Transcription factor

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CONTENT

1. Introduction
2. Classification
3. Activity
4. Some examples of transcription factors

Introduction:

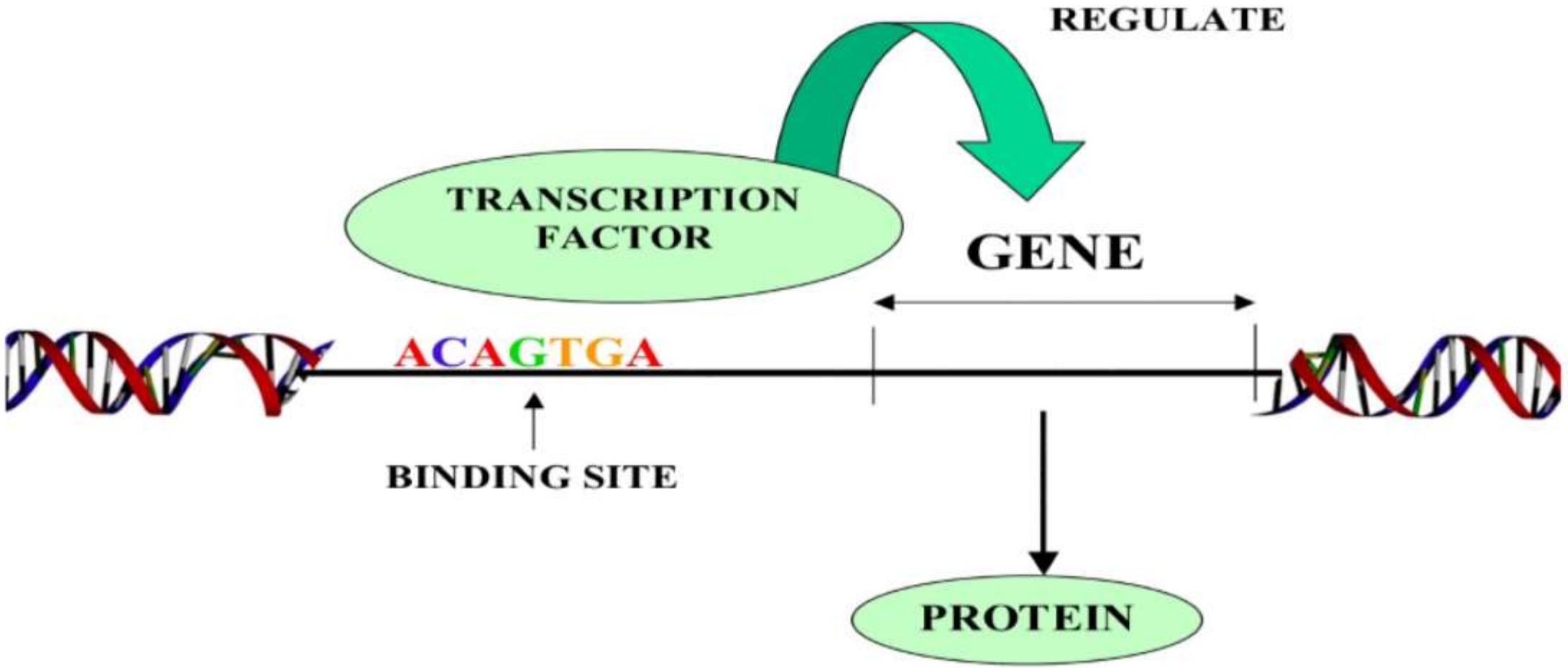
- The process of transcription is the first stage of gene expression resulting in the production of a primary RNA transcript from the DNA of a particular gene.
- This step of gene expression which is followed by a number of post-transcriptional processes such as RNA splicing and translation.
- These lead ultimately to the production of a functional protein and this process is highly regulated.
- Both basal transcription and its regulation are dependent upon specific protein factors known as transcription factors.

- These highly specific protein bind to the specific regulatory gene of DNA sequence and control the transcription process and regulate it.

- For example- enzyme RNA polymerase catalyzes the chemical reaction that synthesize RNA, using the DNA gene as a template, the transcription factor control when, where, and how efficiency RNA polymerase function.

- Play a important role in the normal development and routine of cellular function.

Legend: A transcription factor molecule binds to the DNA at its binding site, and thereby regulates the production of a protein from a gene.



Classification:

- transcription factors are commonly classified into families on the basis of the precise protein structure which they use to mediate binding to DNA or to cause factor dimerization which is often essential for DNA binding.

