Metabolic bone disease is a serious and widespread cause of death and suffering among captive reptiles. The good news is that this disease is commonly caused by poor nutrition and can be prevented by providing your reptile a properly balanced diet.

All vertebrates need certain nutritional building blocks to form their skeletal systems. When they don’t get enough of one or more of these nutritional blocks, or get too much, then their bodies don’t have the necessary materials in the proper proportions to form healthy bone structure. Symptoms of metabolic bone disease vary between species and individual animals, but include soft short jaws, sprawl (inability to lift the body off the ground), anorexia, lameness, swollen limbs, bone fractures, curvature of the spine, tremors, small or deformed carapaces, and death. Metabolic bone disease is particularly devastating for growing animals since this is the time in their lives when they are most actively forming their skeletal structure.

The three most important nutrients for bone development are calcium, phosphorus and vitamin D₃, which form a triad of nutrients that work with each other. All three nutrients are necessary and must be in roughly the correct proportion to each other.

**THE CALCIUM - PHOSPHORUS RATIO**

Past some minimum level, the ratio of calcium to phosphorus is more important than absolute amounts. For example, doubling the calcium in an animal’s diet could cause it to develop metabolic bone disease unless phosphorus is raised as well. On the other hand, cutting the amount of calcium in half might have no effect if phosphorus is lowered accordingly. While there are differences between individuals, all vertebrates, particularly growing animals, are at risk of metabolic bone disease if the ratio of calcium to phosphorus in their overall diet falls below 1:1 or exceeds 2:1. There are several food items commonly fed to captive reptiles that can cause the calcium phosphorus ratio to fall outside the safe 1:1 to 2:1 range.

1. It is always tempting to feed an animal more and more of a food items it likes, and most herbivorous and omnivorous reptiles like fruit. Unfortunately fruit is low in calcium and if it becomes a large portion of the animal’s diet, it may drive the calcium phosphorus ratio to less than 1:1.

2. Many carnivorous reptiles like insects, particularly crickets, meal worms and wax worms, which usually are low in calcium.

3. Some carnivorous reptiles are fed pre-weaned rodents, or “pinkies”. Unfortunately, pinkies are harvested before they have a chance fully to develop their skeletal system, and so may be low in calcium.

**CALCIUM AND VITAMIN D₃**

Vitamin D₃, while only necessary in small amounts, performs a vital function with calcium in laying down the bone structure in a vertebrate’s body. Like calcium and phosphorus, an animal
can have too much D₃ or too little D₃. When there is too little D₃ (the common problem), calcium is not deposited properly for bone formation. When there is too much (less common), calcium deposits can form in the body where they should not (soft-tissue calcification) and damage the health of the animal.

Animal food items such as crickets, pinkies, etc. are rich in vitamin D₃ so carnivorous reptiles usually get plenty of D₃ in their diet. On the other hand, plant food items do not contain D₃, and have varying amounts of D₂, so herbivorous and omnivorous reptiles have to synthesize D₃ in their own bodies. By basking in the sun, the animal uses ultraviolet light to convert sterol precursors to vitamin D₃. While this conversion process works well for wild reptiles, there are several reasons why it generally does not for captive reptiles.

1. Many species of captive reptiles are tropical animals (i.e. iguanas), which tend to naturally bask in the tropical sun. Generally, it is believed that these animals need a lot of sunlight to synthesize enough D₃ to stave off metabolic bone disease. It is clear that in many parts of the U.S. there just isn’t enough sunlight reliably to prevent metabolic bone disease. This is because the low lying sun in Northern latitudes isn’t as intense as in tropical latitudes, Winter days are just too short and tropical reptiles are not suited to be outdoors during the winter of Northern climates.

2. The D₃ synthesis process requires UVB radiation in the 280-315 nm range and this kind of sunlight does NOT travel well through glass or other similar transparent barriers. This means that even in Southern latitudes your reptile must be outdoors most of the time in order to get enough D₃. Keeping it inside a greenhouse or beside a window will not do. This is obviously a problem for someone keeping a tortoise in a cold climate.

3. Ultraviolet lamps help, but the amount of radiation in the 280-315 nm range that can be safely provided by these lamps is often so small that they cannot reliably serve as a substitute for natural sunlight.

So what can you do? Extensive research has shown that domestic animal species can avoid metabolic bone disease if they get enough D₃ in their diet even if they are not exposed to natural sunlight. Research to date for iguanas is inconclusive. All Mazuri® reptile diets, particularly Mazuri® Iguana Diet, contain high levels of vitamin D₃. As an additional precaution we also recommend that you also allow your iguana access to natural sunlight.