**Display Cases**  
**Main – 1st Floor**

*case numbers are located on the lower, left-hand corner of the case.

**Case 1:** The Cambrian Explosion – radiation of life that gave rise to all modern lineages on Earth. The oldest fossils on Earth are primitive cyanobacteria, or stromatolites, which lived as early as 3.5 bya during the Archean Eon. Stomatolites can be found in Precambrian rock near Logan Pass at Glacier National Park. The Ediacara fauna (565-543 mya) from the Late Precambrian possibly represents the first multicellular, soft-bodied, organisms on Earth. The stratotype location is in Southern Australia, but these ‘Verdian’ forms can be found on every continent except Antarctica. The Early Cambrian, Chengjiang Fauna (524-520 mya) from Yunnan Province, southern China, contains the earliest ancestor of vertebrates as well as excellently preserved soft-bodied invertebrate fossils. Lastly, the Burgess Shale is a Middle Cambrian deposit from British Columbia, Canada yields soft-bodied fossils preserved by repeated rapid burial events that prevented the destruction and decomposition of the soft body parts.

**Case 2:** Mammalian Succession – After the extinction of dinosaurs, the Age of Mammals came into swing. During this time, Montana was transformed into a savannah like environment with lots of room for mammals to grow extremely large. These “big game” animals include: giant pigs, elephants, rhinos, horses, camels, and sophisticated carnivores. Most of these megafaunas were victims of mass extinction.

**Case 3:** The Bear Gulch Biota – Specimens from this assemblage represent one of the largest fossil collections at the UMPC. These Mississippian fossils can be found in the Big Snowy Mountains of central Montana. The Bear Gulch limestone was deposited in a shallow tropical ocean and includes: algae, sponges, worms, shrimp, early sharks, ammonoids, and over seventy species of boney fish.

**Case 4:** Bear Gulch Fauna Continued – This case demonstrates examples and reconstructions of the fossils excavated from the Bear Gulch limestone. The background for this display case was painted by Jose Garcia. For more information on the Bear Gulch check out [www.sju.edu/research/bear_gulch/index.php](http://www.sju.edu/research/bear_gulch/index.php)

**Case 5:** Silurian & Devonian Waters – The Silurian Period (444-416 mya) was a geologically short period, lasting only about 30 million years. However, this period witnessed the first record of vascular plants that starting moving towards the edges of their watery habitats. During the first part of the Silurian, jawless fish (agnathans) roamed the waters. By the end of this period, the first jawed fish appeared. The Devonian Period (416-359 mya) is known as the “Age of Fish”, because of a large-scale fish radiation. Also this period is known for the first record of seed bearing plants, gymnosperms, and the emergence of wood (increased strength for the migrating terrestrial plants).

**Case 6:** The Carboniferous – This period is known as the “coal bearing” period because of the excessive layers of coal formed by undecomposed plant material. During this time Earth experienced the highest levels of Oxygen in the atmosphere, released by the large volume of photosynthesizing plants. Burial of megatons of carbon, removed from the atmosphere ushered in an ice age at the end of this period. The armored fish (placoderms) were replaced with sharks, which experienced their zenith during the Carboniferous.

**Case 7:** Dinosaurs - Dinosaurs evolved during the Mesozoic Era, known as the “Age of Reptiles”, spanning three periods, the Triassic, Jurassic, and Cretaceous. The dinosaurs are divided into two classes by their hip structure. One class, the Saurischian “Lizard-Hipped” dinosaurs have feet and
legs that reflect a bipedal and quadrupedal postures. These dinosaurs are represented by the Theropods (*Compsognathus*, *Oviraptor*, *Tyrannosaurus*, and *Coelophysis*) and Sauropods (*Plateosaurus*, *Apatosaurus*, *Brachiosaurus*, and *Camarasaurus*). The other class, the Ornithopoda “Bird-Hipped” dinosaurs have legs and feet that indicates a mostly bipedal habit. They are represented by Iguanodons, Hadrosaurs, Ankylosaurs, Stegosaurs, Pachycephalosaurs, and Ceratopsians. These are the only true dinosaurs and are completely terrestrial. All other swimming or flying forms of reptiles are not considered dinosaurs.

