Feline Red Blood Cell Shape and the Impacts of Cytauxzoonosis

Ashley Destin, McNair Scholar, and Judd A. Case, PhD

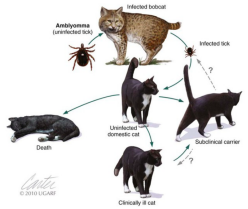
Department of Biology, Eastern Washington University

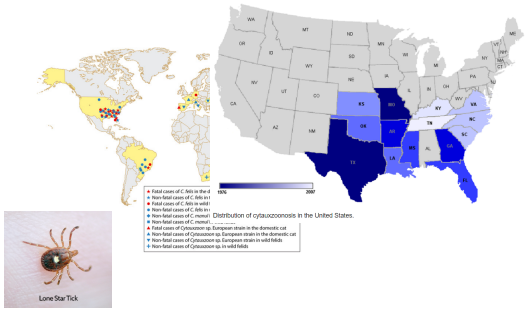
Introduction

With a job as important as carrying oxygen around to tissues everywhere in the body, red blood cells have been well-studied, especially in humans. To meet the higher oxygen needs of large animals like humans, red blood cells are the most abundant and fastest produced cells in the body. In addition, mammalian red blood cells have evolved to have high surface area to volume ration to maximize gas carriage and deformability. Most mammalian red blood cells have a biconcave disc shape giving a distinct lighter area in the center known as the central pallor that can be seen on blood smears. Further research has told us that these cells can carry up to four hemoglobin molecules each to bind with gasses at the expense of the nucleus and most organelles. These additional modifications occur in the bone marrow before the cells are released into the blood stream.

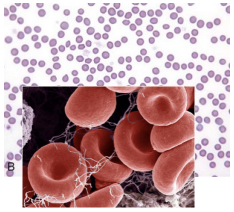
The evolution of the biconcave shape was significant enough that most mammals evolved a similar shape. Though it seems to be less documented, the felid family was no exception. Wild species of felids, such as pumas and lynx, maintained this red blood cell shape. Even ___ has this shape despite living in higher altitudes where most felids would have a difficult time breathing due to weaker oxygen affinity than other species. The red blood cells are also more prone to oxidative damage and Heinz bodies.

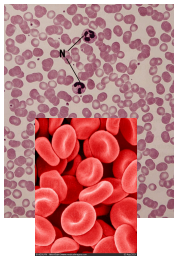
Despite the effectiveness of the biconcave disc, as we start to move into domesticated felids, there is a noticeable change in shape. Rather than having a distinct central pallor, the cell is concave on one side and convex on the other creating more of a bowl shape. This deviation in shape could result in lower gas transportation and exacerbate rouleau stacking leading to additional health problems. However, there doesn't seem to be any research to indicate why or when a mutation in shape occurred or the impacts of it.



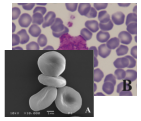


Domestic Cat RBC

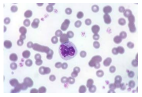




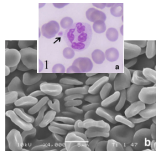
Human RBC



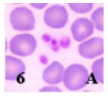
leopard cat (Felis bengalensis)



FelineRouleau

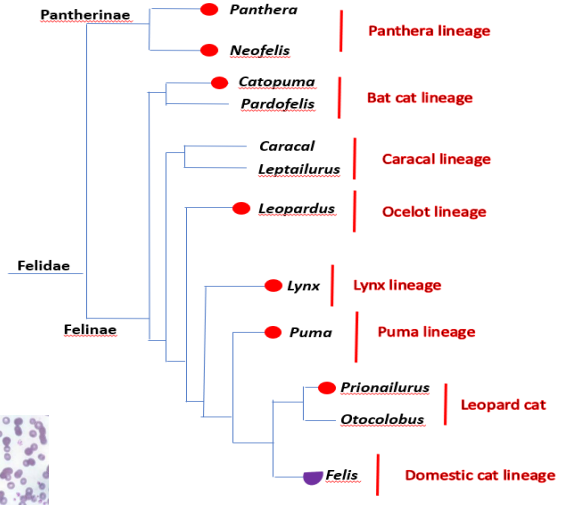


Jungle Cat

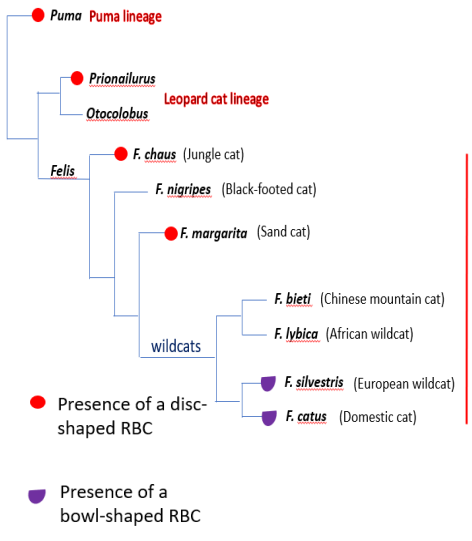


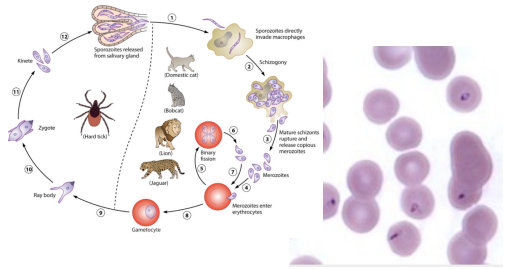
Fishing Cat

Phylogeny of the Felidae with distribution of RBC shape



Phylogeny of derived Felinae with distribution of RBC shape





Discussion