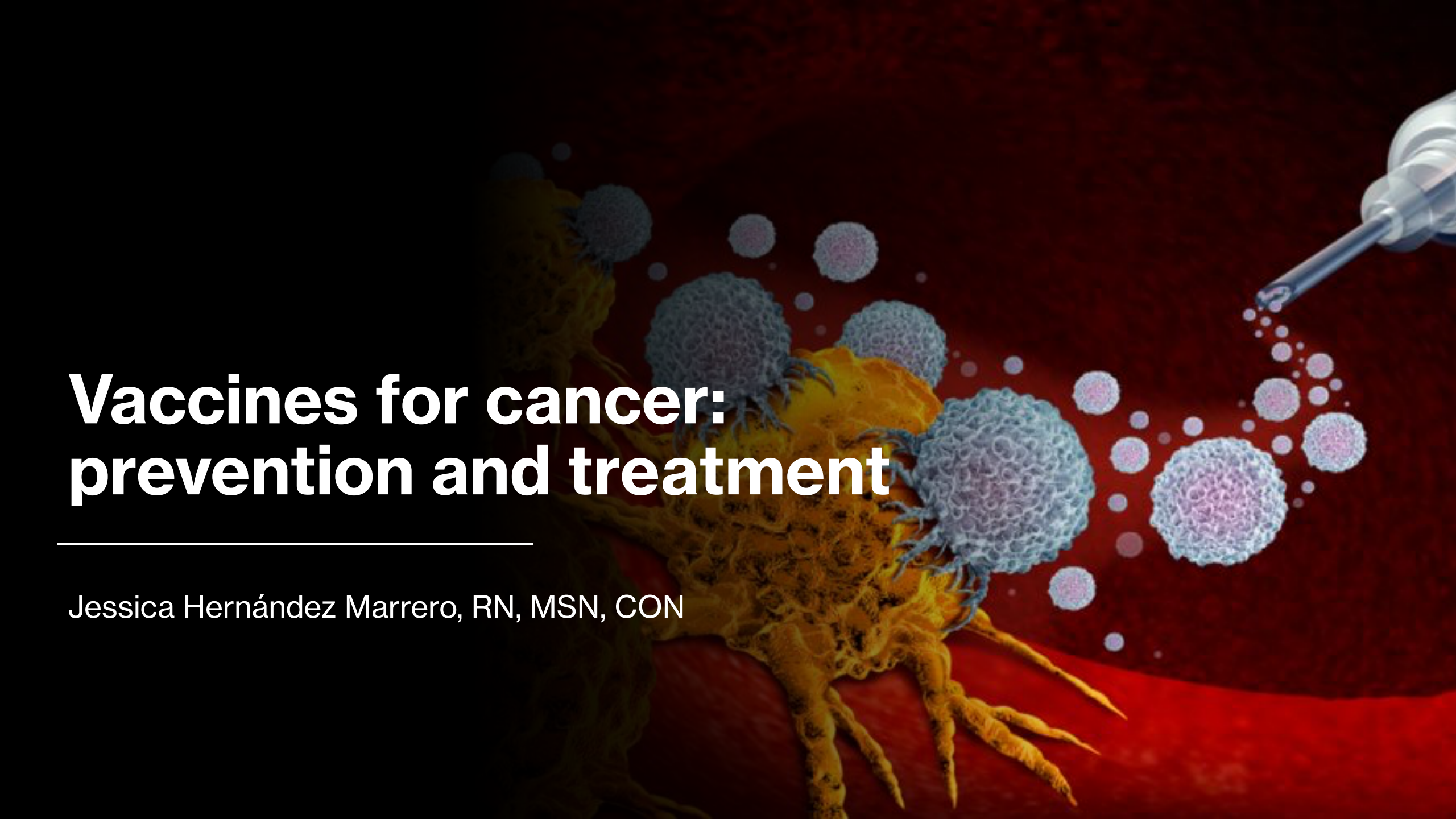
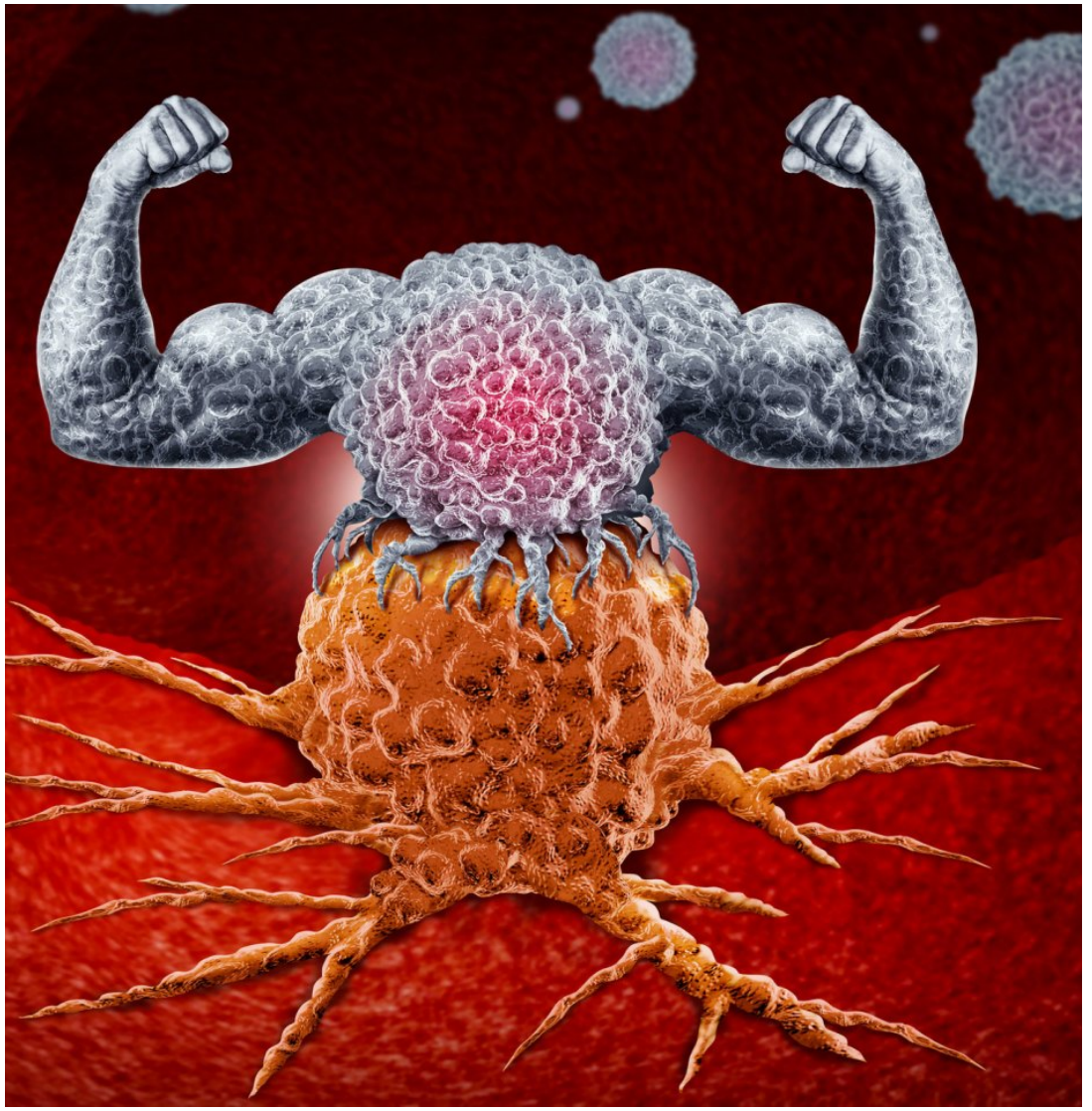


