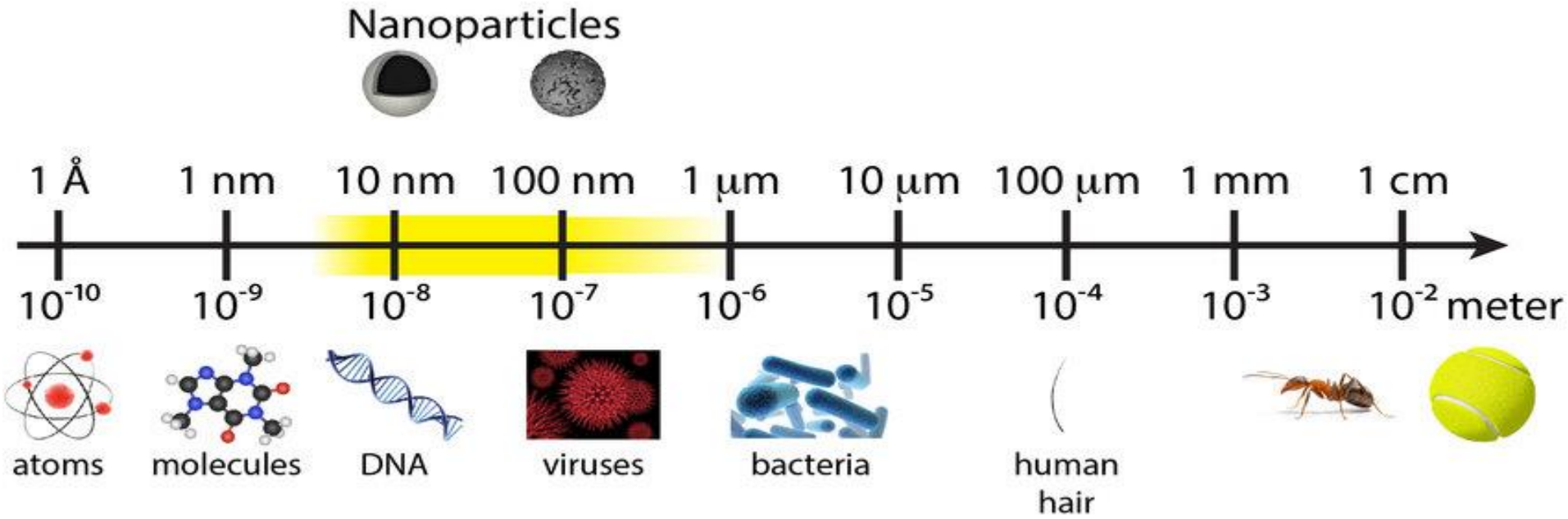
18ECO134T – Sensors and Transducers

Unit IV : Session 7 : SLO 1

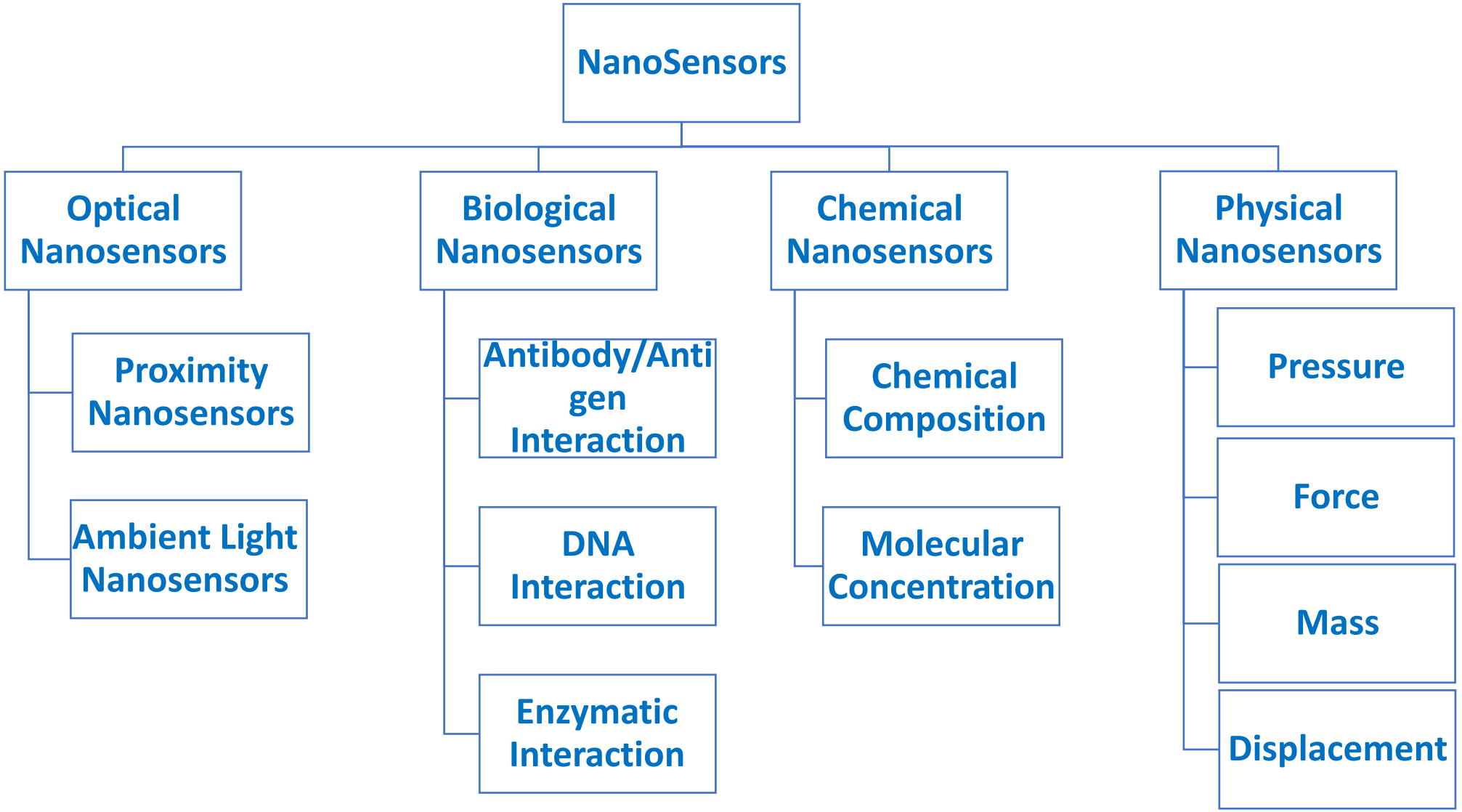
Nano Sensors

- Particles that are smaller than the characteristic lengths associated with the specific phenomena often display new chemistry and new physics that lead to new properties that depend on size
- When the size of the structure is decreased, surface to volume ratio increases considerably and the surface phenomena predominate over the chemistry and physics in the bulk
- The reduction in the size of the sensing part and/or the transducer in a sensor is important in order to better miniaturize the devices
- Science of nano materials deals with new phenomena, and new sensor devices are being built that take advantage of these phenomena
- Sensitivity can increase due to better conduction properties, the limits of detection can be lower, very small quantities of samples can be analysed, direct detection is possible without using labels, and some reagents can be eliminated.

