Factors Affecting Hatching

**Humidity**
The relative humidity under a sitting hen is regulated by the amount of water lost from within the eggs as well as that evaporated through the hens skin during the incubation process and not by external factors. The avian egg, composed primarily of compacted calcium carbonate crystals, has microscopic pores through which this moisture escapes. As the humidity rises under the hen, it creates an internal and external homeostasis where not too much moisture is lost or too little retained for proper growth and hatching. Over the full course of development, the amount of water, which must be disposed of, equals about 15% of the eggs initial weight. Failure of the egg to lose this water results in `water babies'. While some of these babies do survive in the larger parrots, they typically require assistance in hatching and medical interventions. In Budgerigars, most die prior to hatching. Approximately 3% of the number of eggs laid in an aviary will fail to hatch because of dehydration due to defective egg shells. Because the actual birdroom environment has little effect on the developing chick, it is unnecessary to modify the aviary temperature and humidity. Spraying or misting eggs and placing damp materials such as a sponge under the nest block in an attempt to raise the relative humidity in the nest box interior is also an unnecessary and potentially harmful practice. Misting can cause chilling of eggs while introducing damp materials can create a medium for bacterial growth which may penetrate the shell and cause addling; the death of the embryo prior to its hatching date. While these practices are not the only cause for chilling of eggs and infection in eggs, it is highly likely that they account for a portion of the estimated 25% of early embryo deaths.

**Rotation Of Eggs**
As each egg is laid, the hen sets up a systematic routine for rotating them. In the early stages, the eggs are rotated more frequently than at the latter stages. This action reduces the risk of the yolk adhering to the sides of the egg.

Temperature
The incubation temperature must also be reg-ulated and balanced by the hen. As an embryo develops, it begins to generate its own heat which reduces its need for external heat. New eggs, however, are totally dependent on the hen to provide the optimum temperature for growth. One way that the hen meets this challenge of variable incubating temperatures is to place the first eggs laid on the outside of the clutch while new eggs are more centrally positioned. As all of the eggs mature and less overall external heat is required, she will sit less tightly and move off the eggs more frequently allowing more air to flow over them. While maintaining the needed balance of heat, these actions also assist in meeting an increased requirement for greater oxygen and carbon dioxide exchange by the maturing embryos.

**Oxygen - Carbon Dioxide Exchange**
The balance of oxygen and carbon dioxide exchange occurs in much the same manner that moisture escapes and is balanced within the egg. As the embryo uses the oxygen within the egg, it produces waste gasses in the form of carbon dioxide. As the carbon dioxide level increases it is forced out through the porous membranes as new oxygen is absorbed from the environment.

**Pipping**
Approximately 24 to 72 hours before hatching, the air sac membrane drops and blood vessels in the shell membranes begin to recede. In this end stage of development, when the chick is ready to emerge from the egg, increased levels of carbon dioxide in its blood system cause the neck muscles to expand and contract bringing the egg tooth on the tip of its beak into contact with the air sac membrane. As the egg tooth punctures and tears the membrane, oxygen stored in the large end of the egg is released. Gradually, the neonate begins to switch from obtaining oxygen through the chorio allantoic membrane to circulating air through its lungs. As the newly released source of oxygen from the air sac is depleted, carbon dioxide levels in the chick's blood rise. Somewhere between twelve and twenty four hours after piercing the air sac membrane, the neck muscles again begin to work forcing the egg tooth into the shell itself. Once chipped, air enters rapidly oxygenating and strengthening the chick.
After resting, the chick in a combination of repetitive jerking motions of the head, and rotation of its body, cuts and pips a circular path around the central circumference of the egg until the shell is weak enough that it can be pushed apart.
If the chick were to die in this process, as a result of being too weak to complete the task, excessive fluid in the egg, failure to puncture the air sac or because of the drying of internal membranes, which prevent it from exiting the shell, it is referred to as "dead in shell". Up to 8% of embryo death is attributable to dead in shell conditions.

**Assisting Chicks in Hatching**
It is possible to assist a chick out of the egg but the timing of this is important. It is not until the 18th day that the final traces of yolk are absorbed into the chicks abdomen and the umbilicus is sealed shut. Assisting the chick before that time will cause its death. Often, you can candle the egg to see if the yolk sac has fully retracted and that membranes below the shell no longer contain viable blood vessels.
The actual time from which the first expansion of the neck muscle broke through the shell until the chick emerges from the egg can vary from 48 to 72 hours. Initially, you may hear a quiet tapping or even weak squeaks, and find a fine crack, group of cracks or crack plus a tiny hole in the shell. This is the beginning stages of the hatching process and no action is required. If you can hear loud squeaks, see creamy off white patches on the shell with a crack line around its circumference, and detect moist membranes you are observing the latter stages of a normal hatching and it is not necessary to assist the chick.
If you can hear loud squeaks and find a widened crack line around the circumference of the egg or a large hole in the egg, and can observe a dried or drying membrane, then you can assist the chick, as it is having difficulties. To do this, take a haemostat or tweezers and gently work your way around the crack line with the air sac end in an upright position. You will be able to see the position and movement of the chick as you do this. Once having separated the egg, most chicks will be pushing and forcing the shell apart. If this is the case, gently return it to the nest box and the chick and hen will do the rest.
If on the other hand, the dried membrane has adhered itself to the chick or shell, moisten a cotton swab in sterile saline solution and place it on the membrane. This will loosen it enough so that you can remove the chick safely from the shell. If there is slight bleeding at the navel, swab the umbilicus area with a 1% solution of Betadine and place the chick in the nest box. If the egg sac has not completely retracted, you should leave the chick in the bottom part of the shell and place it in an upright position. This sometimes works as it allows extra time for the yolk to retract.