The Biology of Drowning

The human body is slightly heavier than fresh water. Consequently, when unconsciousness takes place, the body sinks. Fat bodies are slightly more buoyant than thin bodies, but still all bodies will sink in fresh water. If there is considerable clothing on the body along with shoes, articles in the pockets and other paraphernalia, it renders the body considerably less buoyant. The question is often asked, "When a body sinks, how far down will it go?" There is some dispute on this point, but the very best evidence indicates that a body will go to the bottom regardless of how deep the water may be, unless it meets with some obstruction or upward current which tends to prevent it. As a body sinks into deep water, the pressure of the water tends to compress gasses in the abdominal and chest cavities with the result that the body displaces less water as it sinks deeper and consequently becomes less and less buoyant, the further down it goes.

Almost without exception, a dead body lying on the bottom of a river or lake will come to the surface again. This is due to gas formed in the body tissues as decay occurs. When enough gas has formed to inflate the tissues and distend the skin, the body becomes lighter than water and rises to the surface. This process is due to the action of bacteria within the body. Consequently, the length of time that elapses before the body rises depends not only upon the amount of fat contained in the tissues but on the temperature of the water. If the water is warm, the formation of gas within the body occurs rapidly and the body may rise to the surface in a day or two. However, if the water is cold, bacterial action takes place very slowly and it may take several weeks before the body appears on the surface. When a body is fully distended it is almost impossible to sink even with counter weights.

A frequently asked question is, "When a person drowns, where may you expect to find the body and if it later comes to the surface, where may you expect to find it?" When a drowning occurs in a river, the most common mistake is to search for the body too far downstream. Sinking takes place immediately, which results in the victim reaching the bottom close to the point he was last seen on the surface. When the body begins to rise, it will appear on the surface not far from where it disappeared.

If drowning takes place when a river is swollen, the supposition is that the rapid current will carry a body along before it strikes the bottom or encounters an obstruction. The fact is that the current on the surface is entirely different from the current on the bottom. While the speed on the surface may be 10 knots, current speed will decrease with depth. There is virtually no current on the

bottom. Consequently, the deeper a body sinks the slower is the current acting upon it until it reaches the bottom were it will stay. It is rare that a victim is found downstream more than a few hundred yards from where it disappeared, and more often than not the body is recovered in close proximity to where it disappeared. It is true that when the body begins to rise to the surface after several days it may drift a considerable distance from the site of death.

The modern medical view of drowning was derived from studies ordered by the US Army during World War II in an attempt to save the lives of fliers who parachuted into water or ditched their airplanes.

The studies indicated that the main cause of death from drowning in fresh water is the explosive dilution of the blood with water from the lungs. This dilution resulted in rapid failure of the bloods ability to carry oxygen resulting in oxygen deprivation in critical areas and asphyxiation.

The studies showed dilution occurred so quickly that after three minutes of submersion, the blood of experimental animals was diluted with an equal volume of water.

In salt-water submersion, an opposite effect occurs. The brine in the lungs acts through osmotic pressure to remove large amounts of water from the blood. In three minutes, experimental animals loss 40% of the normal water volume in their blood. This over concentration of blood can cause heart failure. Additionally, seawater chemicals pass quickly into the blood stream through the lungs disrupting normal fluid balances.

In either case, death from submersion occurs quickly, often in two minutes or less, depending on the physical status of the victim and other factors. In many instances, victims removed from the water alive later die from the delayed effects of submersion.

The usual sequence of events in a drowning is as follows:

Upon submersion, the victim holds his breath until forced to inhale. He gulps water. The water induces spasms of the larynx, which closes of the trachea to protect the lungs. Little water enters the lungs. With the trachea blocked by laryngospasms, no fresh air enters the lungs and the supply of oxygen begins to fail. Lack of Oxygen, anoxia, affects the brain within 30 seconds the laryngospasms begin to weaken with imminent brain failure.

The victim then inhales again, this time aspirating water into the lungs before a fresh spasm closes the trachea again but for a shorter duration. With each successive inhalation, more water is aspirated; anoxia increases, and laryngospasm duration decreases until they are finally abolished and the lungs are filled with water.

If drowning reaches this point, the chance of resuscitation is poor. While spasms are still occurring and protecting the airway, resuscitation efforts are more likely to succeed. Recovery is such cases may occur spontaneously.

For the person confronted with an unconscious individual freshly removed from the water, anesthesiologists have recommended the following guideline:

If the victim is breathing, he will recover spontaneously and resuscitation is not required. If the victim is not breathing, the pulse should be checked. If there is a pulse, begin mouth-to-mouth resuscitation. If there is no pulse begin CPR.

Rapid recovery of a drowned person is of vital importance to the victim's family and local law enforcement. Insurance settlements, pensions, contracts and estate problems may be delayed indefinitely pending recovery and identification of the body.