PRINCIPLES OF PLASTINATION
FORCED IMPREGNATION.

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Forced impregnation is another important step of plastination. Successful impregnation is possible only after complete dehydration with acetone. If ethanol has been used, the dehydrated specimen must have been saturated with an intermediary solvent. As various polymers are available and each requires a slightly different process, we will discuss impregnation with silicone polymer. The silicone polymer [S10 (Biodur SR10) or S15 (Biodur SR15] is mixed with a process of end-to-end linkage of the molecules. At room temperature, this linking is hastened. Therefore, the polymer mix (S10 + S3) may only be utilized for a few weeks before the polymer mixture turns into a viscous blob and a few more weeks into a solid block. For this reason, the silicone mixture is kept at -15°C. This temperature is sufficiently cold to retard the end-to-end linkage but not prevent it from occurring at a later time when the specimen is brought to room temperature. It is desirable to have end-to-end linkage of the silicone molecules which enhances the flexibility of the final product. Hence, when kept cold, the polymer maybe used for many years. Once the mixture is prepared (1 part S3 to 100 parts S10), it is placed into a vacuum chamber which has been placed in a deep freezer. The dehydrated specimens are submerged in the polymer. It is necessary to place a mesh on top of the specimens to keep them submerged. The specimens are allowed to stand in the polymer mix over night and hence equilibrate with the polymer. The next day the vacuum is increased gradually over a period of 3 - 5 weeks until nearly total vacuum (one atmosphere) has been reached. This gradual increase in vacuum allows the solvent which has a lower partial pressure (boiling point , e.g.; acetone: +56°C and methylene chloride: +40°C), than that of the polymer mix, to be extracted from, the specimen and evacuated through the exhaust system of the pump. The loss of the intermediary solvent from the tissue results in a pressure difference between the interstitium of the specimen and the polymer mix allowing the polymer to be drawn into the tissue. The extraction of the volatile intermedium must be slow enough to allow sufficient time for the polymer to enter the specimen. Extraction of intermedium is monitored by observing bubble formation on the surface of the polymer mix. Acetone bubbles are about 1 cm in diameter. Methylene chloride bubbles are slightly smaller. When boiling is too fast, the polymer does not have enough time to flow to all parts of the specimen. This may allow the structural framework of the tissue to collapse and the specimen may shrink. Vacuum is controlled by a needle air inlet valve (Biodur HI 14) which allows a sufficient amount of room air to be pumped in and hence, not extracting too much air from the plastination unit to cause the vacuum level to increase rapidly. As an alternative, a valve may be placed in line and slowly opened to allow incremental evacuation of air and acetone from the unit. A pump with a pumping speed of 25L/ min (0.9cfm) is adequate for most plastination units. Since methylene chloride is more volatile, it will be pumped off at a lower vacuum than acetone will. Impregnation may be considered complete when the vacuum level has stabilized around 5 mm of Hg. Generally around 5 mm, the bubbles have become larger (2 - 3 cm) and are mostly water vapor. However, some acetone will continue to be pumped off until 1 mm of Hg is reached.