (U, C).

Let us now consider the order C, G, U, A proposed in the papers [2,3]. Crick's rules are represented in the following graphical form:



We note that in this case it is convenient to chose the same order of nucleotides for codon and anticodon.

The rules graphically represented above can be formulated in the following way:

in the interaction of codon and anticodon nucleotides (2) (terminations) are paired only with the nearest neighbours in the sequence C, G, U, A.

In particular, since C and A have only in ones nearest neighbour then they recognize only in ones (complementary) nucleotide. It seems to us that this property of C and A is related with the fact that they are correspondingly the strongest and the weakest letters [2,3].

Two sequences of nucleotides U, C, A, G and C, G, U, A considered above seemed to us as being distinguished from others, since for these sequences the decomposition of four nucleotides into two pairs occurs in the most natural way: in the first case - into pyrimidines (U, C) and purines (A, G) and in the second case - into strong (C, G) and weak (U, A) nucleotides.

This statement become obvious if one represent four nucleotides in the form of two x two matrix

$$\begin{pmatrix} C & G \\ U & A \end{pmatrix}$$

We see that the first row of this matrix contains strong nucleotides and the second row - weak nucleotides; the first column contains pyrimidines and the second column contains purines.

It seems to us that from two sequences U, C, A, G and C, G, U, A the second sequence is preferable since this sequence enables us to formulate simple rule of recognition.

In conclusion we note the following. It is natural to consider interactions (pairings) between nucleotides marked above by solid lines as strong and interactions marked by broken lines as weak. Such gradation of the interactions (pairings) enable us to describe qualitatively a set of possible interactions of the nucleotides which are distinguished from C, G, U, A, for example I. Indeed, if one assume that I contains a large admixture of G and a small admixture of U then the interaction I with C is the strongest one (there exists a large admixture of G in I and a strong interaction of this admixture with C). Then it follows the interaction I with U (large admixture of G and weak interaction of this admixture with U) and the interaction I with A (small admixture of U and strong interaction of this admixture with A). At last, the interaction I with G is the weakest one (there exists a small admixture of U in I and weak interaction of this admixture with G).

References

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2. Yu.B.Rumer, Doklady Akademii Nauk SSSR, 183, 225 (1968).
3. B.G.Konopel'chenko, Yu.B.Rumer, Doklady Akademii Nauk SSSR (1975) and J.Theor.Biol. (1975).

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