Overview of gene regulation ?Definition: The process by which cells control the expression of genes.RNA sequencing (RNA-seq), microarrays.Helps fetus to harvest oxygen from maternal blood ?Gene regulation determines which globin polypeptides are made to become functional hemoglobin 2/17/2025 12 Living organisms grow and develop ?Gene regulation is an important process that allows organisms to proceed through developmental stages.Why we need control of gene expression ?All our body cells contain identical genetic instructions ?However, these cells appear very different ?Muscle cells, nerve cells and epithelial cells are different ?This morphological difference reflects a profound difference in gene expression 2/17/2025 4 Overview of gene regulation ?Red blood cells develop from cells which express oxygen carrying protein, haemoglobin.2/17/2025 5 Gene regulation in bacteria ?Most commonly occurs at the level of transcription ?Also, can control rate of translation ?Can be regulated at protein or post translation level Prokaryotic (Bacterial) gene regulation ?Responds to changes in the environment.Post-translation Levels of Gene Expression Control in Eukaryotic Cells 9 2/17/2025 10 Gene regulation in eukaryotes ?Cell differentiation: necessary to produce different cell types in an organism ?All of the organism's cells contain the same genome but express different proteomes due to gene regulation ?2/17/2025 3 Importance of gene regulation ?The regulation of gene expression plays a central role in development from a zygote to a multicellular organism ?Essential for cellular differentiation, development, and response to environmental changes.Different amounts of the same protein Gene regulation in eukaryotes 2/17/2025 11 Developmental gene regulation in mammals ?Example: Hemoglobin in fetal versus adult humans.Overview of gene regulation ?The expression of ?-galactosidase protein is induced by addition of lactose to the medium of E.coli.RNA processing, splicing, and stability (e.g., microRNAs, RNA-binding proteins).?Majority of genes regulated to ensure that proteins are produced at the correct time and amount.Eukaryotic Regulation ?Five primary levels of control: B. Cytoplasmic levels: 4.Translational control.Control of RNA synthesis (e.g., transcription factors, enhancers, silencers).ChIP-seq (Chromatin Immunoprecipitation), bisulfite ???????????? sequencing.?CRISPR-Cas9