One of the most important features of photonic crystals is the presence of a photonic bandgap (PBG). Semiconductor crystals such as Si have a special energy range called a bandgap, within which the electrons cannot have corresponding energy. A photonic crystal can have a similar energy (frequency) range, which should be regarded as a bandgap for photons (PBG). In a photonic crystal, the light with a frequency in the PBG cannot exist. An incident light from the outside is completely reflected, and a light emission from the inside is prohibited. For realizing high-performance lasers or ultra-small integrated optical circuits, PBG is indispensable.

Nanomedicine

One of the many fields that nanotechnology is making major advancements in is the field of medicine. Current medical treatments are usually indiscriminate and affect healthy body cells as well as the damaged or pathogenic cells, either because surgery is required on because the drugs given have no way of distinguishing between body cells and terminat cells. If surgery is required then the risk of infection is increased and the complications may arise. Other treatments such as chemotherapy force and antibiotic for infections can cause side effects and cause damaget chealthy cells.

Applications of nanotechnology in medicine that have already been explored are methods of sensing and diagnostics within the body, methods of injecting drugs into the body without any risk of infection and methods of treating cancer directly. Nanoparticles make good diagnostic tools because they can reach lots of places within the body easily through the blood stream and are also very sensitive due to the size. The tiny size of nanoparticles means they can access every cell in the human body through the blood stream, and the ability for nanoparticles to recognise their target cells as well as treat the cells makes them a more efficient method of treatment. It is into this category that plasmon active gold nanoparticles (PAGNs) fall. Gold is plasmon active because it forms metallic bonds, therefore meaning the electrons are delocalised; this means that as the radiation is absorbed by the gold particles the electrons in oscillate between the top surface and bottom surface (relative to wave) thereby converting light energy into thermal energy. This is advantageous over existing treatments because it allows the relevant drugs to be administered directly to the desired area e.g. to the