

# The Flexible Magnetic Pad

## Principles of Operation

copyright © 2009 Nu-Magnetics, Inc.

The operation of the magnetic therapeutic pads is based upon laws of physics which are a part of a field of study commonly known as electromagnetism. The *Hall Effect*, first described in 1879, characterizes the behavior of charged particles moving through a magnetic field. This **Hall Effect forms** the foundation of the principle of operation of the therapeutic magnetic pads. The **Hall Effect** states:

*... A voltage is generated perpendicular to a flow of charged particles moving through a magnetic field when that flow is directed perpendicular to the magnetic field.*

This relationship can be expressed mathematically as:

$$E = Kn \ qB,v$$

where

E = The Hall voltage

K = a proportionality constant (fudge factor)

n = the number of charged particles

q = the electric charge of each particles

$B_1$  = the magnetic flux density of the perpendicular magnetic field

v = the velocity of the moving charged particles

Since the magnetic pads are used therapeutically, the discussion will be limited to the Hall Effect as it applies to systems of the human body which serve as a source of moving charged particles in the blood and extracellular fluid, (lymphatics).

Blood is replete with ions which are present as a result of the dissociation of commons salts found in the body. One such salt, NaCl, will be used here for illustrative purposes. Since blood is a fluid medium composed of water. NaCl contained in the into its ionic components  $Na^+$  and  $Cl^-$ .

See Figure 1.

As illustrated in the diagram. (Figure 1) these ions will

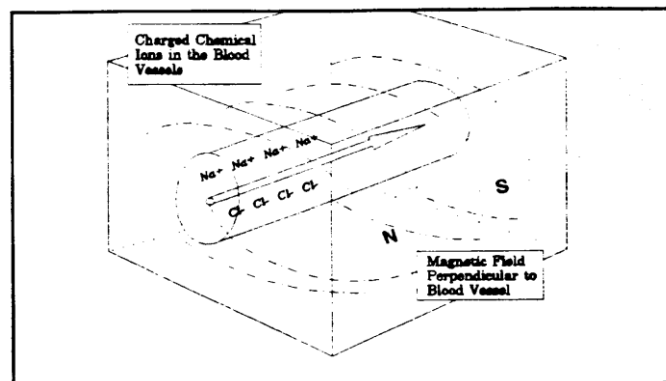


Figure 1

move with a certain velocity depending on the diameter of the blood vessel and the blood pressure.

As the ions pass through a magnetic field in a perpendicular direction to the field, they experience a voltage which drives them apart in opposite directions perpendicular to both the magnetic field and the direction of blood flow.

See Figure 2

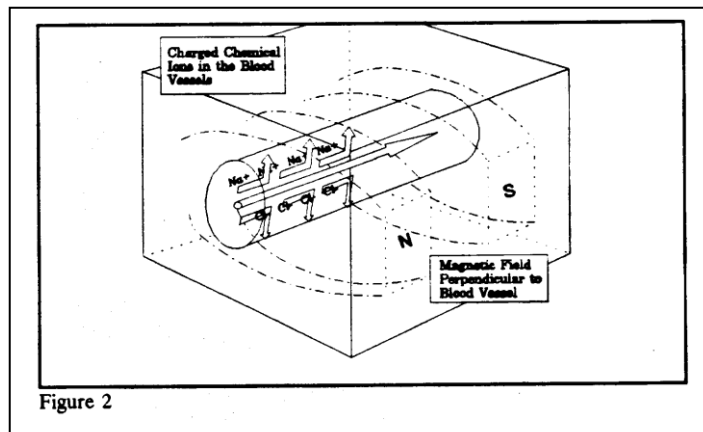


Figure 2

Since the ions are now moving under the influence of a voltage they become, in effect, an electric current whose magnitude is determined by the universal formula of electricity, Ohm's Law:

$$\text{electric current} = \text{Voltage} / \text{Resistance}$$

The ions soon encounter an infinite resistance, the walls of the blood vessel, thus causing the current to suddenly drop to zero. To overcome this limitation, the therapeutic magnetic pads utilizes alternating magnetic

poles which cause the ions in the blood to move in alternating directions, thus avoiding current interruption by the blood vessel walls. Figure 3.

