

## POGIL - Gene Expression: Transcription

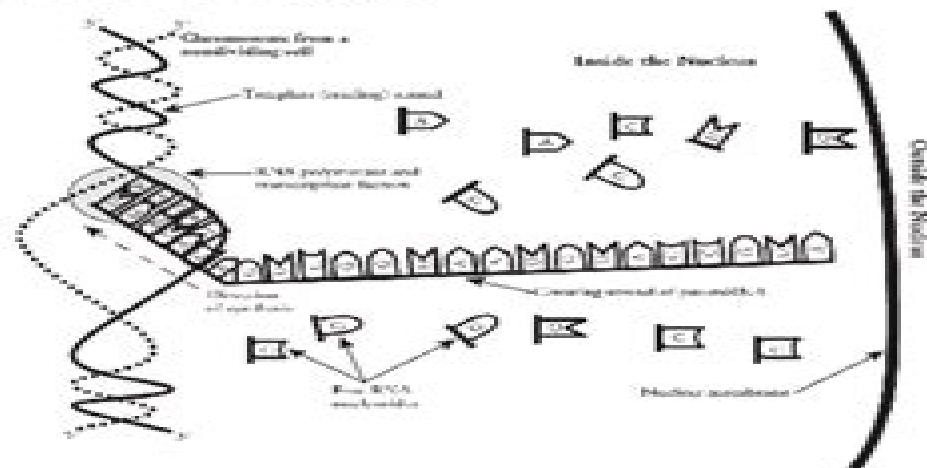
*How is mRNA synthesized and what message does it carry?*

### Why?

Deoxyribonucleic DNA is often referred to as a genetic blueprint. In the same way that blueprints contain the instructions for construction of a building, the DNA found inside the nuclei of cells contains the instructions for assembling a living organism. The DNA blueprint carries its instructions in the form of genes. In most cases the genes direct the production of a polypeptide, from which other more complex proteins, such as enzymes or hormones, may be constructed. These polypeptides and other molecules run the organism's metabolism and, in multicellular

organisms, dictate what each cell's job is. So, what is the language of these instructions and how are they read and decoded by the cellular organelles? This activity will focus on the decoding of genes in eukaryotes.

### Model 1 - Transcription



#### 1. Consider the eukaryotic cell in Model 1.

a. Where in the cell is the DNA found?

b. Where in the cell does transcription take place?

#### 2. Refer to Model 1.

a. What polymer is synthesized during transcription?

b. What monomers are used to construct this polymer and where are they found?

3. According to Model 1, what enzyme is required for transcription? (*Hint: Think about how enzymes are named. What ending is used for enzyme names?*)

#### 4. Refer to Model 1.

a. What is the base-pair rule for a DNA strand matching an RNA strand?

b. Compare this base-pair rule with that of two DNA strands.

5. Which strand of the DNA contains the "blueprint" for the pre-mRNA?

#### 6. Consider Model 1.

a. In which direction is the DNA molecule read? \_\_\_\_\_

b. The DNA strand and pre-mRNA strand are anti-parallel. With this in mind label the 3' and 5' ends of the pre-mRNA strand in Model 1.

c. In which direction is the pre-mRNA molecule constructed? \_\_\_\_\_

7. Before printing presses were available, books had to be transcribed in order to share the information

# Gene Expression Pogil

**Fumiaki Uchiumi**



## **Gene Expression Pogil:**

**Gene Regulation** David S. Latchman,1998 The previous editions of Gene Regulation have helped students in biological science and medicine gain a full understanding of the issues of gene regulation In this edition new material reflects the progress that has been made in the understanding of gene regulation The most significant change is the addition of an extra chapter describing the basic processes by which DNA is converted in RNA and then into protein This important new chapter makes this edition complete as a textbook on gene expression and its regulation

**Mechanisms Of Gene Expression: Structure, Function And Evolution Of The Basal Transcriptional Machine** Robert O J Weinzierl,1999-08-10 A detailed knowledge of the mechanisms underlying the transcriptional control of gene expression is of fundamental importance to many areas of contemporary biomedical research ranging from understanding basic issues such as control of embryonic development to practical applications in industry and medicine Although elementary concepts of gene expression are described in all general molecular biology textbooks the depth of coverage is often rather limited and recent discoveries are sometimes not adequately taken into consideration This book presents much of the current thinking concerning molecular mechanisms of transcriptional control in a form easily accessible to undergraduates with an understanding of basic molecular biology concepts It contains detailed information about the various pro and eukaryotic transcriptional machineries that has recently become available through the combined efforts of geneticists biochemists and structural biologists The book will thus not only serve as an undergraduate text but also offer something new and interesting to more advanced readers and professional scientists who want to keep up to date with rapid advances in this field