SIZE AND COMPATIBILITY

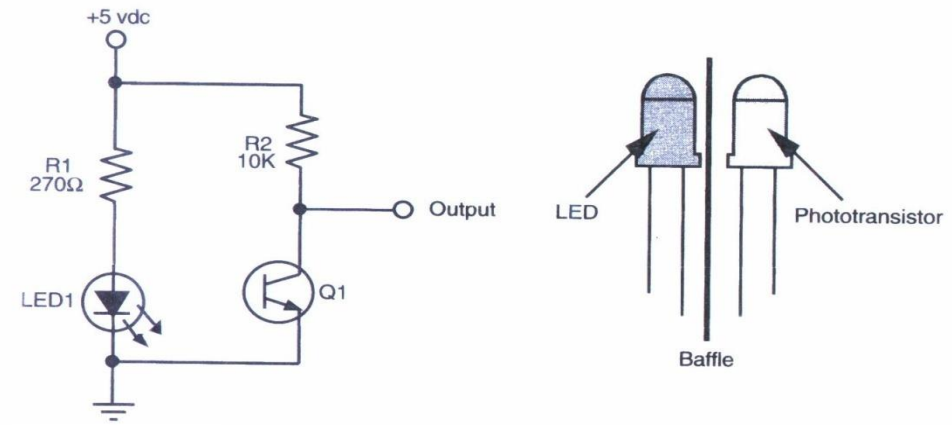


TYPES OF NANOSENSORS



Optical Sensors- Proximity Sensors

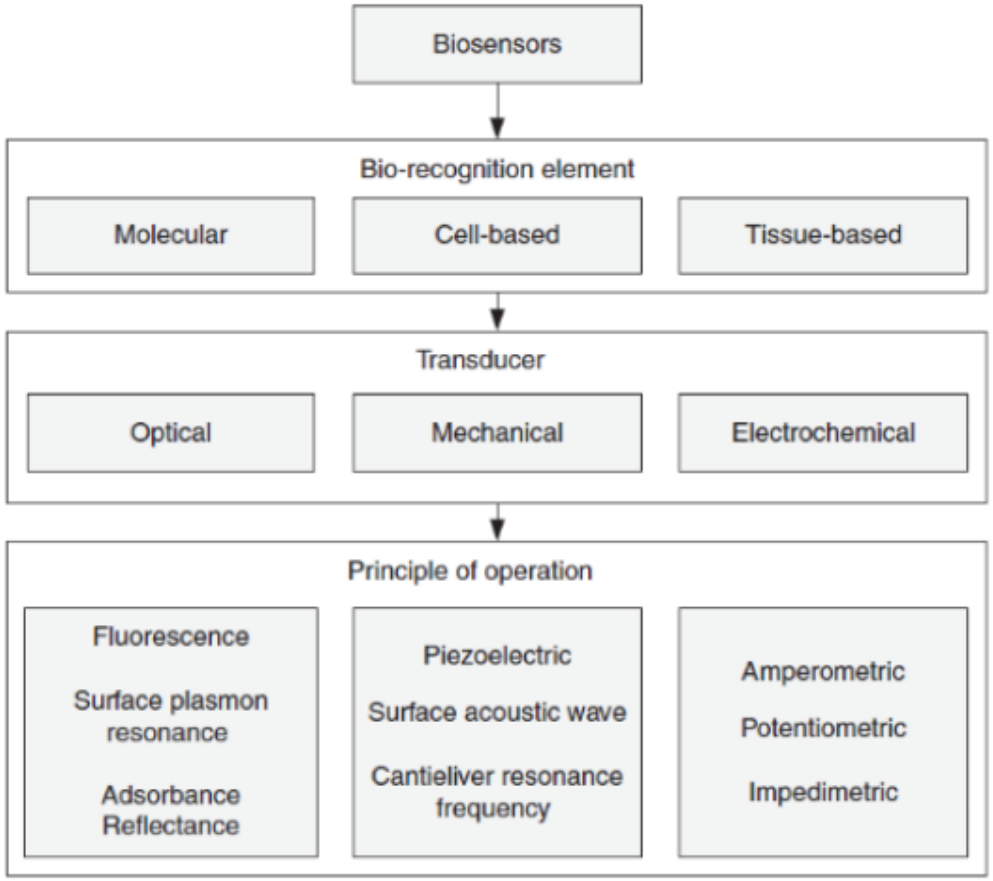
- ✓ Proximity sensors are designed for use in detecting the presence of an object or motion detection in various industrial, mobile, electronic appliances and retail automations.
- ✓ Examples of proximity sensor usage include the detection of an out-of-paper condition in a printer or a mobile phone screen that dims to save battery life when placed near a face.



The basic design of the infrared proximity sensor.

- ✓ Ambient light sensors provide precise light detection for a wide range of ambient brightness and are commonly used in LCD backlight control in mobile phones, LCD TV/panel, and notebook applications.
- ✓ One way to convert the optical signal is by using electro-optical sensors - electronic detectors that convert light, or a change in light, into an electronic signal. Light has many components that can be sensed, such as the wavelength, the intensity, the polarization and the phase. The interaction of light with matter can be quantified by measuring absorbance, reflectance, luminescence and more.