Vaccines for cancer: prevention and treatment

Jessica Hernández Marrero, RN, MSN, CON

Immunotherapy

- Uses invulnerable framework to battle illnesses
- Utilizes resistant framework to battle growth
  - help invulnerable framework to perceive and assault malignancy cells
  - focused on medications or organic treatments or biotherapy
  - This can be done:
    - Stimulating the immune system
    - Giving man-made immune system proteins

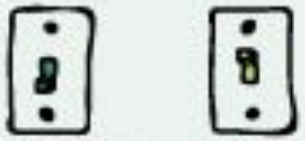


TYPES OF IMMUNOTHERAPY

ANTIBODIES

A version of a protein that can attach themselves to cancer cells, tagging them for immune destruction.

CHECKPOINT INHIBITORS



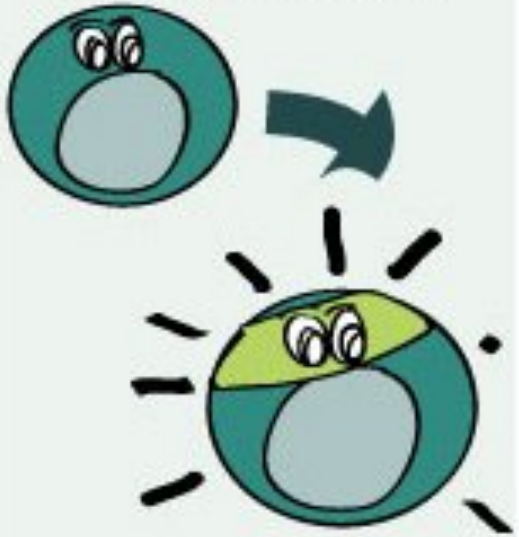
Some proteins help to control the immune system. When these are turned off immune cells are able to kill cancer cells better.

VACCINES

Vaccines work by putting substances into the body that train the immune cells to respond better to cancer.

T-CELL TRANSFERS

Upgrade and improve a patient's T-cells (an immune cell that helps to eliminate cancer)



The immune control of infection (*The Art of war by Sun Tzu*)

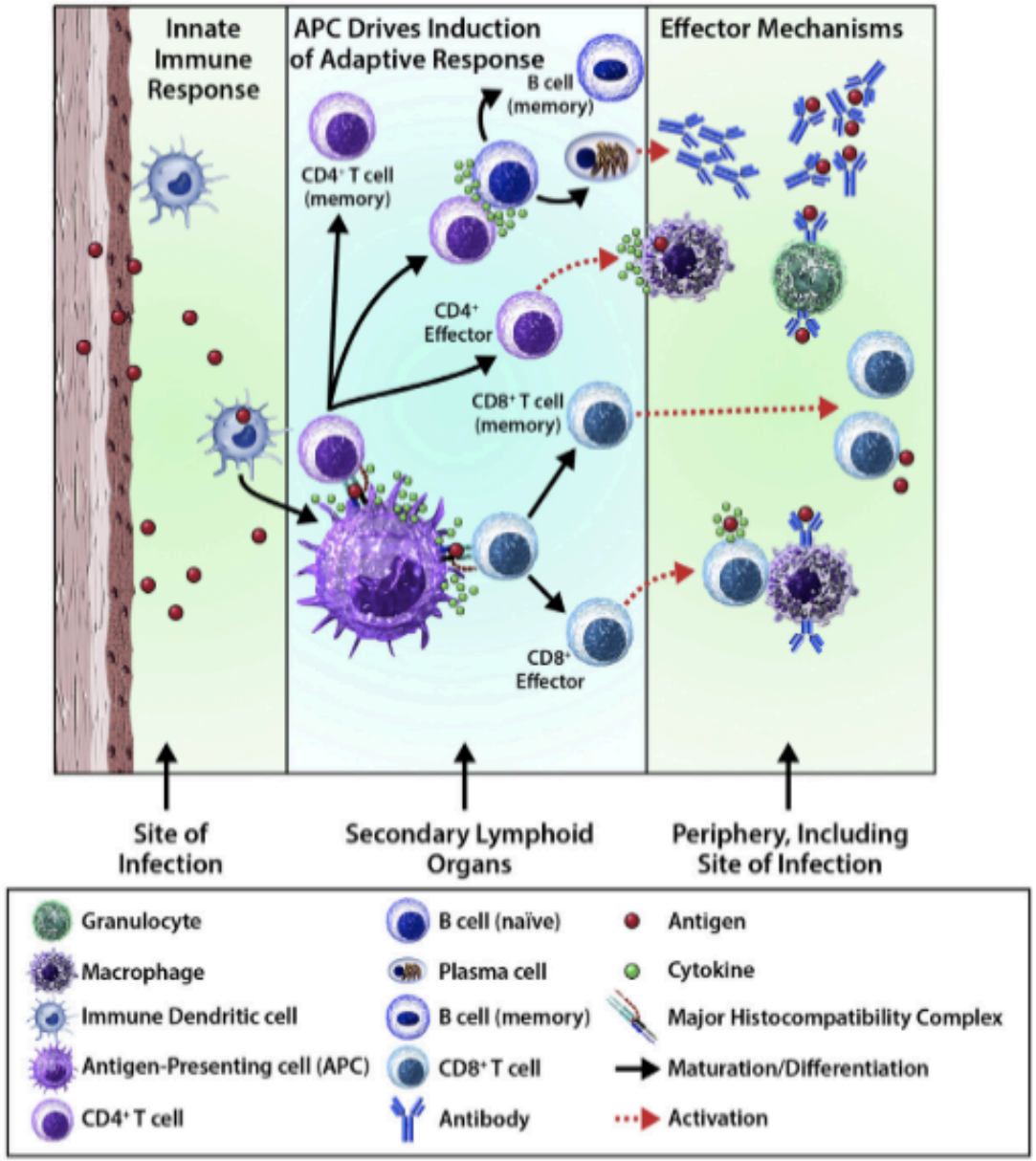
The immune Defense Forces
(Be prepared for any contingency)

