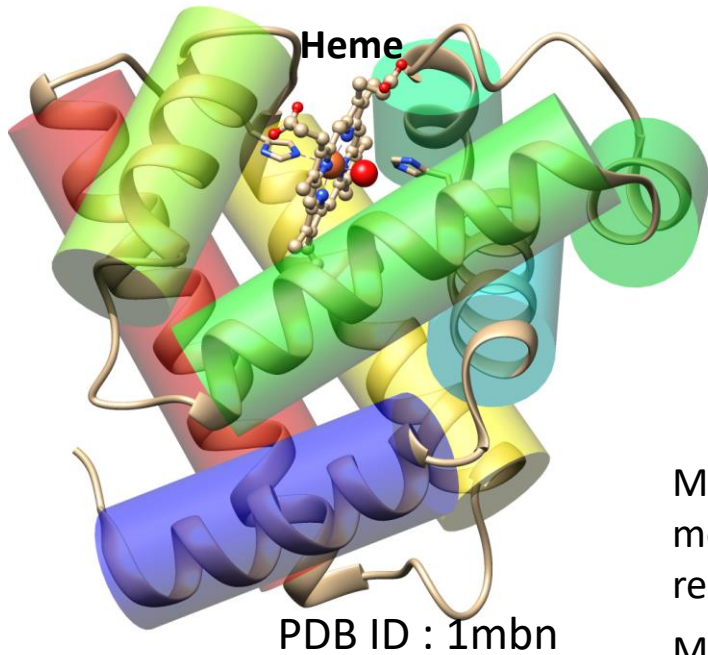


# Paper model of myoglobin

PDB ID : 1mbn Watson, H.C.,Kendrew, J.C. (deposition : 1973-04-05) X-RAY DIFFRACTION(2Å)



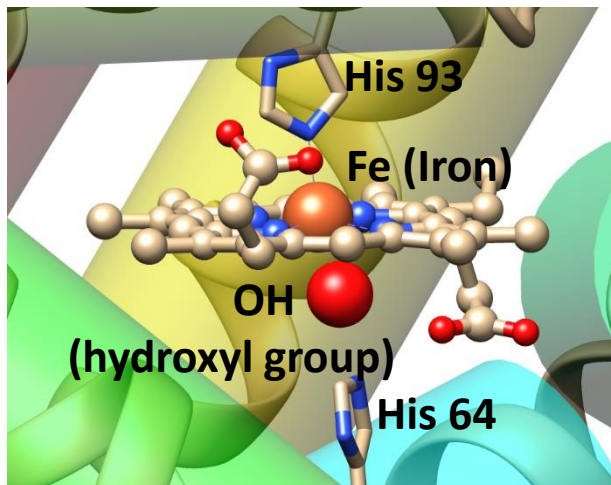
## Myoglobin of Sperm whale

Myoglobin is an oxygen-binding protein working in muscle. It is similar to hemoglobin, working in blood. Myoglobin and hemoglobin belong to the same family, called “globin”.

Marine diving mammals such as whales and dolphins have a large amount of myoglobin in their muscles, because they have to stop the breath and use storing air during diving. We, human, also have myoglobin in our muscle.

Myoglobin is made up of eight  $\alpha$ -helices. The  $\alpha$ -helix is a common motif in protein structures. In the paper model, an  $\alpha$ -helix is represented by a paper cylinder.

Myoglobin binds to a heme molecule. An iron atom (Fe) is located in the center of heme, two histidines (His) are placed above and below the iron. Oxygen molecule binds between the Fe and His.

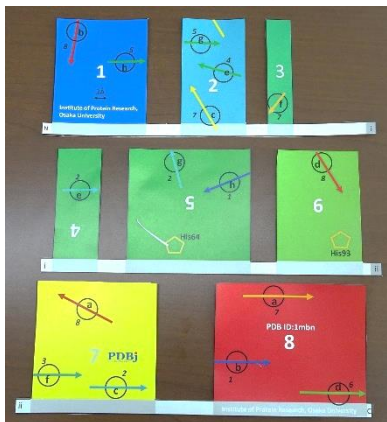


Around the Heme molecule

Myoglobin was the first protein to have its 3D structure solved. In 1958, John Kendrew in UK solved the structure by X-ray crystallography. The shape of the myoglobin was irregular, which was different from the beautiful double helix structure of DNA solved in 1953. People called it “sausage”, “worm-like”, “abdominal viscera”, and “a dog quietly huddled up”. Later, scientists revealed that all the proteins have their own irregular and unique structures. Kendrew shared the 1962 Nobel prize with Max Perutz. **2021/09/06**

# Build a Paper Model of Myoglobin

(1) Cut out three pieces of paper (outlined in solid line)



(2) Roll up 8 colored rectangles so that gray regions are hidden, and tape over the edge to make 8 cylinders.



