Improved treatment for bowel cancer and other cancers, and research into malaria are among the highlights of the Queensland Institute for Medical Research’s work.

Bowel cancer affects one in 23 Australians in their lifetime, and half of these patients will succumb to the disease.

Dr Vicki Whitehall and Professor Barbara Leggett, of the Conjoint Gastroenterology Laboratory at the Queensland Institute of Medical Research, have co-developed a molecular test for the K-ras cancer gene, which will be used by oncologists to determine the optimal therapy for patients with advanced bowel cancer.

Cetuximab (marketed in Australia by Merck Serono as Erbitux) is an antibody therapy which blocks growth factor binding to the epidermal growth factor receptor.

“This receptor is the gateway to a number of molecular pathways which regulate the ability of cancer cells to grow and relocate in the body, critical processes in the spread of cancer,” a QIMR spokesman said.

K-ras is an oncogene which functions downstream of this receptor. When mutated, K-ras can bypass the action of Cetuximab, communicating with cancer cells to continue to grow.

Recent clinical trials have shown that patients with a mutation in the K-ras gene will not respond to Cetuximab.

However, if K-ras is not mutated, significant response is observed when the drug is administered in combination with standard chemotherapy (FOLFIRI).

“This marks a significant advance in the treatment of advanced bowel cancer, not only for the 60 percent of patients whose cancer does not have a mutation in K-ras, but also for the remaining patients who will be offered an alternate therapy more likely to work,” says Dr Whitehall.

“I’m very excited about the introduction of this test, as it represents the first step towards personalised medicine for patients with advanced bowel cancer.”

Other groundbreaking cancer research being undertaken at QIMR includes the work of Dr Derek Richard on super cell proteins.

Interestingly, his research was born out of something completely unrelated. Before coming to Australia and joining QIMR’s Signal Transduction Lab, Dr Derek Richard’s original research involved the study of an ancient organism which lives in boiling sulphuric acid pools in Iceland.

Known as archaea, these single-celled micro-organisms survive in one of the most extreme environments on earth. To do so, it relies on a “super protein” to protect and repair its DNA.

This same super repair protein has also been found in humans. Named hSSB1, it is the central protein required to protect humans from cancer-causing DNA damage.

“Human cancer is caused when specific genes are damaged and not repaired properly,” Dr Richard explains.

“When this occurs in certain genes it’s like losing a map or set of instructions, which can then lead to cells dividing uncontrollably.”

“An average cell’s DNA is damaged 30,000 times every day,” adds Dr Richard. “Without hSSB1, these cells cannot repair their genes when they are damaged.”

QIMR and Cancer Therapeutics (CTx) recently announced a collaboration to discover and develop new drugs for the treatment of many forms of cancer, based on Dr Richard’s findings.

In the lab, the Signal Transduction team can utilise a technique to destroy any protein in study. Through this technique, they discovered that no cancer can survive without hSSB1, whilst normal cells survive.

“We have developed an exciting drug strategy that would allow hSSB1 to be non-functional in patients,” says Dr Richard.

“CTx and QIMR are now working together to make the drug and test its effectiveness.”

Meanwhile, as we prepare for the summer holidays, spare a thought for the people working behind the scenes to keep us safe from some potentially nasty bugs this season, especially those of us lucky enough to be going overseas.

Queensland Institute of Medical Research scientists believe that with climate change, globalisation and increasing international travel, there is a high probability of mosquito-borne diseases spreading to new regions where health authorities are ill-equipped to handle them.

Furthermore, problems with insecticide resistance mean that chemical pesticides have not provided a universal solution to vector control.

Already, north Queensland has experienced an increasing number of dengue
outbreaks since 1990, with the 2003/04 outbreak resulting in 900 confirmed cases including four cases of dengue haemorrhagic fever and one death.

To address the emerging threat from dengue, malaria, Japanese encephalitis and other mosquito-spread diseases, QIMR commenced a new research program in collaboration with Professor Scott O’Neill and Dr Elizabeth McGraw at the University of Queensland, to develop new control methods to protect Australian and regional bio-security.

According to Dr Peter Ryan, Head of QIMR’s Mosquito Control Group, the program will investigate the effects of a strain of the bacterium Wolbachia (wMelPop) on mosquito behaviour (eg, biting and mating), how it reduces mosquito lifespan and whether it can infect key mosquito vector species.

“There’s an incubation period before a newly infected mosquito can transmit an arbovirus to a host,” explains Dr Ryan. “If we can reduce the lifespan of mosquitoes so they die before the end of that period, then we can reduce the risk of infection in Australia.”

Malaria remains a significant public health problem worldwide.

Five species of malaria parasites infect humans. The ideal vaccine would be effective against all five species.

Using a novel protein microarray approach, QIMR will identify Plasmodium proteins that may be excellent targets of a cross-species malaria vaccine. “This research will build on Australia’s current strengths in biotechnology and will result in significant economic benefits by facilitating the development of a malaria vaccine,” Dr Ryan says.