Vigilance/surveillance & detection of danger
(Force enemy to reveal themselves)

Holding the line, communicating the problem to the wider defense forces
(Of greatest importance in war is extraordinary speed)

Calling up appropriate numbers & specifically armed capability. Directing the integrated deployment & attacking the enemy
(Baulk the enemy's power)

Consolidating the gains
Those skilled in war conquer by strategy

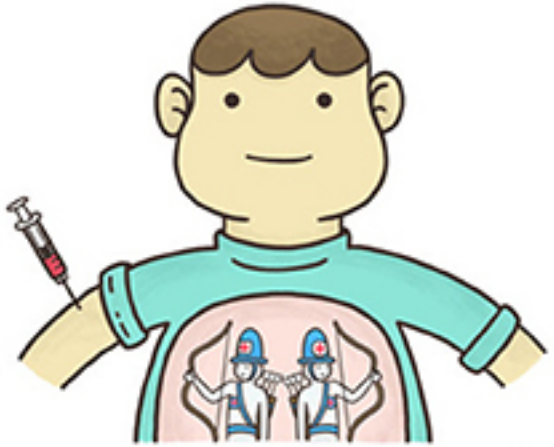


Pathogen Biology and Epidemiology

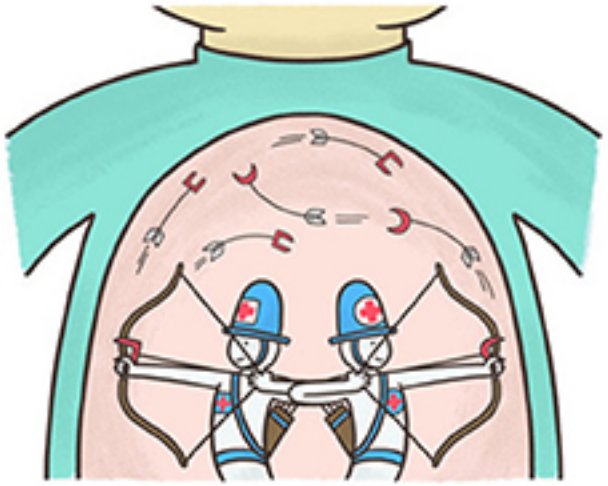
- Structure, biology, associated disease epidemiology and clinical characteristics
- Challenges
  - Distinguish of a microorganism
  - Generate cross-reactive or individual type-specific immunity
- Serotypes geographic or temporal distribution
- Route of entry and replication locations
  - (respiratory: influenza; pneumococcus; gastrointestinal: salmonella)
- Demographics (poverty), specific risk groups, and age-specific infection rates

What are Vaccines?

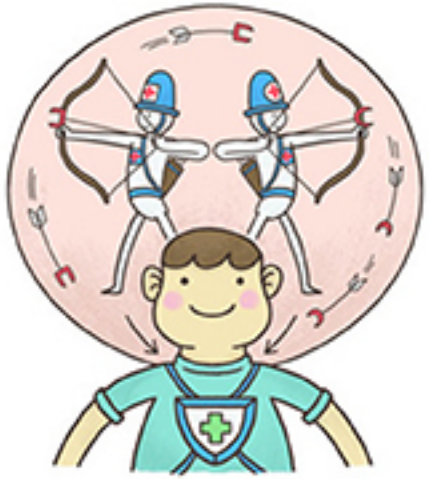
- 1891 - Dr. William Coley
- Help the body fight disease
- Train the body's immune system to fight disease
- Prevent common illnesses
- Prevent cancer
  - Targets the viruses that can cause cancer before the exposure
- Treat cancer
  - Help stop the cancer from coming back or from spreading



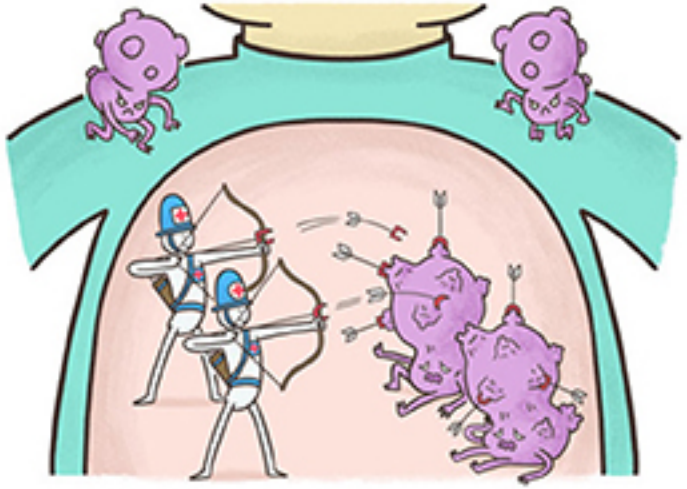
Injection of an inactive form of the microbe (i.e. the vaccine)



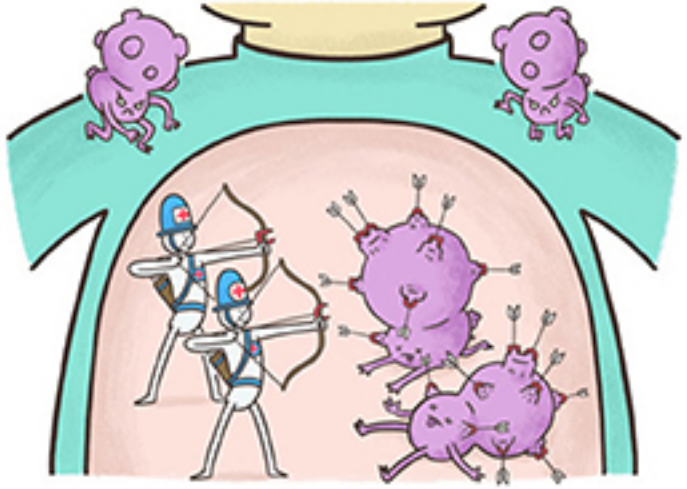
My lymphocytes produce antibodies against the microbe



I am vaccinated (i.e. protected) against the microbe



If I then encounter and get infected by the real microbe ...

