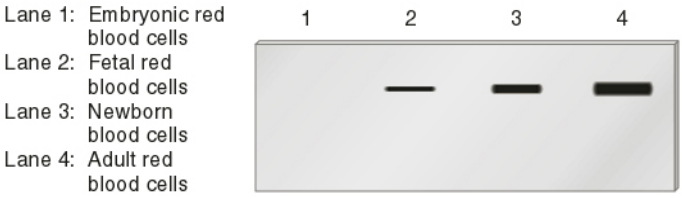
S1.RNA was isolated from four different cell types and probed with a radiolabeled cloned gene that is called gene *X*. The results are shown here.

Explain the results of this experiment.

Answer: In this Northern blot, a dark band appears in those lanes where RNA was isolated from muscle and sperm cells but not from liver and nerve cells. These results indicate that the muscle and sperm cells are transcribing gene *X*, but the liver and nerve cells are not. The muscle cells show a single band, while the sperm cells show this band plus a second band of lower molecular mass. An interpretation of these results is that the sperm cells can alternatively splice the RNA to produce a second RNA containing fewer exons.

S2. In the Western blotting experiment shown here, proteins were extracted from red blood cells obtained from tissue samples at different stages of human development. The primary antibody recognizes the ß-globin polypeptide that is found in the hemoglobin protein.

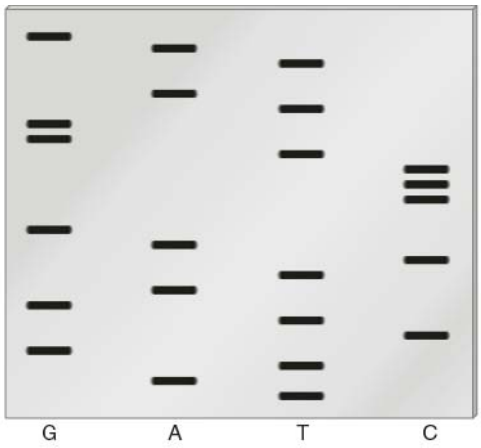


Explain these results.

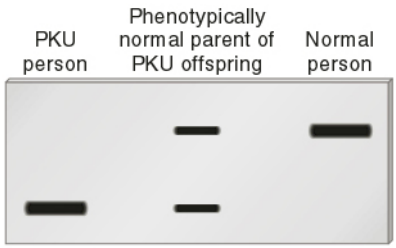
Answer: As shown here, the amount of ß-globin increases during development. There is little detectable ß-globin produced during embryonic development. The amount increases significantly during fetal development and becomes maximal in the adult. These results indicate that the ß-globin gene is "turned on" in later stages of development, leading to the synthesis of the ß-globin polypeptide. This experiment illustrates how a Western blot can provide information concerning the relative amount of a specific protein within living cells.

S3. A DNA strand has the sequence 3′–ATACGACTAGTCGGGACCATATC–5′. If the primer in a dideoxy sequencing reaction anneals just to the left of this sequence, draw what the sequencing ladder would look like.

Answer:



S4. The human genetic disease PKU involves a defect in a gene that encodes the enzyme phenylalanine hydroxylase. It is inherited as a recessive autosomal disorder. Using the normal phenylalanine hydroxylase gene as a probe, a Southern blot was carried out on a PKU patient, one of her parents, and a normal unrelated person. In this example, the DNA fragments were subjected to acrylamide gel electrophoresis, rather than agarose gel electrophoresis, since acrylamide gel electrophoresis is better able to detect small deletions within genes. The following results were obtained:



Suggest an explanation for these results.

Answer: In the affected person, the PKU defect is caused by a small deletion within the PKU gene. The parents are heterozygous for the normal gene and the deletion. The PKU-affected person carries only the deletion, which runs at a lower molecular mass than the normal gene.