B.Sc. Part III

P. VI

PAPER - VI 'B'

GENERAL AND SPECIFIC TRANSCRIPTION FACTORS

The accessory factors are required for initiation of synthesis in all cases, but are not required subsequently. In case of Eukaryotic RNA polymerase, the factors rather than the enzymes themselves, are principally responsible for recognisizing the sequence components of promotors.

The promotor for RNA poly I and II are mostly upstream of the start point. But some promotors for RNA poly III lies downstream. RNA I and III each recognise a relatively restricted set of promotors. and Promoters utilized by RNA poly II shows variation in sequence.

The number of factors that act in conjugation with RNA poly II is large. It can be divided into 3 general groups, which are as follows :-

i) Basal factors :- It is required for the mechanism of initiating RNA synthesis at all promoters. It joins with RNA poly to form a start point and thus made the site of "initiation".

ii) Upstream factors :- These are DNA binding proteins that recognise specific elements located upstream of the start point.

iii) Inducible factors :- They functions like the upstream factors but have regulatory role. The sequence that they binds are called response elements.

→ THE BASAL TRANSCRIPTION APPARATUS "OR" FACTORS :-

The accessory proteins that are required for polymerase II to initiate a promotor ~~they~~ find the general transcriptional factors involved in the mechanism of binding to the DNA. The basal factors are described as "TF II X", where 'X' is a letter that indicates the individual factor.

At the starting point there is a tendency for the first base of mRNA to be 'A' of either side by pyrimidines. This region is called as interior (Inr) and may be discribed in general for ~~Py_2CAPy_5~~ $\in Py_2CAPy_5$. The Inr. is contained between positions -3 and +5. A promoter consisting only of the Inr has the simplest possible form recognisable by RNA poly II.

Initiation requires the transcriptional factor to act in a definite order to build a complex, that is joint by RNA polymerase. The first step in complex formation is binding of a factor to a region that extends, upstream from the TATA box, and the factor is called TF II D. Recognition of the TATA box is confirmed by the TATA binding protein (TBP) a small protein of nearly 30,000 daltons.

TBP binds to DNA in the minor groove (12°A). It surrounds one face of DNA forming a "Saddle" around it. So, the inner surface of TBP binds to DNA and the longer outer surface is available for contact to other proteins.

When TF II A joins the complex TF II B become able to protect a region extending further upstream TF II A contains several subunits which may be activated TBP by releasing a repression. Addition to TF II B protects the template strand from -10 to +10. TF II B bounds downstream of the TATA box. (RAP 74)

The factors TF II F consists of '2' subunits. The larger has an ATP dependent DNA helicase activity that could be involve in melting the DNA at initiation. And smaller (RAP 38) has some homology to the region of ~~polymerase~~ bacterial 'σ' factor that connects with core polymerase. It binds tightly to RNA poly II.

Two more factors TF II H and TF II I, joins the complex after TF II E. TF II H has a kinase activity that can phosphorilate the CTD tail of RNA poly II.

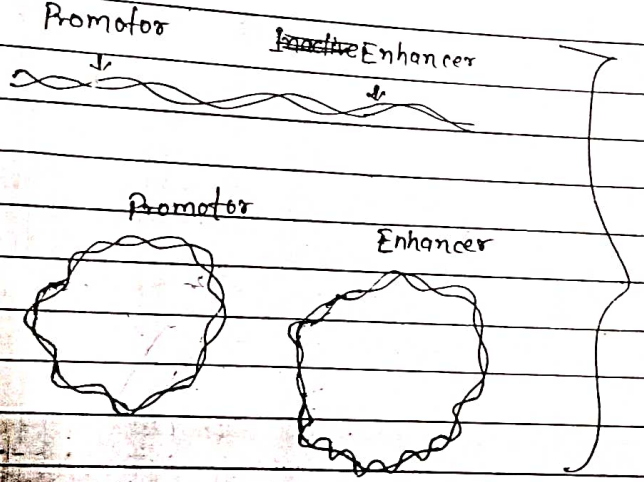
At the TATA less promoters, the same basal transcription factor including TF II D, are needed. An additional factors 'ANCHORS' binds to Inr. complex. Bacterial DNA binds directly to DNA, the 'σ' factor is needed for initiation not for elongation.

ENHANSER :- Eukaryotic promoters does not functions alone. In some cases, the activity of a promoter is increased by a special factor called "Enhanser". An inhancer can stimulates the promoter.

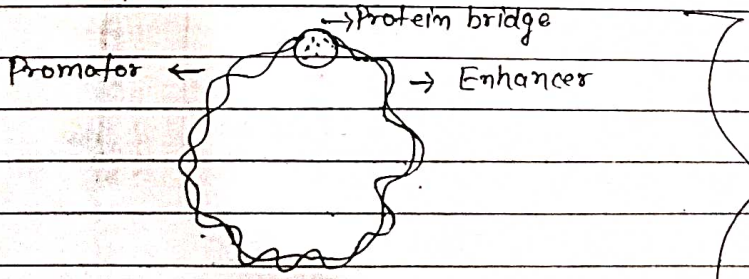
When enhanser were discovered, several possibility were considered for their action. And now it is view that inhancer function involves the same sort of interaction with the basal apparatus as the interaction is sponsered by upstream promotor elements.

However the generality of enhancement is not yet clear. It is not known what proportion of cellular promotors usually rely on an enhancer to achieve their customary level of expression. Nor it is known how effective of an enhancer provides a target for regulation. Some enhancers are activated only in the tissues by which their gene functions.

It has been found that a fragment on DNA that contains an enhancer at one end and a promotor at the other is not effectively transcribed, but the enhancer can stimulate transcription from the promotor when they are connected by a protein bridge. It has been suggested that the critical feature on such structural effects is to bring the enhancer and promotor closer.



Inactive structure.



Active structure.