Deep underground there are _______________ where the sun never shines. The only light that enters these subterranean spaces is from the headlamps of occasional cave explorers. Page 1 @ 1

In some of these underground caves, there are fishes, crustaceans, salamanders and other organisms that have _______________ to live without light. Page 1 @ 2

For example, more than one hundred species of cave _______________ live their lives in perpetual darkness. They depend on senses other than sight to hunt, eat and reproduce. Page 1 @ 2

Many of these species of fishes are _______________ or nearly blind—some don't even have eyes. Yet they all evolved from fishes that could see. Page 1 @ 3

We usually think of evolution in a positive sense, that is, as a process in which species acquire new traits. But in cave fishes we have an example of _______________ evolution, a process in which species lose a trait—in this case, the ability to see. Page 1 @ 5
Animals with traits that make them more successful at having offspring will pass on those traits to succeeding generations. He called this process evolution by natural _______________________.Page 2 @ 3

Most of what we know now is based on the study of the blind Mexican _________________ (Astyanax mexicanus). Scientists have two competing explanations for blindness in the Mexican tetra, which likely apply in other cave fishes as well.Page 3 @ 1

The first hypothesis assumes that blindness gives the fish some sort of evolutionary advantage. For example, it’s possible that changes in the gene or genes that cause blindness are also responsible for some other seemingly _________________ change in the fish that is beneficial. Page 3 @ 2

Scientists call this ______________________________—when multiple effects are caused by the same mutation in one gene. To support this hypothesis, scientists would have to look for some advantage to the cave fish that is linked to the same mutation that causes blindness.Page 3 @ 2

The second hypothesis that could explain blindness in the cave fish is based on the fact that natural selection does not just reward success, it also weeds out _______________________.Page 3 @ 3

In a lake, where there is sunlight, a fish born blind would have trouble competing with other fish that can see. It probably would not survive to have offspring. But a fish _________________ blind in a dark cave would not be at a disadvantage, since in the darkness eyes are useless.Page 3 @ 3
In those conditions, natural selection will not work to weed out the mutation for blindness. Over one to two ___________ years, many more mutations disrupting the development of the eyes will accumulate and eventually the entire population of fish will be blind.

This is called the ________________mutation hypothesis, based on the idea that the mutations for causing blindness have no effect (or have a neutral effect) on the survival of the fish living in a dark cave.

A group of scientists at the University of Maryland set out to investigate the developmental causes of blindness in the cave fish. They carried out an experiment with two _______________ of the same species of Mexican tetras. One variety lives in bodies of water near the surface where there is sunlight and can see. The other variety of tetras lives in dark caves and is blind.

The scientists transplanted a ______________ from the eye of a surface tetra embryo into the eye of a cave tetra embryo. The result was striking—the surface tetra lens transplanted into the cave tetra caused all of the surrounding tissues to develop into a healthy eye.

The scientists knew that there are many genes responsible for the development of each part of an eye (for example, the retina, iris, cornea and lens), which develops independently. However, the results of the experiment showed that blindness in the Mexican tetra was not due to ________________ in all those genes.

However, the results of the experiment showed that blindness in the Mexican tetra was not due to mutations in all those genes. Instead, it suggested a small number of mutations in genetic "master ________________."
These “master switches” have the ability to disable the eye genes so that these remain intact, but inactive. Putting a healthy lens into the cave tetra embryo seems to _____________ master switches to send a signal to the inactive eye genes, allowing cave tetras to develop eyes.

The researchers did indeed find one of those genes. It is nicknamed _____________ or the Hh gene. They discovered that the Hedgehog gene does more than cause blindness in cave tetras—when the fish develops without eyes, the skull bones move into the empty eye socket, which at the same time enlarges the nose.

Unlike other vertebrates, fishes use their nose only for smelling. It could be that the same control gene (Hh) that stops eye development in the fish also is responsible for enhancing its sense of _____________. An enhanced sense of smell would be a definite advantage for a fish that lives in darkness.

As a result of these and other experiments, it now seems highly likely that blindness in cave tetras is in part the result of _____________—one mutation that causes blindness in the fish and at the same time, gives them an enhanced sense of smell.

With new tools that give scientists the ability to genes, find specific mutations, and understand the development of embryos, we are increasing our understanding of how evolution works.

The largest Ozark CAVEFISH populations in ARKANSAS occur in caves used by the GRAY BAT, where the bat’s __________ forms the cave’s primary energy source. A reduction in bat numbers could cause a decline in the cavefish population. TO FIND THE ANSWER go to your Science Class Webpage = scienceclass3000.weebly.com USE the PICTURE BOX IMAGE as a CLUE.
24. A species of blind, cave-dwelling salamander in the US mid-west has switched from a normal carnivorous diet to eating nutritious bat guano, say subterranean researchers. Because bats don't digest their food properly, weight for weight their guano contain more protein and nutrients than a Big Mac. This makes them a perfect snack in a pitch-black environment where food can be scarce. TO FIND THE ANSWER go to your Science Class Webpage = scienceclass3000.weebly.com USE the PICTURE BOX IMAGE as a CLUE.

25. What is the main idea of today's classwork Science Article titled "Why Do Cave Fish Lose Their Eyes?"
SEE PICTURE BOX AND THEN TYPE YOUR ANSWER