*Gene Expression: Plasmids and phages* Benjamin Lewin,1974

**Gene Expression** M. Karin,2013-03-08 This book is the first volume in a new series

*Progress in Gene Expression* The control of gene expression is a central most topic in molecular biology as it deals with the utilization and regulation of gene information As we see huge efforts mounting all over the developed world to understand the structure and organization of several complex eukaryotic genomes in the form of Gene Projects and Genome Centers we have to remember that without understanding the basic mechanisms that govern the use of genetic information much of this effort will not be very productive Fortunately however research during the past seven years on the mechanisms that control gene expression in eukaryotes has been extremely successful in generating a wealth of information on the basic strategies of transcriptional control Although regulation of gene expression is exerted at many different levels much of the emphasis in this series will be on transcriptional control A future volume however will deal with other levels of regulation The progress in understanding the control of eukaryotic transcription can only be appreciated by realizing that seven years ago we did not know the primary structure of a single sequence specific transcriptional activator and those whose primary structures were available e g homeo domain proteins were not yet recognized to function in this capacity

**Gene Expression and Control** Fumiaki Uchiumi,2019-04-17 Transcription is the most fundamental nuclear event by which the information of nucleotide

sequences on DNA is transcribed into RNA by multiple proteins including RNA polymerases Transcription determines the functions of proteins and the behaviour of cells appropriately responding to environmental changes This book is intended for scientists especially those who are interested in the future prospect of gene expression and control in medicine and industry This book consists of 9 chapters divided into four parts Each chapter is written by experts both in the basic and applied scientific field A collection of articles presented by active and laboratory based investigators provides evidence from the research giving us a rigid platform to discuss Gene Expression and Control

**Inducible Gene Expression, Volume 2** P.A. Baeuerle, 2012-06-14 Cells have evolved multiple strategies to adapt the composition and quality of their protein equipment to needs imposed by changing conditions within the organism Extracellular stimuli that inform cells about such needs are hormones cytokines and neurotransmitters which bind to specific cell surface receptors Inside the cell secondary signals are then produced which ultimately initiate the expression of proteins giving novel functional properties to the stimulated cells This process can be controlled at a transcriptional posttranscriptional translational or posttranslational level Extensive research over the past fifteen years has shown that transcriptional regulation is probably the most important strategy used to control the production of new proteins in response to hormonal signals At the level of gene transcription the initiation of mRNA synthesis is most frequently used to govern gene expression The key elements controlling transcription initiation in eukaryotes are activator proteins transactivators that bind in a sequence specific manner to short DNA sequences in the proximity of genes The activator binding sites are elements of larger control units called promoters and enhancers which bind many distinct proteins that may synergize or negatively cooperate with the activators The de novo binding of an activator to DNA or if already bound to DNA its functional activation is what ultimately turns on a high level expression of genes In this second volume of Inducible Gene Expression leading scientists in the field review eight eukaryotic transactivators that allow cells to respond to hormonal stimuli by the expression of new proteins

**Prokaryotic Gene Expression** Simon Baumberg, 1999-05-27 Prokaryotic gene expression is not only of theoretical interest but also of highly practical significance It has implications for other biological problems such as developmental biology and cancer brings insights into genetic engineering and expression systems and has consequences for important aspects of applied research For example the molecular basis of bacterial pathogenicity has implications for new antibiotics and in crop development Prokaryotic Gene Expression is a major review of the subject providing up to date coverage as well as numerous insights by the prestigious authors Topics covered include operons protein recognition of sequence specific DNA and RNA binding sites promoters sigma factors and variant tRNA polymerases repressors and activators post transcriptional control and attenuation ribonuclease activity mRNA stability and translational repression prokaryotic DNA topology topoisomerases and gene expression regulatory networks regulatory cascades and signal transduction phosphotransfer reactions switch systems transcriptional and translational modulation methylation and recombination mechanisms pathogenicity toxin regulation and

virulence determinants sporulation and genetic regulation of antibiotic production origins of regulatory molecules selective pressures and evolution of prokaryotic regulatory mechanisms systems Over 1100 references to the primary literature are cited Prokaryotic Gene Expression is a comprehensive and authoritative review of current knowledge and research in the area It is essential reading for postgraduates and researchers in the field Advanced undergraduates in biochemistry molecular biology and microbiology will also find this book useful