The therapeutic value of the magnetic pads lies in the fact that the by product of current and resistance is heat. This heat is qualitatively represented by a well known formula of electricity:

$$\text{heat dissipated} = (\text{electric current})^2 \times \text{Resistance}$$

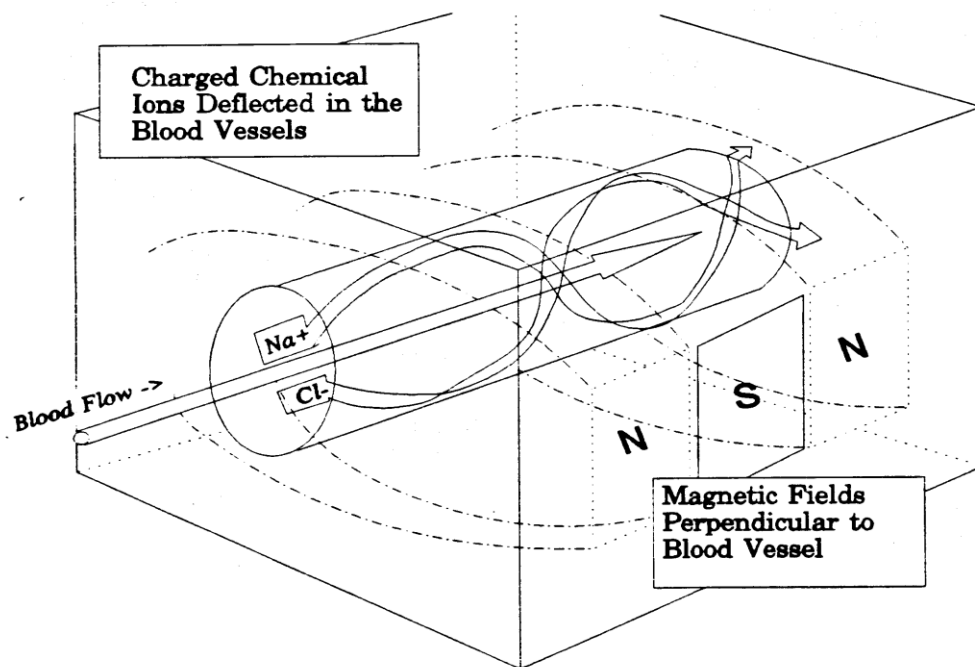
In most electric circuitry this heat is unwanted because it detracts from the electrical efficiency of the circuit.

However, for the purposes presented here this heat has a very important use. Heat, applied to afflicted areas of the body, such as sore muscles, tends to relieve pain and promote healing. Medical science explains that this effect occurs because the heat

compels a widening of the blood vessels, vasodilation, which in turn causes an increase in blood flow. This increase flow allows more oxygen and nutrients to reach the area and a greater flushing out of metabolic wastes.

Previous modalities of heat treatment, such as heating pads, are limited in their effectiveness because they provide heat from the outside in. Externally applied heat loses most of the heat to the outer layers of skin and tissue before reaching the desired area. The magnetic pads generate heat from the inside of the blood vessel itself, producing the desired effect where it is needed most. \*

Since the device uses permanent magnets it can be used indefinitely without need of a recharge. Being light weight and compact, the device assures adequate comfort to the user. All these facts indicate that the magnetic therapeutic pads are a very effective and practical device.



Typesetting, layout and graphics by Dr. Matthew Newman, M.D./ Tacoma, WA 98403

*\*Although the heat generated by magnetic stimulation is relatively small, thermographic testing has shown a definite increase in temperature in the areas affected by these magnetic pads. Whether this temperature rise is a direct or indirect result of the magnetic field's influence on the ionic flow in the blood remains an open question.*