**Gas Exchange in Insects**

Air, close, Tracheae, oxygen, cuticle, open, tracheoles, walls, gases, CO2, spiracles, opposite, internal muscles, abdomen, contractions, haemolymph, O2, internal muscles

The breathing tubes or tracheae make up a branching system carrying oxygen from the atmosphere to all parts of the insect’s body. They are lined with a thin layer of cuticle, thickened in spiral bands, this thickening keeps them open against the internal pressure of the body fluids. The tracheae branch repeatedly until they end in very fine tubes or tracheoles, which penetrate the tissues of the body. The walls of the tracheae and tracheoles are permeable to gases, oxygen can diffuse through them to reach the cells and carbon dioxide can diffuse in the reverse direction into the tubes.

The tracheae open to the atmosphere by pores called spiracles. Often there is one spiracles on each side of every segment of the body, but in some insects there are only one or two on either side. The entrance to the spiracle is usually supplied with a muscle which enable it to open and close. The spiracles close when the insect is not active and therefore needs little oxygen and this closure helps to reduce the loss of water by evaporation from the internal tissues.

The movement of oxygen from the atmosphere through the breathing tubes to the tissues and of carbon dioxide in the opposite direction, can be accounted for by simple diffusion. In active insects however there is often a ventilation process, which exchanges up to 60% of the air in the tracheal system. Ventilation is brought about by rhythmic contractions of the abdomen, produced by the contraction and relaxation of the internal muscles The compression of the abdomen brings about a rise in pressure in the haemolymph, which squeezes the tracheae along their length like a concertina, expelling air from them through the spiracles. When the muscles relax, the abdomen spings back into shape, and the trachea expand and draw in air.