Transfer and Expression of Eukaryotic Genes H.S. Ginsberg, 2012-12-02 Transfer and Expression of Eukaryotic Genes documents the progress in our understanding of the transfer and expression of eukaryotic genes This book covers topics organized around three themes gene expression and its regulation in vivo gene transfer and development and viral gene and oncogene systems This text is divided into three sections encompassing 25 chapters and begins with an overview of the molecular basis of gene expression with emphasis on transcription complexes that account for transcription control in eukaryotic genes It then turns to experiments that assess the in vitro stimulatory effect of the SV40 72 bp repeat on specific transcription from heterologous promoter elements using a HeLa whole cell extract The reader is methodically introduced to the regulation signals and factors of histone gene transcription transcriptional control of beta globin and liver specific genes in mouse cells and gene transfer in Drosophila and the sea urchin Strongylocentrotus purpuratus This book also considers the splicing of messenger RNA precursors and the regulation of thymidine kinase enzyme expression and then concludes with a chapter that describes the activation of the myc oncogene by chromosomal translocation This book will be of interest to students and researchers in fields ranging from molecular genetics to microbiology biochemistry pathology and immunology

**Mechanisms of Gene Regulation** Carsten Carlberg, Ferdinand Molnár, 2013-12-11 This textbook aims to describe the fascinating area of eukaryotic gene regulation for graduate students in all areas of the biomedical sciences Gene expression is essential in shaping the various phenotypes of cells and tissues and as such regulation of expression is a fundamental aspect of nearly all processes in physiology both in healthy and in diseased states This pivotal role for the regulation of gene expression makes this textbook essential reading from students of all the biomedical sciences in order to be better prepared for their specialized disciplines A complete understanding of transcription factors and the processes that alter their activity is a major goal of modern life science research The availability of the whole human genome sequence and that of other eukaryotic genomes and the consequent development of next generation sequencing technologies have significantly changed nearly all areas of the biological sciences For example the genome wide location of histone modifications and transcription factor binding sites such as provided by the ENCODE consortium has greatly improved our understanding of gene regulation Therefore the focus of this book is the description of the post genome understanding of gene regulation The purpose of this book is to provide in a condensed form an overview on the present understanding of the mechanisms of gene regulation The authors are not aiming to compete with comprehensive treatises but rather focus on the essentials Therefore the authors have favored a high figure

to text ratio following the rule which states that a picture tells more than thousand words The content of the book is based on the lecture course which is given by Prof Carlberg since 2001 at the University of Eastern Finland in Kuopio The book is subdivided into 4 sections and 13 chapters Following the Introduction there are three sections which take a view on gene regulation from the perspective of transcription factors chromatin and non coding RNA respectively Besides its value as a textbook Mechanisms of Gene Regulation will be a useful reference for individuals working in biomedical laboratories

*Translational Control of Gene Expression* Nahum Sonenberg, John W. B. Hershey, Michael B. Mathews, 2001 Since the 1996 publication of Translational Control there has been fresh interest in protein synthesis and recognition of the key role of translation control mechanisms in regulating gene expression This new monograph updates and expands the scope of the earlier book but it also takes a fresh look at the field In a new format the first eight chapters provide broad overviews while each of the additional twenty eight has a focus on a research topic of more specific interest The result is a thoroughly up to date account of initiation elongation and termination of translation control mechanisms in development in response to extracellular stimuli and the effects on the translation machinery of virus infection and disease This book is essential reading for students entering the field and an invaluable resource for investigators of gene expression and its control

*Inducible Gene Expression, Volume 1* P.A. Baeuerle, 2012-03-14 Cells have evolved multiple strategies to adapt the composition and quality of their protein equipment to needs imposed by changes in intra and extracellular conditions The appearance of proteins transmitting novel functional properties to cells can be controlled at a transcriptional posttranscriptional translational or posttranslational level Extensive research over the past 15 years has shown that transcriptional regulation is used as the predominant strategy to control the production of new proteins in response to extracellular stimuli At the level of gene transcription the initiation of mRNA synthesis is used most frequently to govern gene expression The key elements controlling transcription initiation in eukaryotes are activator proteins transactivators that bind in a sequence specific manner to short DNA sequences in the 5' of genes The activator binding sites are elements of larger proximity control units called promoters and enhancers which bind many distinct proteins These may synergize or negatively cooperate with the activators The *de novo* binding of an activator to DNA or if already bound to DNA its functional activation is what ultimately turns on a high level expression of genes The activity of transactivators is controlled by signalling pathways and in some cases transactivators actively participate in signal transduction by moving from the cytoplasm into the nucleus In this first volume of Inducible Gene Expression leading scientists in the field review six eukaryotic transactivators that allow cells to respond to various extracellular stimuli by the expression of new proteins

**Gene Expression** Benjamin Lewin, 1974

*Inducible Gene Expression, Volume 1* P.A. Baeuerle, 1994-12-22 Cells have evolved multiple strategies to adapt the composition and quality of their protein equipment to needs imposed by changes in intra and extracellular conditions The appearance of proteins transmitting novel functional properties to cells can be controlled at a transcriptional posttranscriptional translational

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***The Molecular Basis of Gene Expression*** Benjamin Lewin,1970

