THE ROAD TO IMMUNOTHERAPY

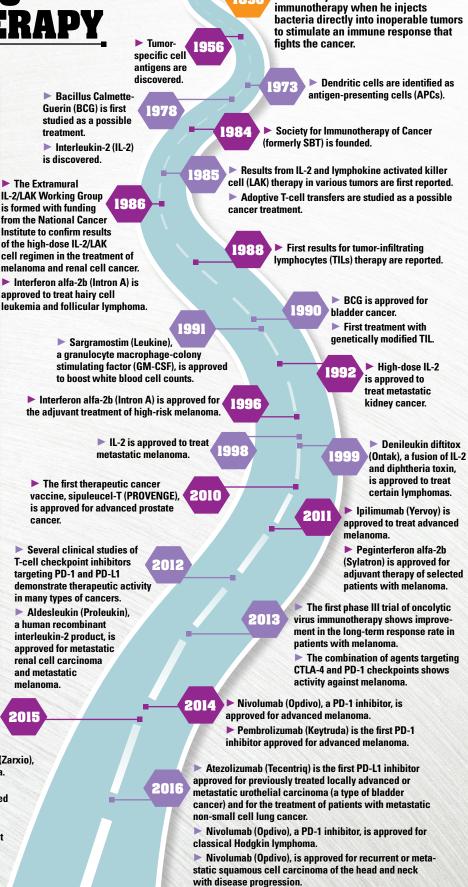
HISTORY OF IMMUNOTHERAPY

Immunotherapy is a cancer treatment more than 100 years in the making, beginning most notably with Dr. William B. Coley, who worked with patients and other doctors to study how cancer tumors reacted to bacterial infections. He treated people with inoperable tumors by injecting a combination of bacteria, which became known as Coley's Toxins, directly into their tumors. His results showed that this kind of treatment shrank the tumors and sometimes even cured the patient. He believed that the body's increased response to the bacteria also helped fight off

In the modern era, Dr. Donald Morton was an early proponent of immunotherapy, particularly cancer vaccines. His work with bacillus Calmette-Guérin (BCG) for melanoma led to the use — and eventual approval — of BCG for bladder cancer, the first successful immunotherapy against a human tumor.

This timeline describes progress in the development of immunotherapy agents. These agents work by altering the immune system, either by stimulating the production of lymphocytes (a type of white blood cell) or antibodies (special proteins) or by overcoming the ability of cancer cells to "hide" from the immune system and not be recognized as a foreign invader. (Some immunotherapies are monoclonal antibodies, but they should not be confused with monoclonal antibodies that directly attack cancer cells, a type of treatment known as targeted therapy.)

- Elotuzumab (Empliciti), a SLAMF7-directed immunostimulatory antibody, is approved for multiple myeloma.
- ► The first biosimilar product, filgrastim-sndz (Zarxio), is approved to treat severe chronic neutropenia.
- Nivolumab (Opdivo) is the first checkpoint inhibitor approved for lung cancer and advanced renal cell carcinoma.
- ▶ Pembrolizumab (Keytruda) is approved to treat metastatic non-small cell lung cancer that has progressed after other treatments and with tumors that express a protein called PD-L1.
- ➤ Talimogene laherparepvec (Imlygic), a genetically modified oncolytic viral therapy is approved for the local treatment of unresectable cutaneous, subcutaneous and nodal lesions in patients with melanoma.



Pembrolizumab (Keytruda) is the first checkpoint

non-small cell lung cancer.

inhibitor approved as a first-line treatment for metastatic

Pembrolizumab (Keytruda) is approved for recurrent or metastatic head and neck squamous cell cancer with

► Dr. Coley creates the first

PatientResource.com disease progression.