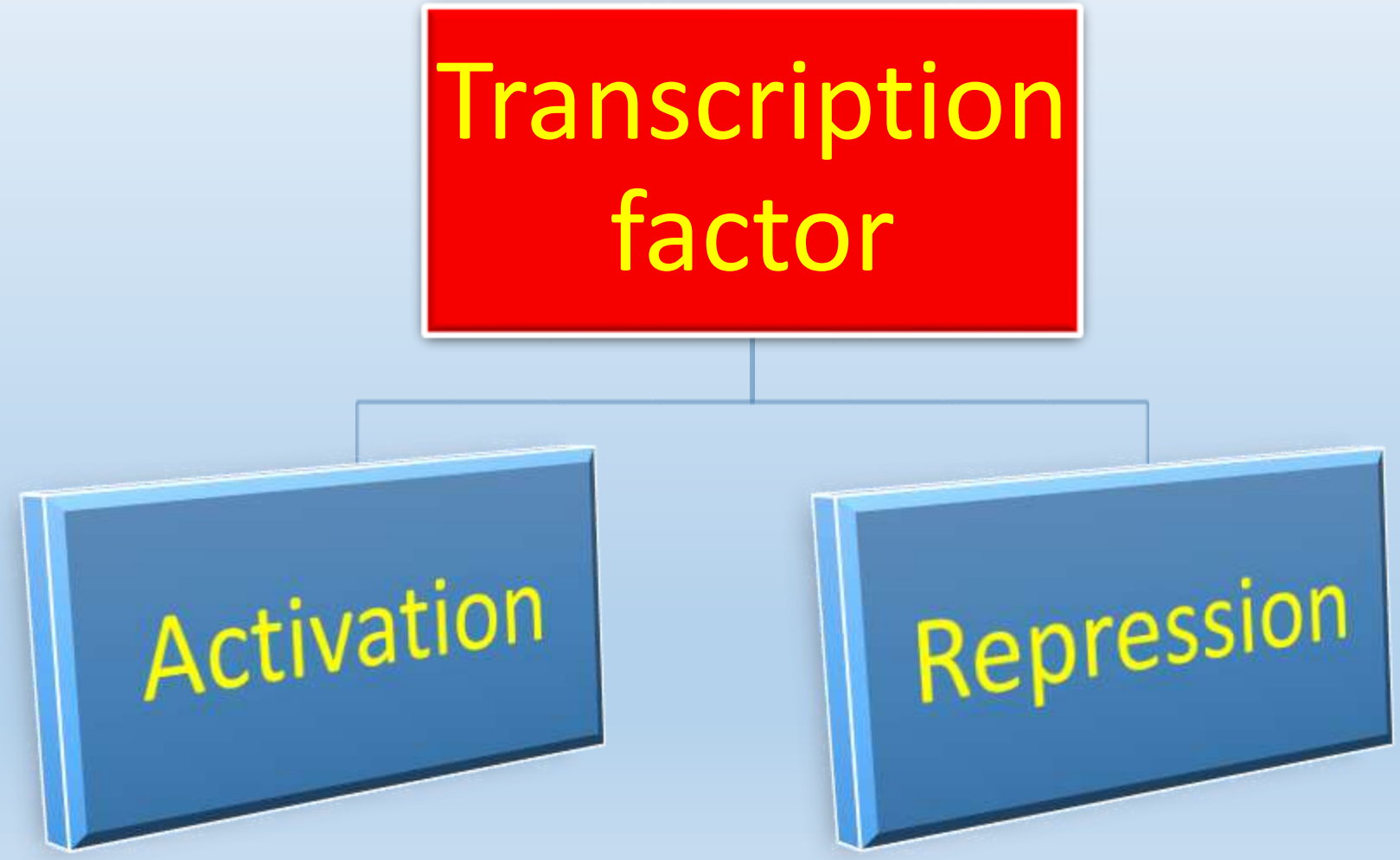
Domain	Role	Factors containing domain	Comments
Homeobox	DNA binding	Numerous *Drosophila* homeotic genes, related genes in other organisms	DNA binding mediated via helix–turn–helix motif
Cysteine–histidine zinc finger	DNA binding	TFIIIA, Kruppel, Sp1, etc.	Multiple copies of finger motif
Cysteine–cysteine zinc finger	DNA binding	Steroid-thyroid hormone receptor family	Single pairs of fingers, related motifs in adenovirus E1A and yeast GAL4, etc.
Basic element	DNA binding	C/EBP, c-*fos*, c-*jun*, GCN4	Often found in association with leucine zipper
Leucine zipper	Protein dimerization	C/EBP, c-*fos*, c-*jun*, GCN4, c-*myc*	Mediates dimerization which is essential for DNA binding by adjacent domain
Helix–loop–helix	Protein dimerization	c-*myc*, *Drosophila* daughterless MyoD, E12, E47	Mediates dimerization which is essential for DNA binding by adjacent domain
Amphipathic acidic alpha-helix	Gene activation	Yeast GCN4, GAL4, steroid-thyroid receptors, etc.	Probably interacts directly with TFIID
Glutamine-rich region	Gene activation	SP1	Related regions in Oct-1, Oct-2, AP2, etc.
Proline-rich region	Gene activation	CTF/NF1	Related regions in AP2, c-*jun*, Oct-2

