# With these special bacteria, a broccoli a day can keep the cancer doctor away

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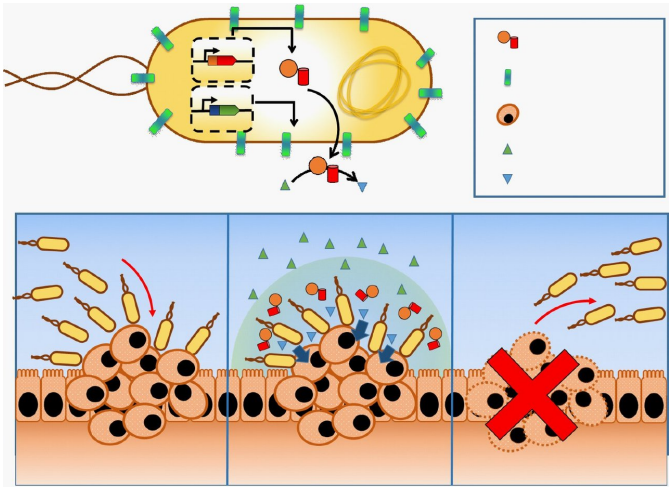
Mouse fed with the engineered microbe and a cruciferous vegetable-rich diet. Credit: Dr. Chun-Loong Ho

Colorectal cancer is one of the most common cancers in the developed world. Although the five-year survival rates for earlier stages of this cancer are relatively high, at later stages, survival drops and the risk of cancer recurrence rises considerably.

To address this problem, a team of researchers in the NUS Medicine lab of Associate Professor Matthew Chang have turned a humble cocktail of bacteria and vegetables into a targeted system that seeks out and kills colorectal cancer cells. The study, which was led by Dr Chun-Loong Ho, will be published online today and in the current issue of *Nature Biomedical Engineering*.

At the heart of this cancer-targeting system is an engineered form of E. coli Nissle, a harmless type of bacteria found in the gut. Using genetic techniques, the team engineered the bacteria into a probiotic that attached to the surface of colorectal cancer cells and secreted an enzyme to convert a substance found in cruciferous vegetables (like broccoli) into a potent anticancer agent. The idea was for the cancer cells in the vicinity to take up this anticancer agent and be killed. Normal cells cannot do this conversion, nor are they affected by the toxin, thus the system should be targeted only to colorectal cancer cells.



Orally administered engineered microbes bind to the surfaces of colorectal cancer cells (a), allowing microbes to secrete myrosinase, which converts dietary glucosinolate found in cruciferous vegetables (b). When the cancer cells are cleared, the microbes are released from the surface of the intestinal wall (c). Credit: Ho CL, Tan HQ, Chua KJ, Kang A, Lim KH, Ling KL, et al. Engineered commensal microbes for diet-mediated colorectal-cancer chemoprevention. Nat Biomed Eng. Jan 2018.

True enough, the mixture of engineered probiotics with a broccoli extract or water containing the dietary substance killed more than 95 percent of colorectal cancer cells in a dish. Moreover, the mixture had no effect on cells from other types of cancer such as breast and stomach cancer. Strikingly, the probiotics-veggie combination reduced tumour numbers by 75 percent in mice with colorectal cancer. Also, the tumours that were detected in these mice were 3 times smaller than those in control mice which were not fed with the mixture.

Dr Ho and Associate Professor Chang, along with colorectal cancer specialist Dr Yong Wei Peng at the National University Hospital, envision that these probiotics could be used in two ways: as prevention, and to clean up the cancer cells remaining after surgical removal of tumours. One day, colorectal cancer patients may be able to take the probiotics as a dietary supplement along with their broccoli to prevent colorectal cancer or to reduce recurrence after cancer surgery.

As Associate Professor Chang puts it, "One exciting aspect of our strategy is that it just capitalizes on our lifestyle, potentially transforming our normal diet into a sustainable, low-cost therapeutic regimen. We hope that our strategy can be a useful complement to current cancer therapies."

Or, as Dr Ho says, "Mothers are right after all—eating vegetables is important."

**More information:** Chun Loong Ho et al, Engineered commensal microbes for diet-mediated colorectal-cancer chemoprevention, *Nature Biomedical Engineering* (2018). DOI: 10.1038/s41551-017-0181-y

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