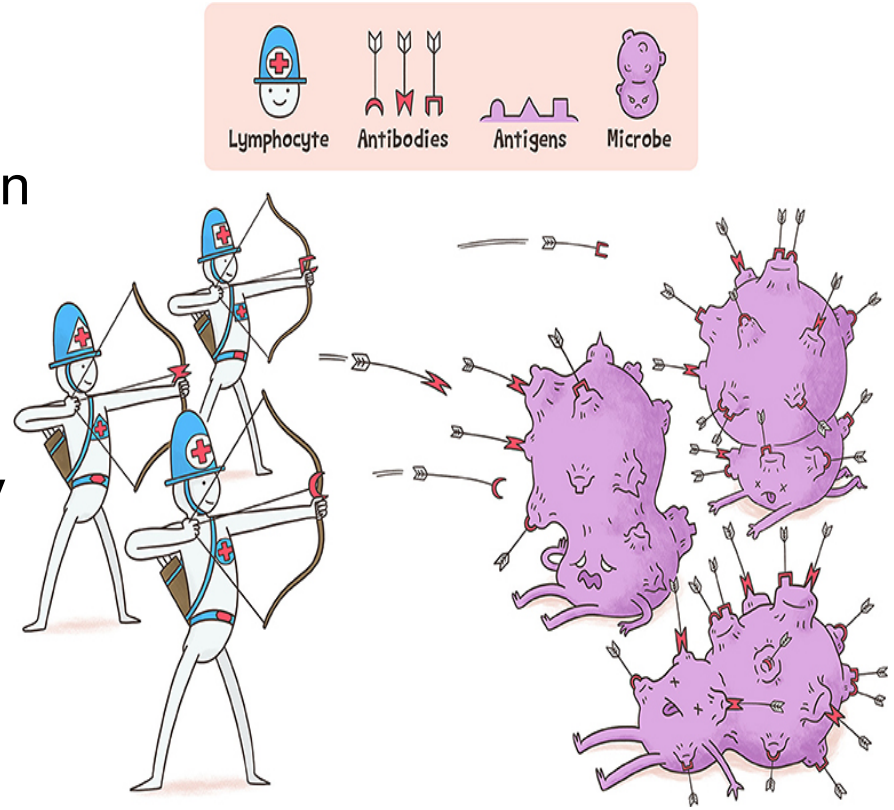


My antibodies will neutralize and kill the microbe

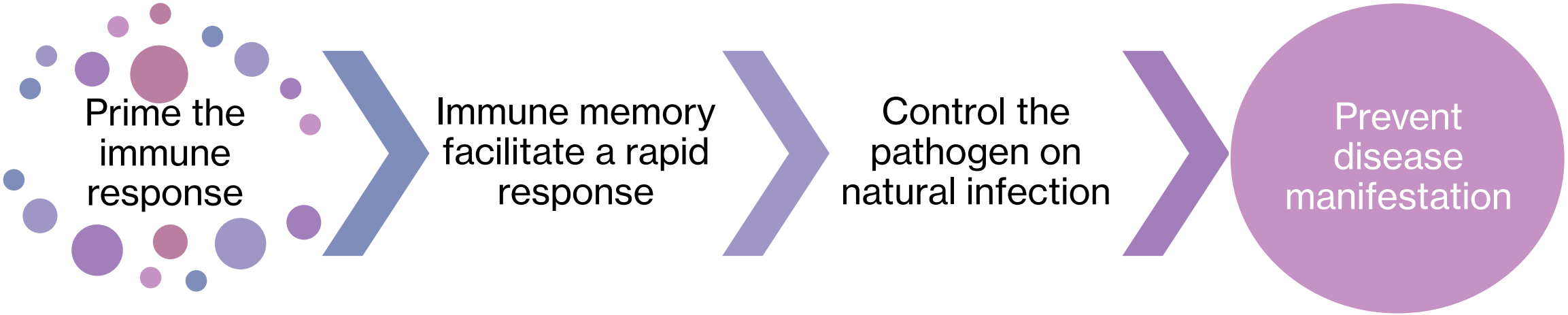
I do not become sick (i.e. I do not develop disease)

Vaccines, how they work?

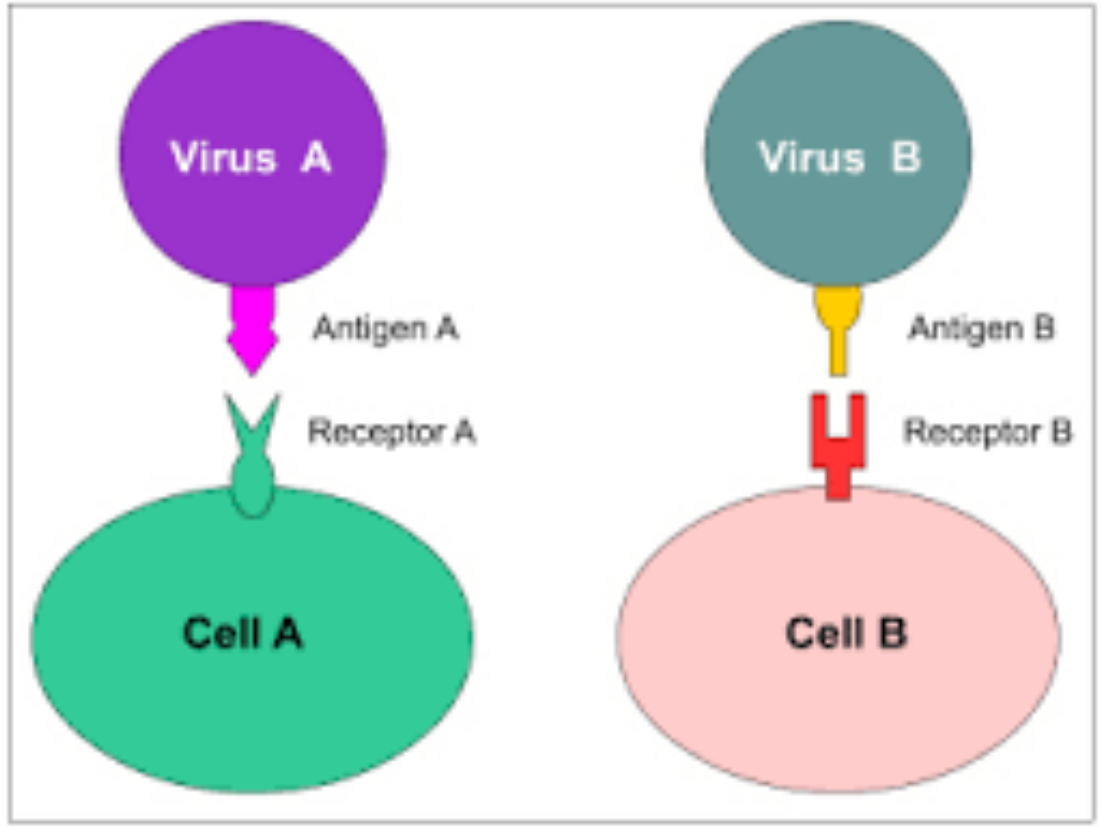
- Exposure immune cells to antigens
  - free-floating or present on the surface of whole cells
  - artificial active immunity - differentiation and proliferation
  - immunological memory
- Exposure to the same antigen 2nd time
  - immune response fast and stronger
  - pathogens and cancer cells - destroyed more efficiently
- Adjuvants
  - modify the effects of vaccines
    - booster immune responses
    - longer-lasting immunity
    - stronger secondary response



