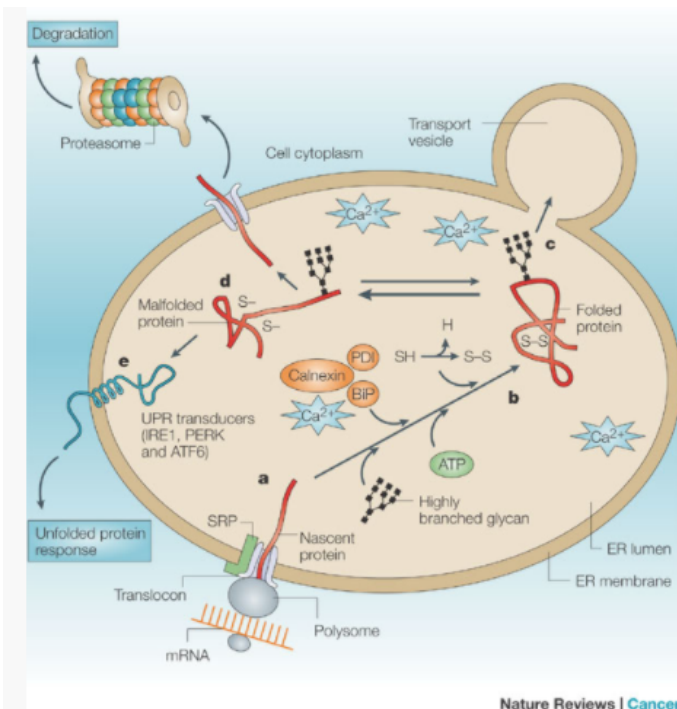


Most of the energy required for the synthesis of ATP is produced by...

Select one:

- ☒ a. the reoxidation of NADH and FADH₂ into mitochondria
- ☐ b. phosphocreatine
- ☐ c. the anaerobic metabolism of glucose



Nature Reviews | **Cancer**

Proteins from this compartment will be transported by transport vesicles to the next compartment which is....

Select one:

- ☐ a. mitochondrial intermediate space
- ☐ b. nucleolus
- ☒ c. cis-Golgi
- ☐ d. cytosol
- ☐ e. mitochondrial matrix space
- ☐ f. trans-Golgi

Screenshot

Which microscope would you use to observe eukaryotic cells in culture?

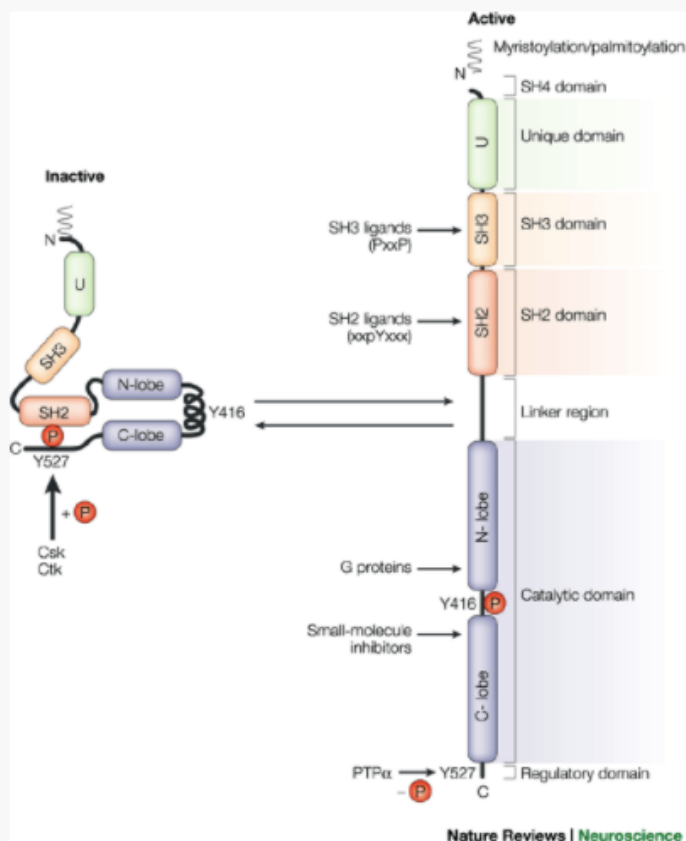
Select one:

- ☐ a. upright phase contrast microscope
- ☐ b. scanning electronic microscope (SEM)
- ☒ c. inverted phase contrast microscope
- ☐ d. upright fluorescent microscope
- ☐ e. transmission electronic microscope (TEM)
- ☐ f. inverted fluorescent microscope

Mitosis and meiosis accomplish segregation of the replicated DNA to two or more daughter cells. Which of the following is characteristic of both mitosis and meiosis?

Select one:

- ☐ a. The resulting cells are diploid ($2n$).
- ☒ b. Spindle fibers attach to chromosomes at their kinetochores
- ☐ c. Chiasma form between chromosome arms.
- ☐ d. The resulting cells are haploid ($1n$)
- ☐ e. Chromosomes attach to spindle fibers composed of actin



Nature Reviews | Neuroscience

According to the figure, which deletion would inhibit the enzymatic activity of this protein ?

Select one:

- ☒ a. Tyrosine-416
- ☐ b. U-domain
- ☐ c. SH2 domain
- ☐ d. myristoylation/palmitoylation site
- ☐ e. Tyrosine-527

Screenshot

It is an important technique used in cell and molecular biology. By using it, researchers are able to identify specific proteins from a complex mixture of proteins extracted from cells. The technique uses three elements to accomplish this task: (1) separation by size, (2) transfer to a solid support, and (3) marking target protein using a proper primary and secondary antibody to visualize

Select one:

- ☐ a. southern blotting
- ☒ b. western blotting
- ☐ c. elisa
- ☐ d. PCR amplification
- ☐ e. double labelling immunohistochemistry

Which of these cellular structures is composed of intermediate filaments?

Select one:

- ☒ a. nucleoskeleton
- ☐ b. mitotic spindle
- ☐ c. cilia
- ☐ d. flagellum

Which of the following proteins are translated by free ribosomes?

Select one or more:

- ☐ a. lysosomal enzymes
- ☒ b. actin
- ☒ c. mitochondrial proteins coded by nuclear genome
- ☐ d. aquaporins
- ☒ e. ribosomal proteins

In vertebrate neuromuscular junction:

Select one:

- ☒ a. Nicotinic receptors are activated by acetylcholine and trigger a depolarization
- ☐ b. acetylcholine excites muscles through the release of second messengers
- ☐ c. An electrical synapse occurs
- ☐ d. End-plate potentials propagate throughout all the muscle fibers without decaying

Heart innervation in vertebrates....

Select one:

- ☐ a. activates nicotinic receptors on cardiomyocytes
- ☒ b. modulates contraction force and rate acting on different cell types
- ☐ c. excites pacemaker cells that are silent in resting conditions
- ☐ d. modulates pacemaker cells contraction

Passive ion fluxes through cell membranes depend on:

Select one:

- ☐ a. chemical gradient and membrane permeability
- ☒ b. electrochemical gradient and membrane permeability
- ☐ c. membrane permeability only
- ☐ d. electrical gradient only

Renal ultrafiltration occurs:

Select one:

- ☐ a. in Henle's loop
- ☐ b. in the collecting tube
- ☐ c. everywhere along the renal tubes
- ☒ d. at the interface between glomerulus and Bowman's gland

Sensory receptors are usually classified into phasic or tonic on the basis of

Select one:

- ☒ a. receptor potential duration
- ☐ b. stimulus intensity
- ☐ c. PdA duration
- ☐ d. stimulus duration

When a cell presents one chromosome in excess of the normal number, which of these is the correct definition ?

Select one:

- ☐ a. allotetraploid
- ☐ b. tetraploid
- ☐ c. haploid
- ☐ d. polyploid
- ☒ e. aneuploid

You are comparing the aminoacid sequence of the proteins encoded by gene A and B using BLAST and obtain an "e" value of e^{-100} .

