

2. List the classes that employ external fertilization and those that employ internal fertilization.
3. Excluding birds, what is the major excretory structure and product of the remaining four classes?
4. Which class has internal development? Where does this development take place?

DNA and Protein Synthesis:

1. Define transcription. Where does it take place?
2. What is a codon? What is its function?
3. If one nucleotide in a codon was substituted by another through a mutation, what would result? How is it possible that there is no change in phenotypic expression even though such a mutation occurs?

Oxytocin & ADH Origins

1. Of the five vertebrate classes, which are likely to produce ADH? Which is likely to produce both hormones?
2. Describe the structure of both hormones. How do they differ?

3. Assuming that both hormones have a common origin, which most likely preceded the other? Is it possible that an intermediate hormone gave rise to oxytocin and ADH? Explain.

4. Using a codon chart, compare the two differing amino acid codons. Does it appear that a single substitution of a single nucleotide may have occurred to account for the differences.

5. Messenger RNA codons are transcribed from DNA. What specific substitutions may have occurred in DNA molecules?

Notes to the Teacher

It should be apparent that these two hormones have a common origin. Both originate in the hypothalamus and are strikingly similar, and both overlap in function. These similarities pose many intriguing questions that may be explored by students who have completed a unit on protein synthesis that includes transcription of DNA to RNA codons and the general understanding that mammals evolved from earlier vertebrate forms.

It may benefit the students to provide an introduction such as written above along with a codon and amino acid charts. Such charts are usually found in most texts, but if not found in yours, copies can be included with the exercise. It is also recommended that the textbook reading on general evolution of vertebrates be included. Students may work in groups to discuss and answer these questions with a summary writeup by the end of class or the next day.

Answers

The Evolution of Vertebrates:

1. fishes, amphibians, reptiles, birds, mammals
2. External: fishes, amphibians Internal: reptiles, birds, mammals
3. Mammals, In the endometrium(uterine lining)
4. Urine(urea). Kidney

DNA & Protein Synthesis:

1. The copying of the DNA triplet code into m-RNA, which is then read by the ribosomes in the cytoplasm. The copying of DNA takes place in the nucleus.

2. A unit of genetic coding, three nucleotides long. To be read by ribosomes to construct polypeptides.

3. Substitution of a different amino acid. If the substitution results in coding for the same amino acid, no apparent changes will be observed.

The origin of Oxytocin & ADH

1. Perhaps all five classes. Birds unknown. It is likely that only mammals produce both hormones.

2. Nine amino acids, two vary, the 3rd & 8th

3. ADH- kidneys developed prior to the uterus and breast tissue. An intermediate molecule is possible that only varies by one amino acid from both hormones. It might be interesting to synthesize an intermediate polypeptide, inject it into mammals and study the resulting effects.

4. Yes, Phe to ileu, 1st nucleotide from U to A. Arg to Leu
2nd nucleotide from G to U.

5. See above, reverse transcription.

6. Phe & ileu are nonpolar, therefore this substitution should have little effect on the folding of this polypeptide. On the other hand arg is a basic amino acid and leu is nonpolar. Such a substitution is more likely to affect the folding pattern of the polypeptide, which may affect its function.