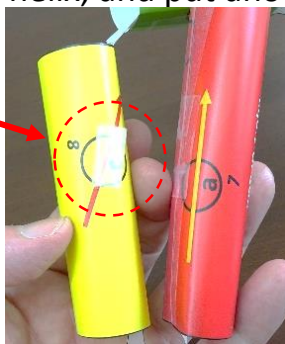
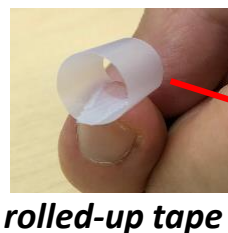
(3) Tape together the two ends marked as **i**. Similarly, tape the ends **ii**.



(4) Tape helices **7** and **8** so that circles **a** and the orientations of the red and yellow arrows are aligned. Prepare a **rolled-up tape**, and put it on the circle **a** of one helix, and put another helix on it.

(5) Tape helices **1** and **8** on the circle **b**, and tape helices **2** and **7** on circle **c**.

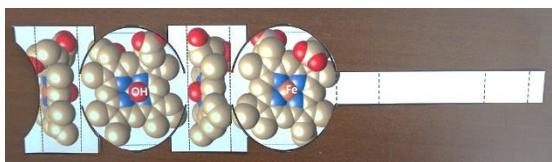
(6) Similarly, tape the circles **d**, **e**, **f**, **g**, and **h** to make a globin-fold.



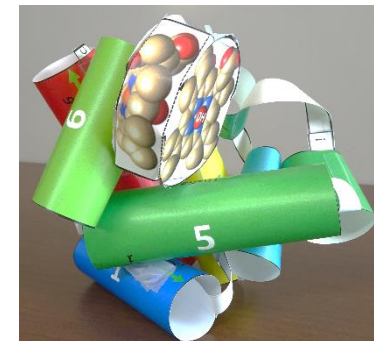
(7) Cut off a piece of paper for Heme in solid line

(8) Mountain-fold the paper on the dotted-lines. First, tape the long rectangle at the right to make a U-shaped bridge. And tape all the 8 trapezoids to make an elliptic cylinder.

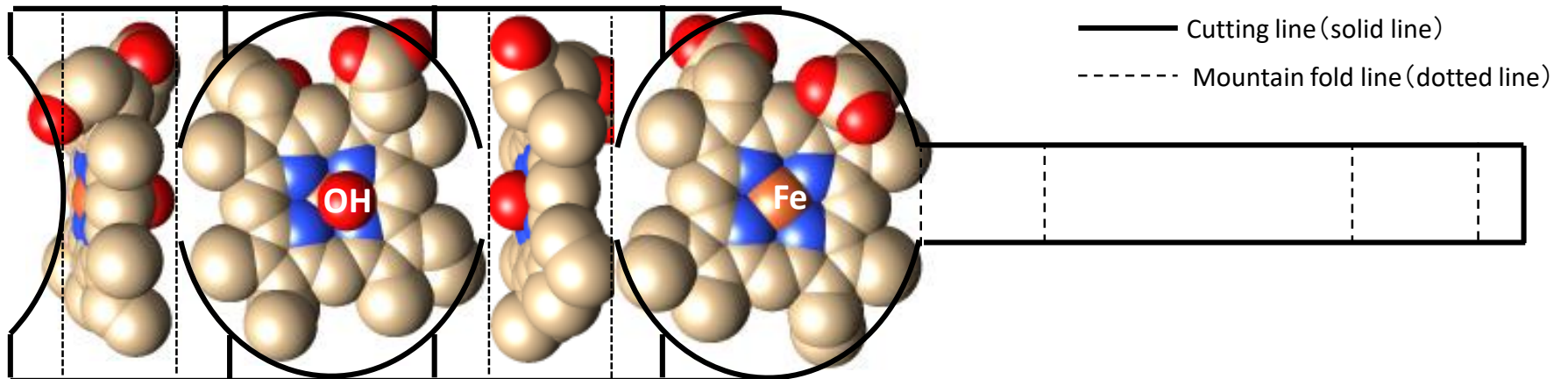
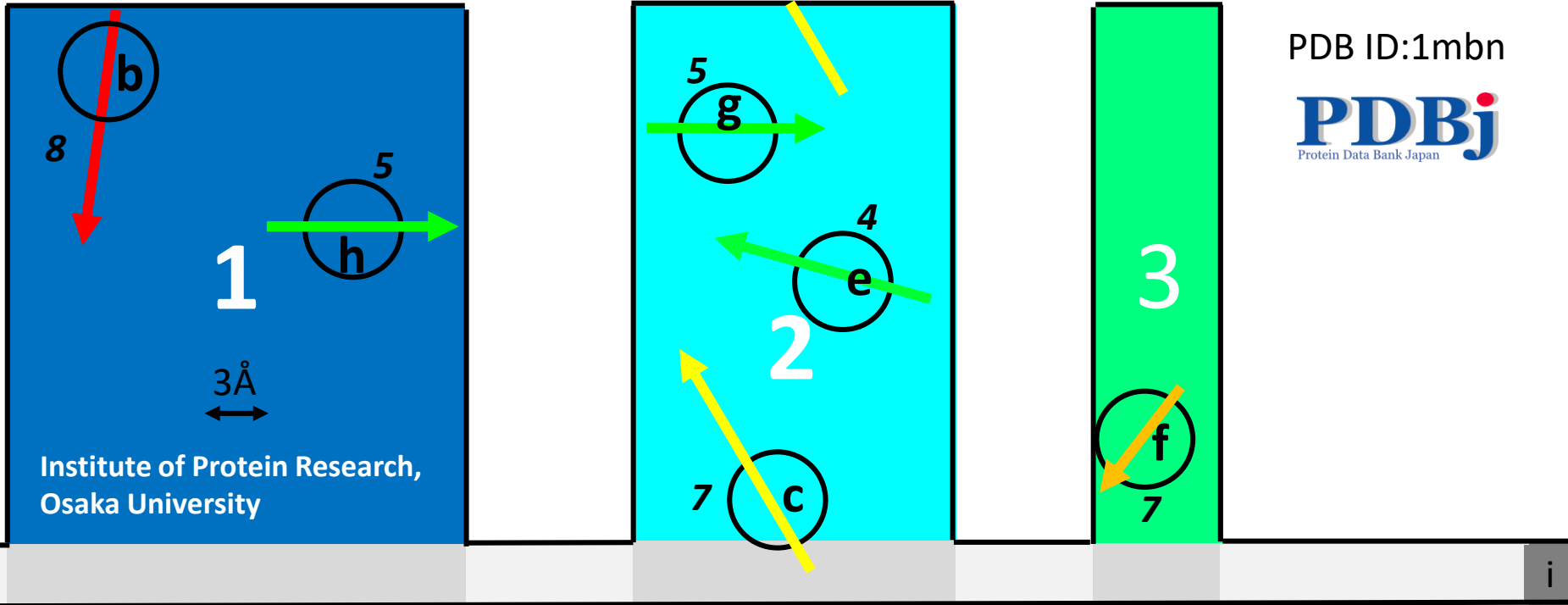
(9) Put the Heme in the globin