Which of the following conclusion is acceptable in front of such a low "e" value ?

Select one:

- ☐ a. the two proteins work in a dimeric complex
- ☐ b. the two genes have completely unrelated functions
- ☐ c. the two genes are expressed in the same tissues
- ☒ d. the two genes derive from a common ancestor
- ☐ e. Their coding sequence (cds) is longer than 100 bp

Cyclins are proteins involved in the regulation of:

Select one:

- ☐ a. The cycling of tubulin subunits through microtubules
- ☒ b. Cell-cycle protein kinases
- ☐ c. Circadian rhythms
- ☐ d. Synthesis of cAMP
- ☐ e. Membrane circulation via exocytosis and endocytosis

In the Human genome, the regions devoted to transcriptional regulation containing CpG-islands are repressed by which of the following modification ?

Select one:

- ☐ a. guanine acetylation
- ☐ b. histone myristylation
- ☐ c. CpG phosphodiesterase
- ☐ d. RNA polymerase phosphorylation
- ☒ e. cytosine methylation

The genetic drift makes isolated populations:

Select one:

- ☐ a. in a situation of Hardy-Weinberg equilibrium
- ☐ b. genetically stable
- ☐ c. genetically similar
- ☒ d. genetically different from each other

A silent mutation in a protein-coding gene will result in:

Select one:

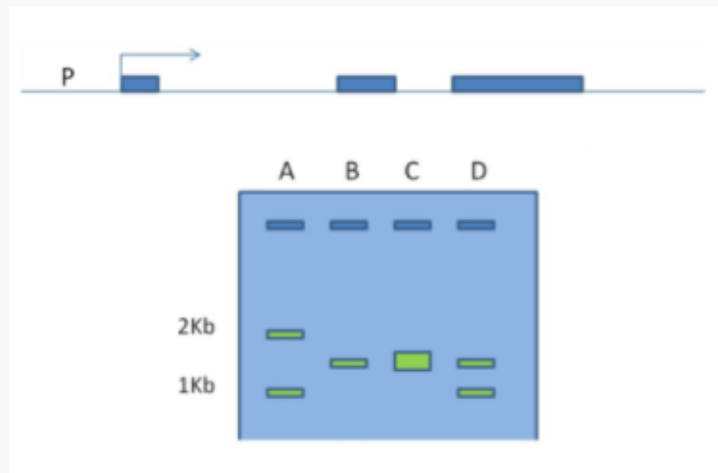
- ☐ a. a shift of the reading frame of mRNA during protein synthesis
- ☐ b. no change in the mRNA nucleotide sequence
- ☐ c. zeroing of the amount of the protein encoded
- ☒ d. no change in the encoded protein aminoacid sequence
- ☐ e. an aminoacid change that will have a significant effect on protein function

A second mutation in the same gene that restores the wild-type phenotype is referred to as....

Select one:

- ☐ a. epistasis
- ☒ b. intragenic suppression
- ☐ c. intergenic complementation
- ☐ d. synthetic enhancement
- ☐ e. gene conversion

In this Figure, a scheme of YFG gene is depicted. Blue boxes are exons and "P" indicates the promoter. You wish to study YFG expression in three different cell lines B, C and D and use RT-PCR to analyze RNA. You will then design the Forward primer in the first exon and the Reverse primer in the last exon. After PCR and gel electrophoresis, you obtain this result (A is the molecular weight standard lane).

