

Brain Cancer: Why there are no better therapies yet

You, your joys and your sorrows, your memories and your ambitions, your sense of personal identity and free will, are in fact no more than the behaviour of a vast assembly of nerve cells and their associated molecules.

The Astonishing Hypothesis, Francis Crick

I do believe there is more that defines us, not only the brain cells and the number of proteins they release into the synaptic gaps. But given that brain cancer robs its victims of much of their life's joys - not seeing your child first time in the school uniform, not being able to accompany your partner to the wedding of a close friend, not remembering the day you became an Australian, not being able to think for yourself – there is something astonishingly correct about *The Astonishing Hypothesis*.

Brain cancer is the leading cause of cancer-related death in people under the age of 39. This cancer cannot be detected without a thorough physical examination and there are no risk factors. Thus, we cannot prevent brain cancer. Once diagnosed, patients undergo brain surgery to remove the tumour bulk. However, because the brain is such a sensitive and vital organ, surgery is usually very dangerous or impossible. Subsequent radiation and chemotherapy aim to kill the remaining cancer cells. Unfortunately, these therapies cause lots of pain and will not always cure the patient. Brain cancer can be treated, however the destructive nature of this disease takes no time in making its pathway to a painful conclusion-whether that be life or death.

Nine out of ten people diagnosed with brain tumour will die. My friend Ingrid is the one that survived. We met during our PhDs at university in Germany. Ingrid started her post-graduate studies several years before me, but was diagnosed with a brain tumour in her first year. Following two years filled with surgeries and endless radiation and chemotherapy sessions, she returned to the lab – right side of her body was paralysed and she was on a strong anti-epileptic medication to prevent seizures, of which she experienced many. She had to learn doing everything with her left hand, accepting her body being slower, listening to her brain when tired. Despite the vast list of physical limitations, Ingrid reached her ambition: she completed her research, graduated with PhD and got a job in the pharmaceutical industry. Later that year she got married. I left to Australia and our friendship became – let's call it – facebooked. Ingrid is doing great and continues to inspire everybody with her patience, perseverance and strength.

There are several reasons why we have not yet improved the survival of brain cancer patients. Firstly, each brain tumour is different and thus must be treated differently according to its unique features. Just like in other cancers, one drug fits all does not work. Secondly, brain cancer cells are fast runners and spread to healthy brain tissue so quickly, that cures are sometimes virtually impossible. If we could catch cancer cells before they take off into other parts of the brain, we would make brain tumours more manageable. Thirdly, because of something called the blood-brain barrier, tumours in the brain are much harder to treat. The blood-brain barrier is a membrane that controls various chemicals from being able to pass from the blood into the brain. Unfortunately, this applies to many of the drugs that are used to treat cancer. Finally, it's not only the malignant cells that make cancer, but also the environment where they *live*. The tumour microenvironment determines how quickly the tumour will grow and how quickly cancer will spread. Recalling the seed and soil hypothesis put forward more than a century ago, the local environment is indeed a rich soil in which tumours flourish. Killing the tumour itself, like pulling weeds, does little if the soil is still hospitable to scattered seeds. Together, these facts make the brain cancer one of the most dangerous forms of cancer and also one of the most difficult to treat.

Brain cancer is a thief. It can take a lot from you. But with the increasing number of amazing scientists doing greater than ever research into better brain cancer therapy, it is fair to say that this will not be the case for long.