



# The Second Law of Thermodynamics

by William MacPherson

One of Creationism's favorite canards is that Evolution can't be true because it violates the Second Law of Thermodynamics. A full refutation of this moonshine would have an extremely soporific effect on the general reader and could even put a scientist to sleep. Within my understanding of Thermodynamics, I will attempt to explain the argument in as straightforward and intelligible a manner as possible. Most of the engineers I know, when they first heard this argument, scratched their heads and said "Huh? Evolution and thermodynamics don't have anything to do with each other" And they don't, but you can judge for yourself.

In layman's terms, thermodynamics states that when a hot body is brought into thermal contact with a cold body, the hot body cools and the cold body warms up. The same is true of pressure. A gas will always migrate from an area of high pressure to one of low pressure. (You can feel the effects of that in Albuquerque when there is a high pressure system on the other side of the mountains and a low to the west. The winds through the mountain passes at these times are a marvel to behold.) The Second Law states that whenever two systems are not in thermodynamic equilibrium, work can be produced. If the systems are in thermodynamic equilibrium, no work can be done. The Second Law tells us how to calculate the theoretical efficiency of a heat engine. Finally, and this may seem obvious, but it is impossible to merely extract heat from a source and produce work, you must have a reservoir that is colder than the source into which to expel heat.

The Second Law leads us to the concept of entropy. Entropy is defined as the amount of heat entering or leaving a body reversibly, divided by the body's absolute temperature (Kelvin Scale.) If heat enters a body, entropy is positive, if it leaves entropy is negative. It is the Creationist view that entropy is always positive. Positive entropy equates to greater disorder in a closed irreversible system. For instance, if salt is dropped into a glass of water, the structure of the salt crystals will dissolve and the salt molecules will become more disordered. No amount of waiting will suffice to have the salt dissociate itself from the water. Therefore, say Creationists, Evolution is impossible because it says that life forms have increased in complexity over time when it is the natural order of things for complexity to decrease and disorder to increase. The Creationists claim that before the "Fall" God kept entropy at bay and disorder did not increase with time. After the fall everything started to age. Rather imaginative, don't you think?

This bit of pseudoscience is refuted by the facts. First of all entropy only increases irreversibly in a closed system. The Universe as a whole is a closed system for there is neither a source from which energy can be introduced nor a sink into which energy can be expelled. The Earth, on the other hand is an open system, and receives energy constantly from the sun and produces abundant energy from its

molten core. It likewise expels heat out into space. Entropy is constantly being reversed all the time here on Earth. The refrigeration cycle is a good example of negative entropy, a tray of ice cubes is order itself, the formation of snowflakes is another. While I'm not sure of the exact Thermodynamic processes involved in the development of a single celled zygote into a human baby, you can be sure that the end result is more complex than the starting point and represents a definite decrease in entropy. If you put the above mentioned glass of water in front of a window and let the Sun shine on it, the water would eventually evaporate leaving the salt once more in a solid condition. If this didn't happen rain would be salty.

Creationists are not satisfied that religion holds the preeminent spot in the world in discussion of morals and ethics. For the Creationist the Bible must be literally true if the moral message is true. This is very unfortunate since it leads them to stretch scientific facts to the breaking point and invent fanciful "Theories" to try to reconcile the Bible with the real world. Most mainstream religions have come to the conclusion long ago that the Bible stories are meant to convey lessons and are not to be taken literally.