**Case 8**: *Maiasaura* – This case is based on the children’s novel, *Maiasaura: The Good Mother Dinosaur* (1991) edited by Elizabeth J. Sandell. Large nesting areas of *Maiasaura* were found in Montana.

**Case 9**: Fort Peck’s Rex – This T-Rex was excavated in McCona County, Montana in 1997, near the Fort Peck Dam. It is the only T-Rex to exhibit the third “pinkie” digit in the forearm and a preserved furcula (wishbone). A full, fleshed out reconstruction of the Peck’s Rex can be seen at the Fort Peck Dam and Interpretive Center in Eastern Montana.

**Case 10**: Mastodon Megaherbivore – This case is dedicated to the Gomphotheres, an ancient line of elephants. During the Miocene, these large elephants roamed Europe, Asia, and North America. This individual was found in Powell County, Montana and is known as a “Four-Tusker”. It had two normal tusks on the upper jaw and two more tusks on the bottom jaw. Using the lower jaw as a scale, it can be assumed that this four-tusker was about 8 feet high at the shoulder and weighed up to 10 tons, smaller then a modern Asian elephant.

**Case 11**: Past Paleontological and Geological Research in the Sonoran Desert – The Sonora desert in northern Mexico has a limestone deposit that contains remains of ancient marine life from the Late Triassic Period. The fossils occur in the Antimonio Formation and include: sponges and corals in life positions. Also found are straight cephalopods, ichthyosaur skeletons, and clams. Specimens were collected by George Stanley and students.

**Case 12**: Silicates – The silicate minerals are the most common mineral class on Earth, constituting over 90% of Earth’s crust. There are five major classes of silicates. Nesosilicates – “island silicates”, kyanite, topaz and zircon
Cyclosilicates – “ring silicates”, tourmaline
Inosilicates – “chain silicates”, hornblend & diopside
Phyllosilicates – “sheet silicates”, muscovite & talc
Tectosilicates – “framework silicates”, quartz & orthoclase
*a few common silicate mineral examples

**Case 13**: The Reawakening of Mount St. Helens – on May 18th, 1980, Mount St. Helens erupted for the first time since 1842. The eruption started at 8:45am, by noon the ash plume had reached Moscow, Idaho, and by 3pm the ash reached Missoula, Montana. Northwestern Montana received between 0.5mm and 5mm of ash. The vessels inside the display show decreasing fall out of ash and pyroclastic debris from the volcano as we move eastward from the eruption.

**Case 14**: Sedimentary Structures – mud cracks, ripple marks, and rain drops are all formed from modern day processes and can be preserved in sandstones and mudstones. Ancient examples of these sedimentary structures can be found in the red and green Precambrian Belt Rocks of western Montana. A good area to see these structures is on I-90 traveling from Missoula to Lookout Pass. These structures are important when interpreting ancient environments and taphonomy.
**Rancho La Brea Tar Pits:** The La Brea Tar Pits were formed by ancient marine sediments that transformed into crude oil during the lithification process. This crude oil seeped out of the ground through conduits and fissures in the overlying sediments, forming pools in low-lying areas. Although, these pools are known as “Tar Pits”, the liquid is actually comprised of asphalt, not tar.

Since this asphalt is semi-solid, leaves, dust, and water could cover the surface and partially obscure it from view. Animals would pass by and unknowingly venture into the camouflaged asphalt. If the conditions were right, the animal would become trapped in the sticky substance. The stranded animal would become any easy target for the carnivores that lived in the area. However, these predators that would attack these stranded animals would also risk becoming entrapped and many of them did.

The excellent quality of fossil preservation occurred because the bones were buried fairly rapidly by the asphalt and other sediments. This rapid burial kept the fossils from being exposed to the elements, which cause erosion, for an extended length of time. Bones that were preserved by the asphalt are stained in different shades of brown.

Both specimens (Saber-Toothed Cat and Dire Wolf) are on permanent loan from the George C. Page Museum in Hancock Park, California.

