

# ***Biophysics***

Third lecture

**Brownian motion**

**Second stage**

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## Brownian motion

Brownian motion: is the random motion of particles suspended in a medium (a liquid or a gas).

Biological molecules are not all spherical, of course. Variations in the shape of the molecule will have an effect on the movement of molecules through a medium. The starting point for assessing the influence of molecular shape is to first assume the molecule is a sphere moving through a medium and measure the frictional force  $F$  as it moves with velocity  $v$ , a relation known as the Stokes equation:

$$F = 6\pi\eta r v \dots\dots\dots(1)$$

which is clearly related to frictional coefficient  $f$  above:

$$F = f v \dots\dots\dots(2)$$

Since the random collisions can move the molecule in any direction, over a long time all directions will have collisions. To measure Brownian motion then, the root mean square distance is used, similar to the discussion above on the radius of gyration. During observations of objects moving by Brownian motion, the specific position of the object is noted at each time interval  $\Delta t$ , and the distance moved  $x_i$  from the previous position measured. After  $n$  such measurements, the mean square of the distance moved is

$$\langle x^2 \rangle = \frac{\sum x_i^2}{n} \dots\dots\dots(3)$$