Vaccine goals

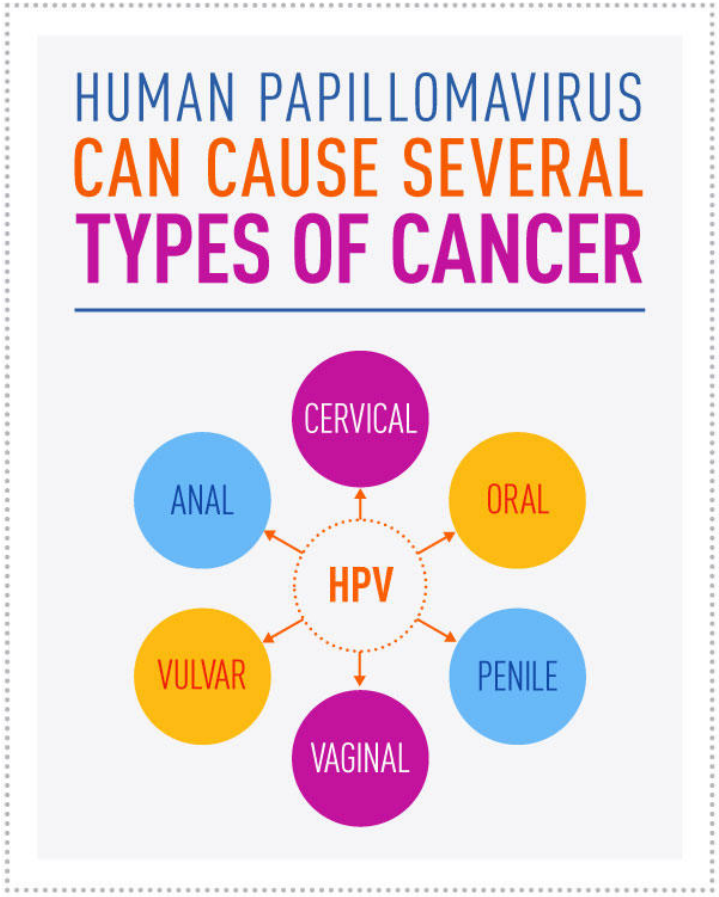


Vaccines to prevent cancer



- Immune cells - part of the body's defense
  - Immune receptors – proteins on the surface of immune cell
  - Antigens - proteins on the surface of viruses
- Receptors and antigens are unique (lock and key)
  - immune cell finds the antigen
  - "fits" in its lock
  - binds to it
  - destroys the virus
- Vaccines to prevent cancer train the immune cells to recognize the virus