**Saber-Toothed Cat:** is an extinct genus of large machairodontine felines that lived between 2.5 million years ago and 10,000 years ago in North and South America. The common name “Saber-Toothed Cat” originated from the extreme length of their maxillary canine teeth. This displayed specimen is Smilodon fatalis and its size was between the smaller S.gracilis and the larger S.populator. The estimated body mass for S.fatalis ranges between 160 to 220 kg (352 to 485 lbs). In the largest species, S.populator, the body mass could reach up to 400 kg (880 lbs) and the canines could grow to 17 cm (7 inches) in length. Compared to the modern lion, Smilodons were not as tall or as long, but they were twice as heavy. They also could roar like a lion, because its throat bones (the hyoids) are shaped like those of a lion. Also Smilodon could open its jaws 120 degrees, where as lions can only open their jaws 65 degrees. It sported a bobtail, in contrast to the long tails that provides balance for other modern cats. Smilodon’s short legs, bulky body, and bobtail indicate that it didn’t run far while hunting. This leads paleontologist to believe that this animal waited for its prey to get close and launched a surprised attack on its victim. Smilodon’s bulkiness also means it could topple large, lumbering prey that didn’t run far either. Old interpretations of Smilodon’s coloring indicated an animal that was golden yellow, similar to a lion. New evidence indicates that Smilodon was spotted like a leopard. Leaves found in tar or stuck to the teeth of fossilized herbivores suggest that the Pleistocene Los Angeles basin was a plain dotted with sagebrush, buckwheat, and clumps of oat and pine. This ancient landscape would be able to camouflage a spotted predator.

Some researchers believe that Smilodon used its great upper body strength to wrestle prey to the ground, where its long canines could deliver a deep stabbing bite to the throat which would generally cut through the jugular vein and/or the trachea and thus killing the prey quickly. However, Smilodon’s long canines where slender and prone to breaking, especially when embedded into the body of a struggling animal or when biting in areas close to bones. Because most Smilodon fossils have intact (unbroken) canines, suggests that it would have probably bit the victims deep into the belly with its powerful head-depressing muscles and gripped a chunk of flesh with its other, interlocking teeth. It would then rip out the chunk and then hang around until the animal bled to death.

One of the richest assemblages of Smilodon fossils are from the Rancho La Brea Tar Pits in Los Angeles and are housed at the George C. Page Museum in Hancock Park, California. This collection has approximately 166,000 Smilodon bones that accumulated over a 25,000 year period. Because of the large amount of Smilodon bones found at the La Brea Pits, paleontologists can use pathologies preserved on bones to form theories on how the animal lived. These pathologies are in the form of dislocated hips, bite wounds, evidence of persistent infections, and evidence of the body’s attempts to reinforce overexerted muscles. These injuries probably occurred when the animal was trying to acquire prey. Many of these injuries were so prominent that the animal would have been affected dramatically. Some of these intense injuries had time to heal, even though the animal most likely could
not hunt. This suggests that Smilodons had a social structure that encouraged the nurturing of injured individuals. Perhaps their families brought them food, protected them from other carnivores, or allowed them to hang around until all the others were done to eat.

**Dire Wolf**: (Canis Dirus) is another form of Rancho La Brea Tar Pit fauna. It is an extinct form of the genus Canis and is most commonly found in North and South America during the Pleistocene. The Dire Wolf evolved on the North American continent, possibly from a small, fox-like *Leptocyon* in the Late Miocene Epoch (9 to 10 mya). Contrary to popular belief, the Dire Wolf is only slightly larger than the Grey Wolf. Also the Dire Wolf had a larger blade on the upper carnassial teeth, a longer temporal fossa, broader zygomatic arches, shorter legs, and a smaller brain case than the Grey Wolf. Many paleontologist suspects that the Dire Wolf may have used its large teeth to crush bone, an idea that is supported by the large amounts of wear on the crowns of fossilized teeth. Other aspects of the skull suggest that the Dire Wolf killed in a manner similar to its modern relative, by delivering a series of shallow bites, strongly indicating pack hunting behavior. The larger temporal fossa and zygomatic arches indicate that the Dire Wolf had a large temporalis muscle capable of generating slightly more force than a grey wolf. Although it was closely related to the Grey Wolf, it was not the direct ancestor of any living species today. The Dire Wolf and Gray Wolf co-existed in North America for about 100,000 years; however the Dire Wolfs became extinct around 10,000 years ago. The reason for this extinction has by hypothesized that the short, sturdy legs of the Dire Wolf were unable to hunt the swifter species that remained after the extinction and were forced to rely on scavenging. So the extinction of the large herbivores may have then led to the extinction of the Dire Wolf.