List of Transcription Factor Families

This page lists the predicted transcription factor families and the numbers of their members that present on the Medicago GeneChip (*). You may follow the link to browse the list of transcription factors in each family, or selected multiple families.

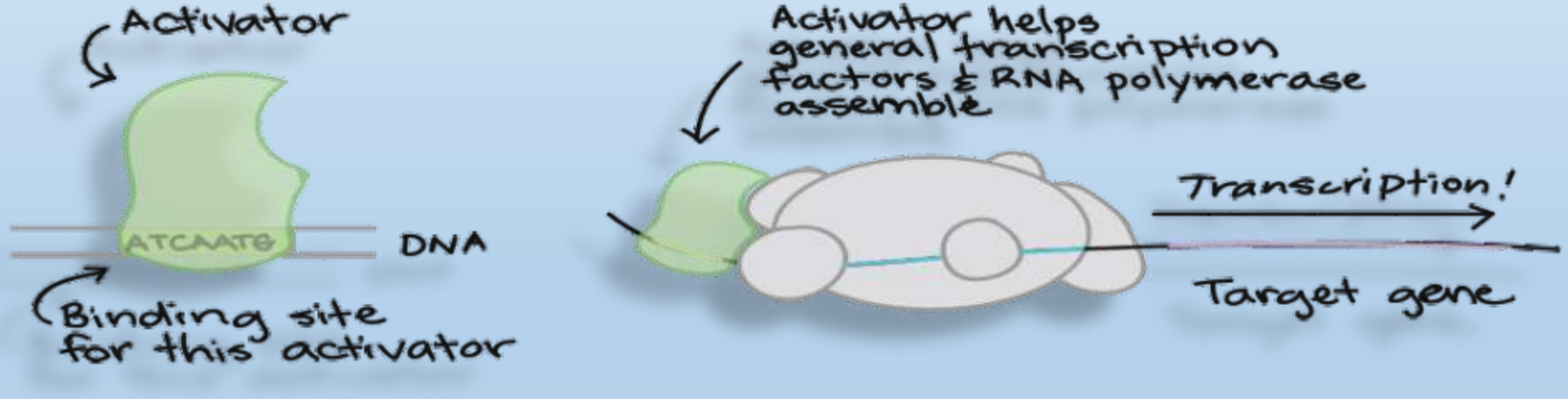
- A20-like (1)
- ABI3/VP1 (26)
- AP2-EREBP (13)
- AP2/EREBP (90)
- ARF (39)
- ARID (4)
- AS2 (7)
- AUX-IAA (15)
- BED (8)
- BES1/BRZ1 (2)
- bHLH (100)
- BTB/POZ (1)
- bZIP (91)
- C2C2 (ZF) (63)
- C2C2-Gata (8)
- C2C2-YABBY (1)
- C2H2 (1)
- C2H2 (ZF) (77)
- C3H (1)
- C3H (ZF) (39)
- CAMTA (2)
- CBF (1)
- CCAAT (28)
- CCAAT-HAP2 (2)
- CCAAT-HAP3 (1)
- CCAAT-HAP5 (3)
- DDT (3)
- E2F-DP (1)
- E2F/DP (4)
- EIL (5)
- FHA (10)
- G2-like (5)
- GARP (28)
- GRAS (51)
- GRF (7)
- HD (64)
- Homeobox (6)
- HSF (25)
- HTH (11)
- JUMONJI (16)
- jumonji (jmj) (1)
- jumonji (jmjC) (5)
- LIM (2)
- MADS (47)
- MBF1 (1)
- MYB (175)
- NAC (69)
- NLP (3)
- PHD (28)
- Putative Novel TF (129)
- S1Fa-like (2)
- SBP (10)
- similar to PEP (PEPPER) (1)
- SNF-2 (8)
- SRS (3)
- ssDB TR (5)
- SWI/SNF (1)
- TAZ (3)
- TCP (14)
- Trihelix (1)
- TTF-type (ZF) (5)
- TUBBY (8)
- U1-type (ZF) (2)
- WRKY (85)
- ZIM (6)
- zinc finger (CCCH-type) (2)
- Zinc finger, NF-X1-type (1)
- Zinc finger, RING-type (1)