***Long-Range Control of Gene Expression*** Veronica van Heyningen,Robert E Hill,2011-09-02 Long Range Control of Gene Expression covers the current progress in understanding the mechanisms for genomic control of gene expression which has grown considerably in the last few years as insight into genome organization and chromatin regulation has advanced Discusses the evolution of cis regulatory sequences in drosophila Includes information on genomic imprinting and imprinting defects in humans Includes a chapter on epigenetic gene regulation in cancer

***Analysing Gene Expression*** Stefan Lorkowski,Paul M. Cullen,2006-03-06 This book combines the experience of 225 experts on 900 pages Scientists worldwide are currently overwhelmed by the ever increasing number and diversity of genome projects This handbook is your guide through the jungle of new methods and techniques available to analyse gene expression the first to provide such a broad view of the measurement of mRNA and protein expression in vitro in situ and even in vivo Despite this broad approach detail is sufficient for you to grasp the principles behind each method In each case the authors weigh up the advantages and disadvantages paying particular attention to the automated high throughput processing demanded by the biotech industry Completely up to date the book covers such ground breaking methods such as DNA microarrays serial analysis of gene expression differential display and identification of open reading frame expressed sequence tags All the methods and necessary equipment are presented visually in more than 300 mainly colour illustrations to assist their step by step reproduction in your laboratory Each chapter is rounded off with its own set of extensive references that provide access to detailed experimental protocols In short the bible of analysing gene expression

***Recent Trends in Gene Expression*** Subhrangsu S. Mandal,2013 The term Gene refers to a segment of DNA present inside the genome that code for a protein Depending on the organism a particular genome may encode thousands of diverse types of genes responsible for various functions These genes are differentially expressed and tightly regulated as needed at different stages of cell and

physiological functions including cell differentiation and development Gene expression may be influenced by various environmental and stimuli such as temperature nutrients hormones stress etc Though the fundamental mechanism of transcription production of mRNA from the protein coding genes is very similar in different organisms the mechanism of gene regulation and the machineries involved are distinct for different organisms In the post genomic and epigenomic era it is increasingly being recognised that gene expression is not only controlled gene sequences but also various other non genomic factors that include protein and DNA modifications and non coding RNAs Various aspects of gene expression in prokaryotes and eukaryotes the mechanism of transcription and gene regulation and influences of various environmental factors are highlighted in different chapters of this book **Genes & Signals** Mark Ptashne,Alexander Gann,2002 P 103

**Inducible Gene Expression, Volume 1** P.A. Baeuerle,1994-12-22 Cells have evolved multiple strategies to adapt the composition and quality of their protein equipment to needs imposed by changes in intra and extracellular conditions The appearance of proteins transmitting novel functional properties to cells can be controlled at a transcriptional posttranscriptional translational or posttranslational level Extensive research over the past 15 years has shown that transcriptional regulation is used as the predominant strategy to control the production of new proteins in response to extracellular stimuli At the level of gene transcription the initiation of mRNA synthesis is used most frequently to govern gene expression The key elements controlling transcription initiation in eukaryotes are activator proteins transactivators that bind in a sequence specific manner to short DNA sequences in the 5' of genes The activator binding sites are elements of larger proximity control units called promoters and enhancers which bind many distinct proteins These may synergize or negatively cooperate with the activators The de novo binding of an activator to DNA or if already bound to DNA its functional activation is what ultimately turns on a high level expression of genes The activity of transactivators is controlled by signalling pathways and in some cases transactivators actively participate in signal transduction by moving from the cytoplasm into the nucleus In this first volume of Inducible Gene Expression leading scientists in the field review six eukaryotic transactivators that allow cells to respond to various extracellular stimuli by the expression of new proteins The Analysis of Regulatory DNA: Current Developments, Knowledge and Applications Uncovering Gene Regulation Kenneth Berendzen,Joachim Kilian ,Dierk Wanke,2013-10-29 A major goal of integrative research is understanding regulatory networks to such an extent as to allow researchers to model developmental and stress responses Regulatory networks of living systems include complex and vast interactions between proteins metabolites RNA various signaling molecules and DNA One aspect of systems biology is understanding the dynamics of protein DNA interactions affecting gene expression that are caused by transcription factors TFs and chromatin remodeling factors This e book provides a resource for summarizing current knowledge eukaryotic transcription and explores cis elements and methods for their analysis prediction and discovery The book also presents an overview of exploring gene regulatory networks chromatin and miRNAs Information about state of the art techniques for the



determination of TF cis element interactions in vivo and in silico give cutting edge insights on how genomic scale research is being approached The Analysis of Regulatory DNA provides readers with both the necessary background knowledge and provocative up to date insights aimed at sparking new and vibrant experimental designs for understanding and predicting cis elements in the eukaryotic genome

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