Vaccines to prevent cancer



Cancer Vaccines

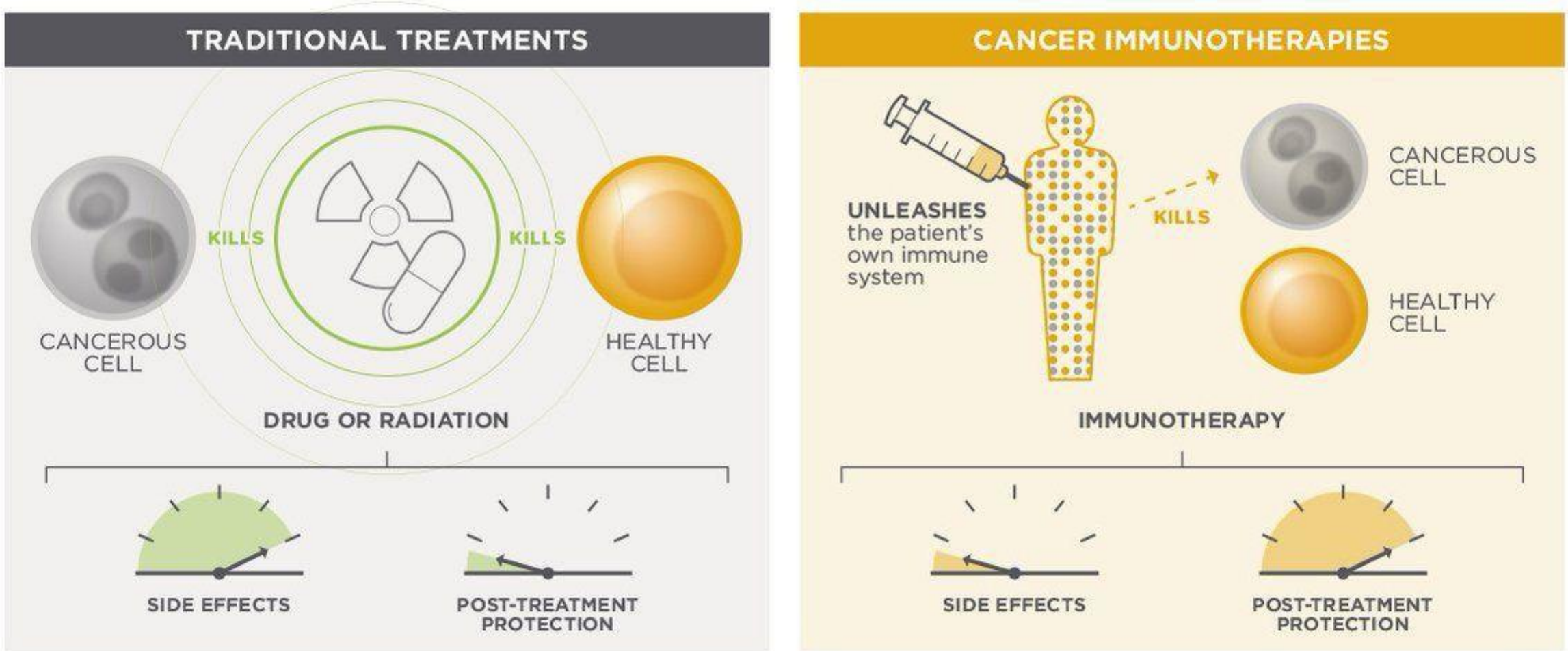
Advantages

- Low toxicity
- Less side effects

Limitations

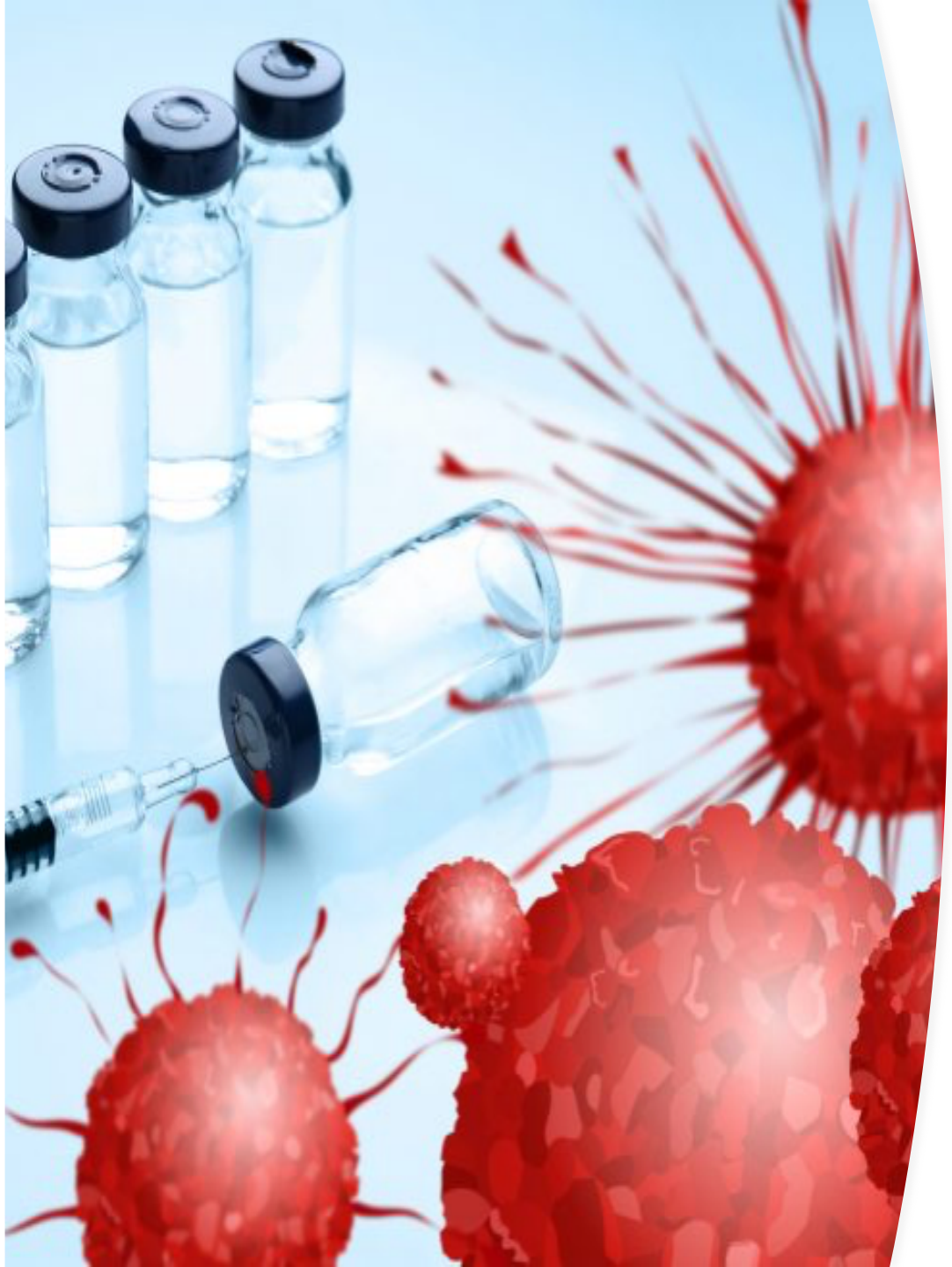
- Low approval rate
- Increase in tumor burden since more cancer cells are initially introduced into the body
- effects - not immediate
- tumors can evade and suppress the immune system

IMMUNOTHERAPY VS. CHEMOTHERAPY



 Source: Cancer Research Institute

Adaptive biotechnologies®



Types of cancer vaccines

- Peptide- and Protein-Based Vaccines
  - combination with potent immune adjuvants needed
- Cellular Vaccines
  - DCs (antigen cell - APCs) loaded with tumor (neo)antigens, modified autologous cancer cells, and allogeneic tumor cell lines
- Genetic Vaccines (antigen or fragments in vivo)
  - nucleic acid–based vaccine designs
  - DNA or RNA- based vaccines
    - electroporation, sonoporation, nanoparticles, gene guns, microneedle arrays, needle-free injection and liposomal encapsulation
- Other Types of Cancer Vaccines
  - intravesical immunotherapy (i.e., vaccination)
  - intratumoral administration of oncolytic viruses

Vaccines to treat cancer

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JULY 29, 2010 VOL. 363 NO. 5

Sipuleucel-T Immunotherapy for Castration-Resistant Prostate Cancer

Philip W. Kantoff, M.D., Celestia S. Higano, M.D., Neal D. Shore, M.D., E. Roy Berger, M.D., Eric J. Small, M.D., David F. Penson, M.D., Charles H. Redfern, M.D., Anna C. Ferrari, M.D., Robert Dreicer, M.D., Robert B. Sims, M.D., Yi Xu, Ph.D., Mark W. Frohlich, M.D., and Paul F. Schellhammer, M.D., for the IMPACT Study Investigators*

CONCLUSIONS

The use of sipuleucel-T prolonged overall survival among men with metastatic castration-resistant prostate cancer. No effect on the time to disease progression was observed. (Funded by Dendreon; ClinicalTrials.gov number, NCT00065442.)