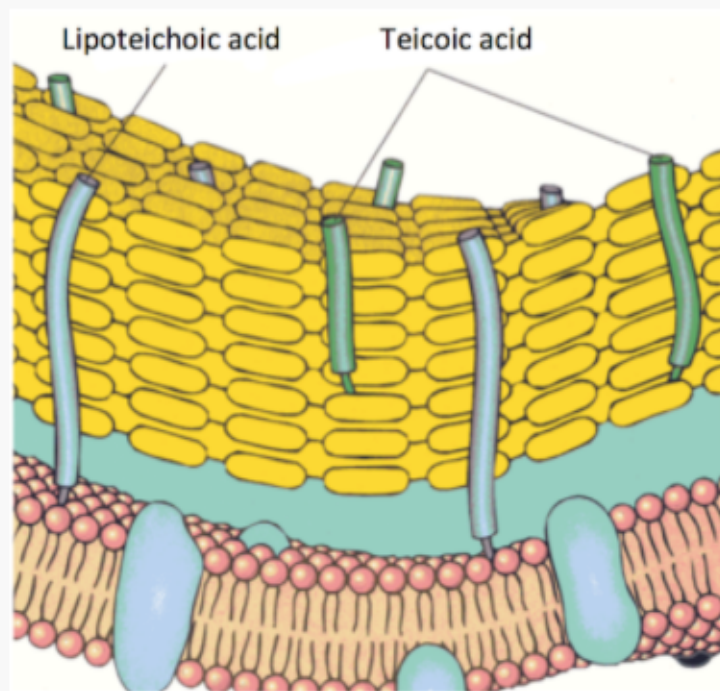


Which of the following illustrates your result?

Select one:

- ☐ a. YFG is expressed at the same level in all cell lines and in "D" a contamination by genomic DNA is most likely
- ☐ b. YFG is expressed at high levels in the "C" cell line, whereas in "D" a contamination by genomic DNA is most likely
- ☒ c. YFG is expressed at high levels in the "C" cell line, whereas in the "D" cell line an alternative splicing isoform may be present
- ☐ d. YFG is expressed at the same level in all cell lines; in the "D" cell line an alternative splicing isoform may be present

This structure belongs to....



Select one:

- ☐ a. *Escherichia coli*
- ☐ b. *Arabidopsis thaliana*
- ☒ c. *Bacillus subtilis*
- ☐ d. *Saccaromyces cerevisiae*
- ☐ e. *Mus musculus*

You have one liter of nutrient broth with an initial concentration of *Escherichia coli* of 100 CFU/ml. Which will be the total number of CFU by growing this culture for 3 hours at 37°C, given a latent phase of 1 hour and an average doubling time of 20 min?

Select one:

- ☐ a. 4×10^5
- ☐ b. 8×10^5
- ☒ c. 6.4×10^6
- ☐ d. 1.6×10^6
- ☐ e. 3.2×10^6

Enzymes promote...

Select one:

- ☒ a. a decrease of the activation energy needed for the reaction
- ☐ b. a change in free energy (ΔG°) between substrates and products
- ☐ c. a variation of the equilibrium constant

To express a human protein in E. coli you need to generate a suitable plasmid expression vector. Which of the following regulatory elements you must insert in the vector to assure an efficient expression?

Select one:

- ☒ a. a RBS (Shine-Dalgarno) sequence 7-10 nt upstream from the AUG of the human ORF
- ☐ b. a RBS (Shine-Dalgarno) sequence at 35 nt upstream of the transcription start site (+1)
- ☐ c. a TATA box sequence 10 nt downstream of the transcription start site (+1)
- ☐ d. a RNP-sigma 70 dependent (-10 -35) promoter 3' to the human ORF
- ☐ e. rho-independent terminator 5' to the human ORF

Proline is....

Select one:

- ☒ a. an amino acid that can promote an abrupt interruption of alpha helix structures
- ☐ b. an aromatic amino acid
- ☐ c. an amino acid that promotes the ordered secondary structures

Indicate the right affirmation about "proteins":

Select one:

- ☐ a. have an absorbance at 260 nm due to the presence of nitrogen bases
- ☒ b. have an adsorbance at 280 nm due to the presence of aromatic amino acids (Tyr and Trp)
- ☐ c. have an absorbance at 240 nm due to the presence of the peptide bon
- ☐ d. have an absorbance at 280 nm due to the presence of hydrophobic and basic amino acids (His and Leu)