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The past few decades have seen a groundswell of research on the immune system yielding a deeper understanding of how cancer progresses and offering new ways to stop it. As this Outlook reports, a range of cancer therapies that exploit the complex interactions between tumours and immune cells are the result of this effort.

Cancer immunotherapy is the product of reciprocal learning: even as the immune system teaches researchers about its intricacies, researchers are teaching immune cells how to use those abilities to specifically target disease. By using what they learn about the immune system, scientists can create synthetic molecules to attack a tumour, or can help the immune system to do its job more effectively (S2).

In 1891, William Coley injected cancer patients with bacteria to ignite an immune response — a strategy now experiencing a revival (S4). Immunologists are finding ways to harness the immune system, including training immune cells to recognize a patient's particular cancer (S9 and S13).

The finding that tumours can actively suppress immunity has led to the development of 'checkpoint blockades' that prevent this suppression (S6). Medical imaging technology is providing a clearer picture of how cancerous cells interact with other cells, even at the molecular level (S10). Bioengineers are getting involved, too: the first implantable cancer vaccine, made by combining the latest cancer immunology with materials science, entered clinical trials in 2013 (S16). And patients are already benefiting, as Carley Rutledge — a Colorado student — attests in a naturevideo that accompanies this Outlook (go.nature.com/yfwwi).

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Lauren Gravitz
Contributing Editor

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