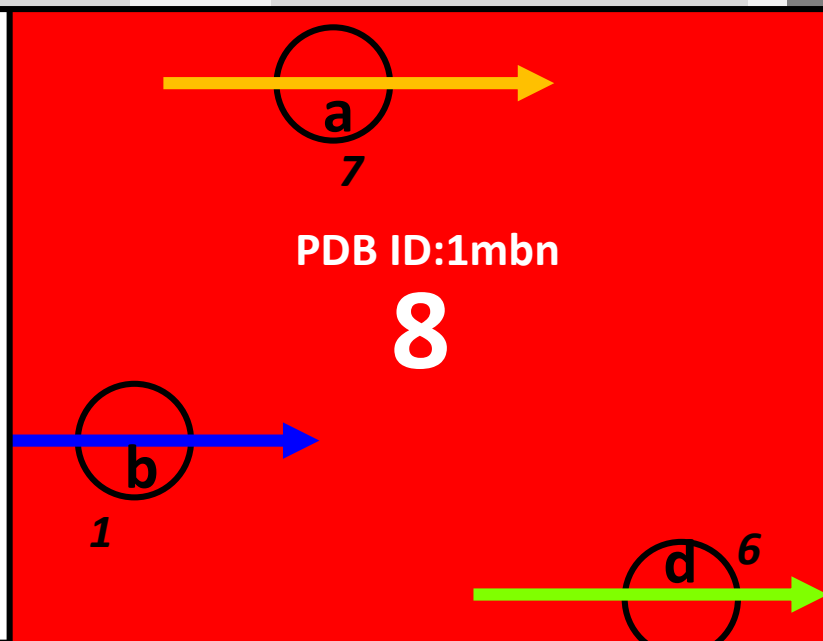
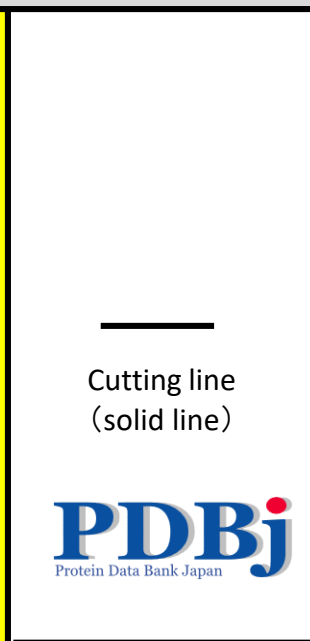
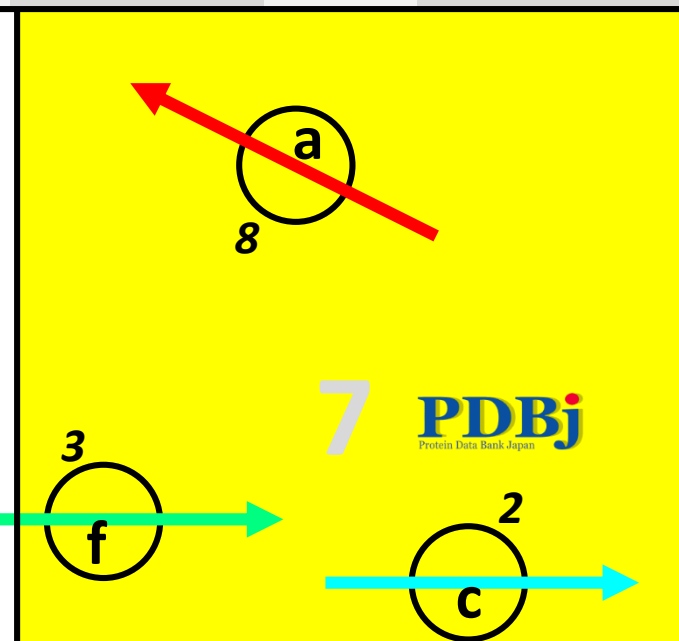
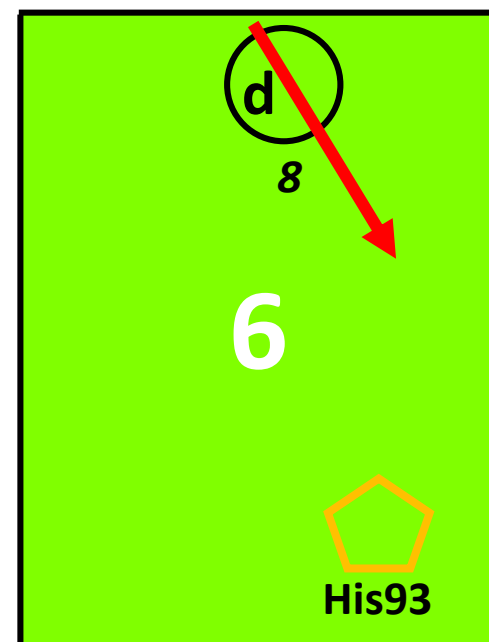
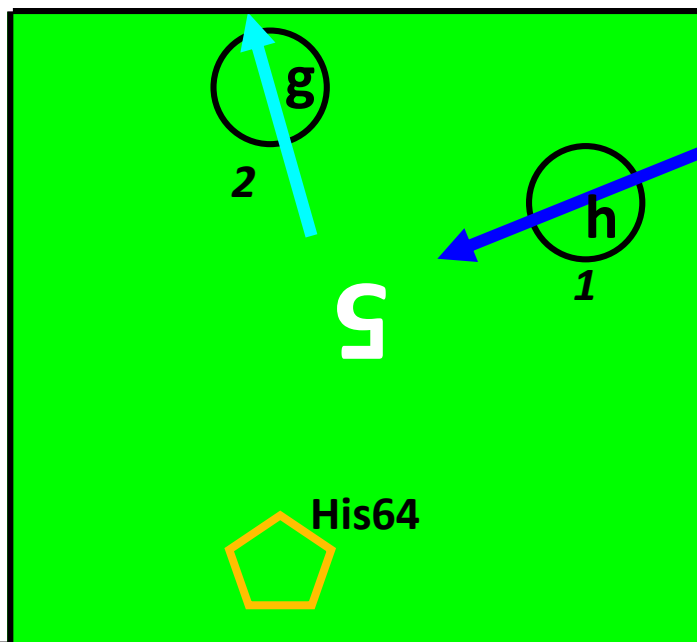
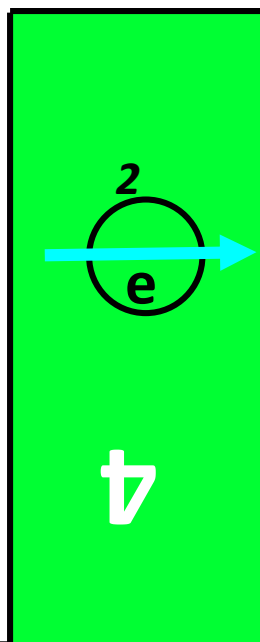


NOTE: If you can't fix Heme, tape **Fe** on Heme to **His93** in globin.



# Paper model of myoglobin





i

ii

ii

C