Vaccines to treat cancer

ImmunoTargets and Therapy

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REVIEW

Bacillus Calmette-Guérin (BCG) Therapy for Bladder Cancer: An Update

This article was published in the following Dove Press journal:
ImmunoTargets and Therapy

Sandra Guallar-Garrido
Esther Julián

Departament de Genètica i de Microbiologia, Facultat de Biociències, Universitat Autònoma de Barcelona, Bellaterra (Barcelona), Spain

Abstract: Physicians treating patients affected by nonmuscle-invasive bladder cancer (NMIBC) have been in shock during the last six years since manufacturing restrictions on the production of the first-option medicine, *Mycobacterium bovis* Bacillus Calmette-Guérin (BCG), have resulted in worldwide shortages. This shortage of BCG has led to a rethinking of the established treatment guidelines for the rationing of the administration of BCG. Some possible schedule modifications consist of a decrease in the length of maintenance treatment, a reduction in the dose of BCG in intravesical instillations or the use of different BCG substrains. All these strategies have been considered valuable in times of BCG shortage. In addition, the lack of availability of BCG has also led to the general recognition of the need to find new treatment options for these patients so that they are not dependent on a single treatment. Few alternatives are committed to definitively replacing BCG intravesical instillations, but several options are being evaluated to improve its efficacy or to combine it with other chemotherapeutic or immunotherapeutic options that can also improve its effect. In this article, we review the current state of the treatment with BCG in terms of all of the aforementioned aspects.

Keywords: mycobacteria, nonmuscle invasive, immunotherapy, alternative treatment

Vaccines and clinical trials

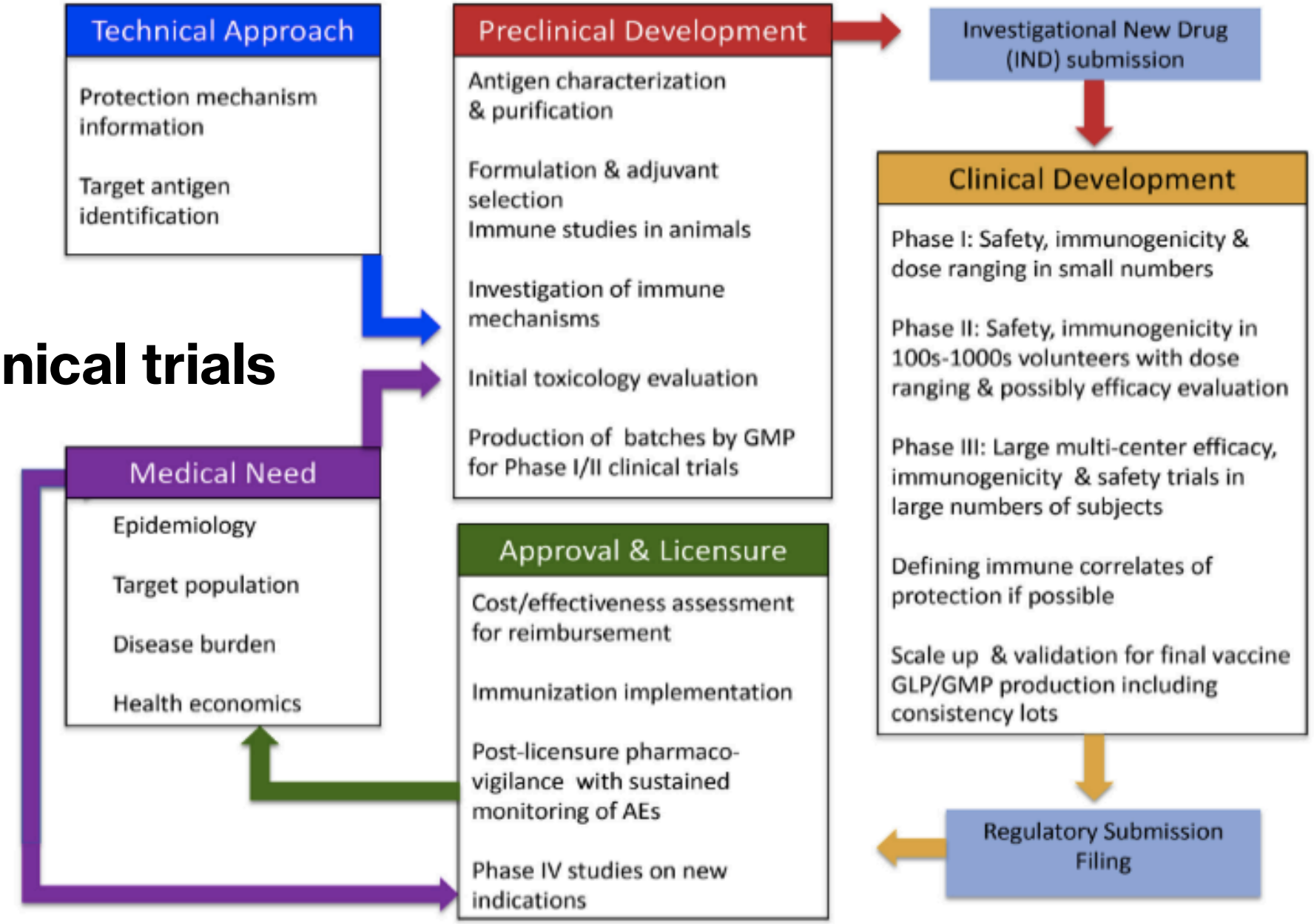

Figure 6. Vaccine development phases. The preclinical, clinical, and postlicensure phases can take a considerable time (10-30 years). The process integrates the requirement to ensure safety, immunogenicity, and efficacy in the final licensed product.

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OCTOBER 26, 2021 / NEWS RELEASES

Cleveland Clinic Launches First-of-its-Kind Preventive Breast Cancer Vaccine Study

Novel clinical trial based on research from Cleveland Clinic's Lerner Research Institute

- Phase I trial
- Determine the maximum tolerated dose of the vaccine in patients with early-stage triple-negative breast cancer
- Characterize and optimize the body's immune response


Cleveland Clinic

Advisor

Home » Cancer Topics » Gastrointestinal Cancers

July 23, 2019

Colon Cancer Vaccine: Promising Phase 1 Results

C. Andrew Kistler, MD, PharmD

Although colorectal cancer (CRC) incidence and mortality continue to decline in the United States, the disease continues to be both a national and worldwide concern based on it being the fourth most common cause of cancer and second leading cause of cancer-related mortality worldwide. [1,2]

At the time of diagnosis, close to two-thirds of patients undergo surgical resection, however, up to 50% of patients can develop recurrence leading to increased risk of

In this study, preexisting immunity to the viral vector used for the vaccine led to poor responses, as the product was neutralized.