Activity of transcription factor:



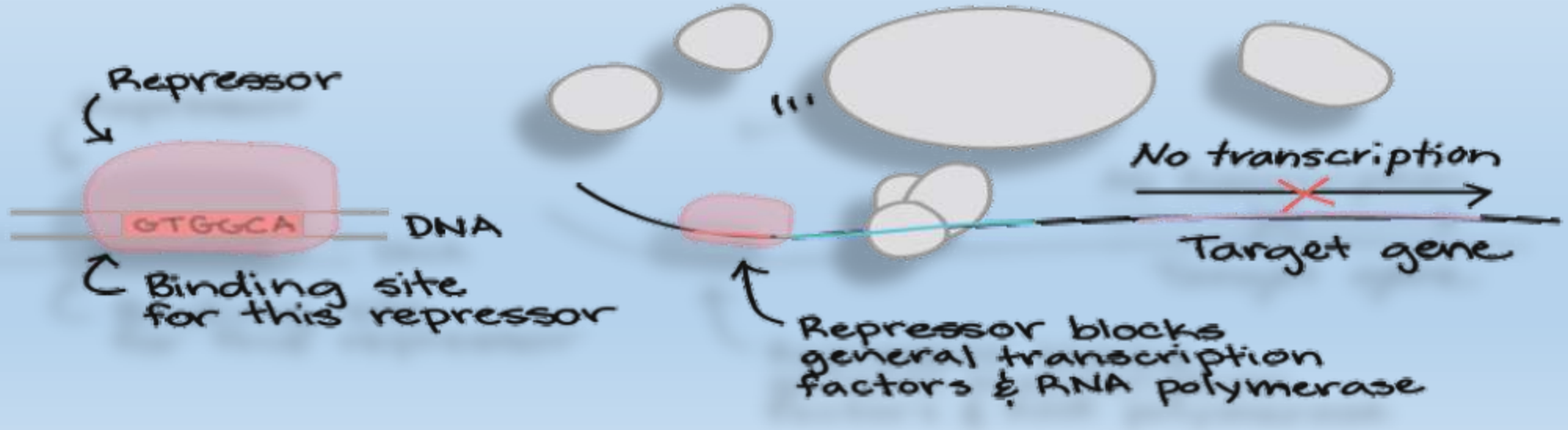
(a). Activation:

- Some transcription factors **activate** transcription. For instance, they may help the general transcription factors and/or RNA polymerase bind to the promoter, as shown in the diagram



(b). Repression:

- Other transcription factors **repress** transcription. This repression can work in a variety of ways. As one example, a repressor may get in the way of the basal transcription factors or RNA polymerase, making it so they can't bind to the promoter or begin transcription.



