

## **New Cancer Drug Given the Green Light for a Red Light Solution**

A Canadian scientific team led by Julia Levy and David Dolphin from the University of British Columbia has developed a new technique that fights the war against cancer tumours. The technique is called photodynamic therapy and is being developed by the company Quadra Logic Technologies (QLT) that was founded by Levy and Dolphin.

Photodynamic therapy has been shown to eliminate small tumours as well as tumours that are present in hard-to-reach places. The cancer is attacked by microscopic strangulation of the tumour cells so that the supply of oxygen is severed and the cells can no longer survive. This is accomplished with the use of a weapon, the laser gun, and its ammunition, a chemical called photofrin. The effective wavelength used for the laser corresponds to the red light region of the spectrum. A laser (light amplification by stimulated emission of radiation) is a concentrated, sharply focused, intense beam of light that has only one single wavelength (monochromatic). Photofrin is a light-sensitive chemical that, when treated with laser light, acts as a catalyst (a catalyst is a substance that increases the rate of a reaction without being used up in the reaction) to activate oxygen. Triplet oxygen is the normal form of oxygen present in the air. Photofrin complexes the oxygen and, when activated by the laser, allows an excited state of oxygen, called singlet oxygen, to be formed. The singlet oxygen is a non-discriminating oxidizing agent that takes oxygen from everything in its path and this results in suffocation of the cells.

The chemical warfare begins by intravenous injection of photofrin into the patient. The photofrin selectively accumulates inside the tumour and waits for the laser gun to be strategically placed so that it has a clear shot at the tumour. The selective accumulation occurs because the light-activated molecule is carried to cells via a lipoprotein component of the blood that normally carries cholesterol to dividing cells. Cancer cells differ from normal cells in that they divide at a greater rate and so the newly formed blood vessels in the tumour region have a higher concentration of the receptors for recruiting the lipoproteins. This property of cancer cells causes the photofrin to be selectively delivered to the rapidly dividing tumour cells. When the laser is affixed on the photofrin-filled tumour, the photofrin becomes 'armed' and catalyzes the production of a highly reactive singlet oxygen. The singlet oxygen has a half life of only 5 ms (milliseconds) so that once the laser is turned off; its effects are felt for only a short time. Disintegration of the tumour cells and the tiny blood vessels that nourish the tumour are ultimately responsible for the annihilation of the tumour.

During the development of photofrin, another light activated molecule was discovered by Dr. Dolphin and Dr. Levy that is currently being developed by QLT. This molecule is a Benzoporphyrin derivative (BPD) and works chemically in a similar way to photofrin. However, BPD has certain advantages over photofrin. For example, BPD is taken up by cells more readily and therefore, the waiting period between injection of the molecules and laser treatment is only 2-3 hours for BPD (48 hours for photofrin). In addition, BPD is cleared out of cells more rapidly, resulting in lower toxicity. Lastly, BPD requires a longer wavelength (less energy) to be activated. These benefits show greater potential for this light-activated molecule and BPD is now being clinically tested for the treatment of psoriasis, skin cancer, and ocular (eye) diseases.

Photodynamic therapy is an extremely important development in cancer treatment because it allows the cancer cells to be selectively attacked, leaving the healthy cells unharmed. The treatment is most successful if the cancer is identified in its initial stages. Early detection is very important because, given time, cancer cells will spread throughout the body (metastasis) and will no longer be manageable by simple therapies such as the one described.