- Guanylyl cyclase C (GUCY2C)
  - antigen
  - membrane receptor - intestinal cells
  - overexpressed in CRC
- 10 patients - early-stage CRC
- Surgical resection - no chemotherapy or radiation
- 40% - T-cell responses
- 10% developed antibodies
- AE's
  - chills/rigor (20%)
  - injection site reaction/arm swelling (20%).
  - 10% (dizziness, diaphoresis, aches, and fever)

Vaccines and clinical trials in Puerto Rico

- Study to Evaluate Adverse Events and Change in Disease Activity When Intravenous (IV) Infusion of ABBV-927 is Administered in Combination With IV Modified FOLFIRINOX (mFFX) With or Without IV Budigalimab Compared to mFFX in Adult Participants With Untreated Pancreatic Cancer Metastasis
- Antibodies Production After Covid-19 Vaccination Among Patients With Medical History of Cancer and Anti-CD-20 Treatment
- Cancer Preventive Vaccine Nous-209 for Lynch Syndrome Patients
- VGX-3100 and Electroporation in Treating Patients With HIV-Positive High-Grade Anal Lesions
- Nine-valent HPV Vaccine to Prevent Persistent Oral HPV Infection in Men Living With HIV
- Vaccine Therapy in Treating Patients With Newly Diagnosed Advanced Colon Polyps
- IMPAACT P1085: Human Papilloma Virus (HPV) Type-Specific Antibody (HPV)
- PSMA and TARP Peptide Vaccine With Poly IC-LC Adjuvant in HLA-A2 (+) Patients With Elevated PSA After Initial Definitive Treatment
- A Study of VGX-3100 DNA Vaccine With Electroporation in Patients With Cervical Intraepithelial Neoplasia Grade 2/3 or 3 (HPV-003)
- Vaccine Therapy in Preventing Human Papillomavirus Infection in Young HIV-Positive Male Patients Who Have Sex With Males
- Phase 3 Study of ProstAtak® Immunotherapy With Standard Radiation Therapy for Localized Prostate Cancer (PrTK03)
- Phase I of Human Papillomavirus (HPV) DNA Plasmid (VGX-3100) + Electroporation for CIN 2 or 3
- Study of Imprime PGG® in Combination With Cetuximab in Subjects With Recurrent or Progressive KRAS Wild Type Colorectal Cancer(PRIMUS)
- Fourth Dose of Human Papillomavirus (HPV) DNA Plasmid (VGX-3100) + EP in Adult Females Previously Vaccinated With Three Doses of VGX-3100
- A Randomized, Double-blind, Phase 3 Efficacy Trial of PROSTVAC-V/F +/- GM-CSF in Men With Asymptomatic or Minimally Symptomatic Metastatic Castrate-Resistant Prostate Cancer (Prospect)
- DNA Vaccine Therapy in Treating Patients With Chronic Hepatitis C Virus Infection

Why continue with therapeutic cancer vaccination efforts

- Patient ability to prime tumor with checkpoint inhibitors and tumor-antigen-specific T cells or spontaneous response
- Effective of combination therapies incorporating vaccines and checkpoint inhibitors
- Negative studies lessons
  - need for antigens and vaccine designs for greater immunogenicity
  - combination treatment strategies
- Better vaccine design and selection of appropriate antigens
- Ability to induce type 1 anti-tumor immunity
- Spuleucel-T approval provided clinical validation for therapeutic vaccination concept
  - although limited efficacy has been observed with the therapeutic cancer vaccine

References

- Barrell, Amanda; Medically reviewed by Krystal Cascetta, M. (2021). Everything to know about cancer vaccines. *Medical News Today*. Retrieved from https://www.medicalnewstoday.com/articles/what-is-a-vaccine#summary
- Buteau, C., Markovic, S. N., & Celis, E. (2002). Challenges in the development of effective peptide vaccines for cancer. *Mayo Clinic Proceedings*. https://doi.org/10.4065/77.4.339
- Cuzzubbo, S., Mangsbo, S., Nagarajan, D., Habra, K., Pockley, A. G., & McArdle, S. E. B. (2021, February 17). Cancer Vaccines: Adjuvant Potency, Importance of Age, Lifestyle, and Treatments. *Frontiers in Immunology*. Frontiers Media S.A. https://doi.org/10.3389/fimmu.2020.615240
- Guallar-Garrido, S., & Julián, E. (2020). Bacillus Calmette-Guérin (BCG) Therapy for Bladder Cancer: An Update . *ImmunoTargets and Therapy*, *Volume 9*, 1–11. https://doi.org/10.2147/itt.s202006
- Igarashi, Y., & Sasada, T. (2020). Cancer Vaccines: Toward the Next Breakthrough in Cancer Immunotherapy. *Journal of Immunology Research*. Hindawi Limited. https://doi.org/10.1155/2020/5825401
- Jiang, S., Good, D., & Wei, M. Q. (2019). Vaccinations for Colorectal Cancer: Progress, Strategies, and Novel Adjuvants. *International journal of molecular sciences*, *20*(14), 3403. https://doi.org/10.3390/ijms20143403

References

- Kantoff, P. W., Higano, C. S., Shore, N. D., Berger, E. R., Small, E. J., Penson, D. F., ... Schellhammer, P. F. (2010). Sipuleucel-T Immunotherapy for Castration-Resistant Prostate Cancer. *New England Journal of Medicine*, *363*(5), 411–422. https://doi.org/10.1056/nejmoa1001294
- Maeng, H., Terabe, M., & Berzofsky, J. A. (2018, April 1). Cancer vaccines: translation from mice to human clinical trials. *Current Opinion in Immunology*. Elsevier Ltd. https://doi.org/10.1016/j.coi.2018.03.001
- Miao, L., Zhang, Y., & Huang, L. (2021, December 1). mRNA vaccine for cancer immunotherapy. *Molecular Cancer*. BioMed Central Ltd. https://doi.org/10.1186/s12943-021-01335-5
- Morse, M. A., Gwin, W. R., & Mitchell, D. A. (2021, March 1). Vaccine Therapies for Cancer: Then and Now. *Targeted Oncology*. Adis. https://doi.org/10.1007/s11523-020-00788-w
- Stern, P. L. (2020, July 1). Key steps in vaccine development. *Annals of Allergy, Asthma and Immunology*. American College of Allergy, Asthma and Immunology. https://doi.org/10.1016/j.anai.2020.01.025

References

- https://newsroom.clevelandclinic.org/2021/10/26cleveland-clinic-launches-first-of-its-kind-preventive-breast-cancer-vaccine-study/
- https://clinicaltrials.gov
- What are Cancer Vaccines?. (2020). Approved by the Cancer.Net Board. *Cancer.Net*. Retrieved from http://www.cancer.net/about-us/cancernet-editorial-board