Biophysics

second lecture

Diffusion and directed transport.

Second stage

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1- Diffusion and directed transport

1-1 Forces and Flows

A detailed derivation of the laws governing the thermodynamic and kinetic properties of biophysical systems was presented by Katchalsky and Curran (1975). In covering the salient points of this area, the force and flow equations presented here have a detailed, formal development in that book. Biophysical systems are not static: they are subject to various forces, and respond to those forces with movement. Thus, there is a direct link between force and flow. Students are exposed to this concept in their initial exposure to electrical physics, in the relation between current I, resistance R, conductance C and voltage **V**:

$I = \frac{V}{R} = CV$……..(2.1)

The voltage is the force, and the current is the flow. An equation applies to the

flow of blood F, the blood pressure P and the resistance R:

$F = \frac{P}{R}$ ……..…(2.2)

Each of these relates a flow to a particular driving force. Newton defined the

relation of force, mass and acceleration for an object in a vacum with no friction

$f = ma$……(2.3)

conditions that do not apply to physiological systems. When friction is also

considered, the relation becomes :

$F = ma + fv$…….(2.4)

with the force f having both acceleration and velocity components. When the

acceleration is damped out or the mass is so small as to make main significant,