For a number of years there has been some dispute about the lubrication mechanisms which exist in human joints. Some workers claim that boundary lubrication (Jones, 1934. Charnley 1959, 1960. Linn and Radin 1968.) is the main mechanism, while others say that fluid film lubrication is more important (MacConaill, 1932. McCutchen 1962. Dintenfass 1963. Dowson 1966. Tanner 1966).

Before discussing the merits of these suggestions we ought to examine some physical characteristics of these types of lubrication.

**Boundary Lubrication.**

**FIGURE 1.**

Figure 1 shows diagramatically how polar active long chain molecules may attach to surfaces which are sliding over one another and provide a low shear strength layer to reduce the friction caused by sliding. These adsorbed layers protect the surfaces as well as reduce the friction.

They behave like solids in terms of their frictional response to sliding in that they exhibit a constant coefficient of friction no matter what the sliding speed.
Fluid film lubrication.

Figure 2 shows 3 types of fluid film lubrication. The first two are self generating types of fluid film whilst the third is a squeeze film lubrication. However the essential feature is that the opposing surfaces are completely separated by a fluid film. This eliminates wear and reduces friction.

a) **Hydrodynamic lubrication**

To produce this type of lubrication it is necessary that one surface be inclined to the other and that one surface is sliding in such a way as to cause fluid to enter the converging wedge so formed. This would cause the fluid film to generate a pressure which can support a load (Reynolds, 1886). The thickness of the fluid film so formed depends on the viscosity of the lubricant and the speed of sliding of the surfaces.

b) **Elasto-hydrodynamic lubrication**

This can be considered as an extension of hydrodynamic lubrication. The same conditions have to be fulfilled the only difference is that the boundary surfaces are allowed to deform, as in real human joints, and this modifies the film shape and gives a thicker fluid film for the same fluid, load and sliding speed.

c) **Squeeze film lubrication**

In this case it is not necessary to have the surfaces sliding one over the other. Here the important feature is a changing load. Consider two plates separated by a fluid. If we put a load onto one of the plates, retaining the other stationery, the fluid will start to squeeze out but due to the viscosity this will take some finite time.

This process takes place every time the load changes and so squeeze film action can act as a powerful buffer against surface contact even though this only lasts for short periods of time at once.

Squeeze films are important therefore under conditions of fluctuating loads.