Bio-Nanosensor



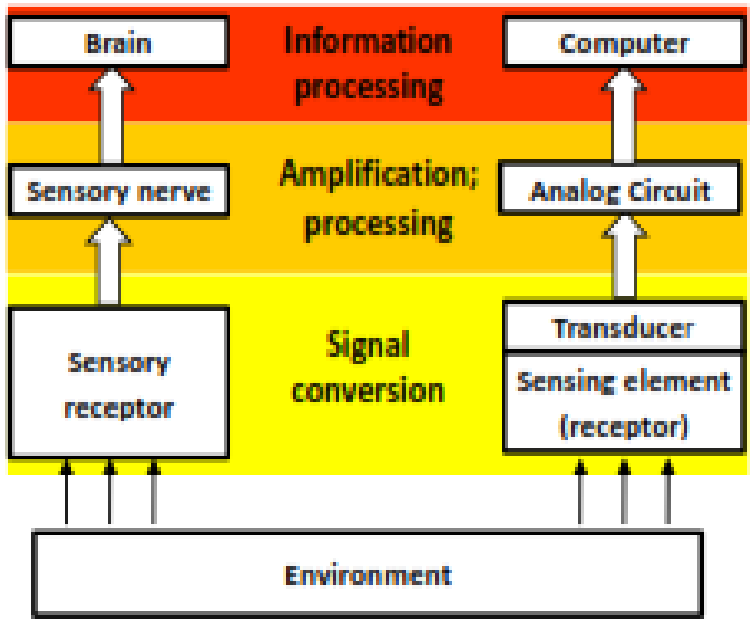


Figure 3-1: Analogy between the human sensing system and artificial sensors.

BIOSENSORS

- Biosensor: analytical device for measurement of a specific analyte
- •biological material + physicochemical transducer(electrochemical, optical, thermometric, piezoelectric,magnetic or micromechanical)

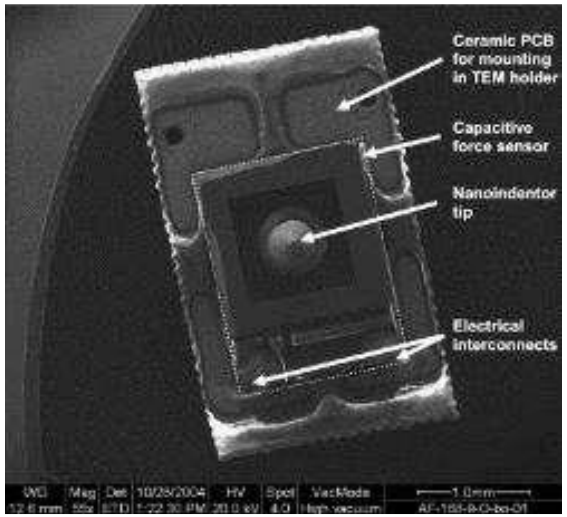
- • Nanomaterials and nanosensors increase sensitivity and detection level to pico-, femto-, atto- and even zepto- scales (10^-12-10^-21) – this facilitates helps in early disease detection.

- • Biomarkers, molecules with a function indicating physiologic or pathologic state, interact with specific receptors fixed onto the surface of a biosensor transducer.

Chemical Nanosensors

- Chemical sensors usually contain two basic components connected in series: a chemical (molecular) recognition (receptor) and a physicochemical transducer. In the majority of chemical sensors, the receptor interacts with the analyte molecules. As a result, the physical properties are altered in such a way that the appending transducer can gain an electrical signal. In some cases, a single physical object acts as a receptor and as a transducer.

- ✓ The physical nanosensor sense the environmental physical change such as
- ✓ Force
- ✓ Acceleration
- ✓ Flow rate
- ✓ Mass
- ✓ Volume
- ✓ Density
- ✓ pressure



Nanoindentor:The force range is up to 500 μN and 1 mN for the two main designs, with a force resolution of to 0.3 μN.