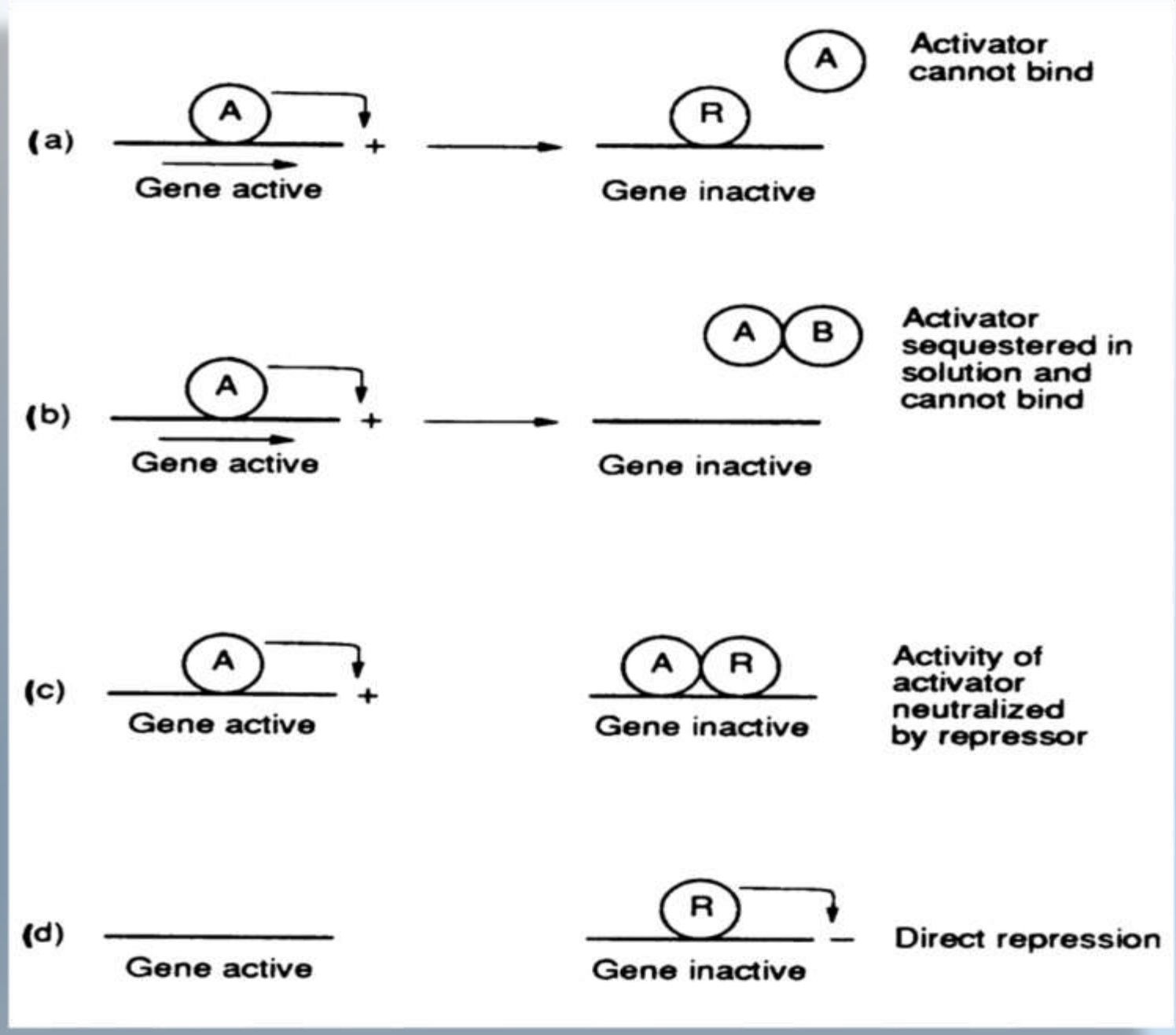
Repression of transcription by:

A. Competition for binding,

B. Sequestration in solution,

C. Quenching of activity

D. Direct repression.



Some example of Transcription Factor

Kruppel-like factor 4 (KLF-4):

- **Kru¨ppel-like factor 4 (KLF-4)** is family of zinc finger containing transcription factor
- Highly expressed in epithelial of gastrointestinal tract, skin and vascular endothelial cells.
- Play a important roll during the differentiation of gut epithelial cell.
- KLF4 activates the promoter of the negative cell-cycle-regulatory cyclin-dependent kinase inhibitor p21WAF/Cip1 gene in a p53-dependent manner

- Induces cell cycle arrest at the transition from G1 to S phase

- Altered expression of KLF4 may be involved in the tumorigenesis of several kinds of human cancers, including-
- **Colon** cancer
- **Breast** cancer
- **Gastric** cancer
- **Esophageal** cancer
- **bladder cancers** cancer

Kruppel-like factor 7 (KLF-7):

- Krüppel-like factor 7 (KLF7), a member of Krüppel-like transcription factors (KLFs), also known as ubiquitous Krüppel like factor (UKLF)

- ubiquitously expressed in various tissues of adult human beings.
- Genetics reports showed that the genetic polymorphism of *KLF7* is associated with obesity, type 2 diabetes, mental development in human beings.

- *KLF7* methylation is associated with the development of diffuse gastric cancer (gastric adenocarcinoma).

- KLF7 is one of the key transcription factors in the regulatory networks of serum markers change during the cardiovascular disease.

- involved in the regulation of the development and function of the nervous system and adipose tissue, blood diseases, as well as pluripotent cells maintenance.


Thank You