INTRODUCTION: TUMOR-IMMUNE INTERACTIONS

Overview

1. Mysteries of the Immune System: Dormancy and Chemotherapy response.
2. Importance of the Immune System for Cancer Treatment.
3. Overview of the Human Immune Response.
   - Immune system targets cancer
   - Activation of B-cells and Helper T-cells
   - Natural Killer Cells
   - Activation of Killer T-Cells
   - Flow Chart

Introduction: Tumor-Immune Interactions

Mystery of the Immune System: Dormancy

Mystery 1: Why is it that one patient's cancer returns after some time, while another patient can remain cancer free? This phenomenon is known as:

- **Tumor** _____(1). Disappearance and reappearance of tumors. Mathematically possible with immune system component.

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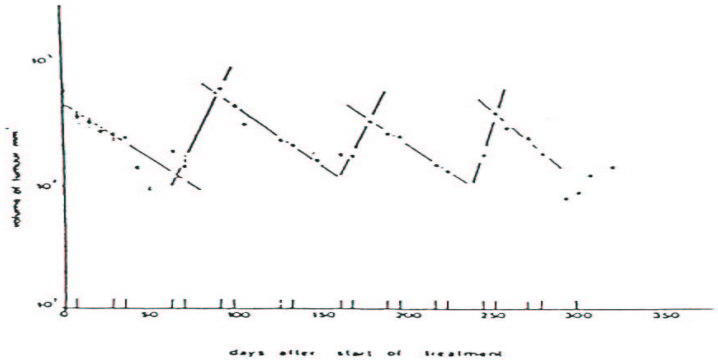
Mystery of the Immune System: Chemotherapy Response

Mystery 2: Why would a tumor treated with chemotherapy first grow, and then shrink?

- **Asynchronous tumor response to** _____(2) (Thomlinson 1982). Also mathematically achievable with immune system interaction.



Note: The tickmarks on the horizontal axis represent administration of chemotherapy, the dots represent measured volume of tumor. Horizontal axis represents days of treatment, vertical axis represents volume of tumor.

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Problem Statement

We will develop a mathematical model of tumor-immune interactions which will exhibit

- Tumor dormancy
- Asynchronous response to chemotherapy

This mathematical model will focus on two populations of cells. We present the background and justification for our model assumptions in the slides that follow.

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Importance of the Immune System

Two clinical approaches to fighting cancer:

- **Immunotherapy**: Enlisting the body's own defenses, also known as the _____(1), to join the fight against cancer.
- **Vaccine**: A compound or group of compounds designed to produce a _____(2) immune response to a tumor.

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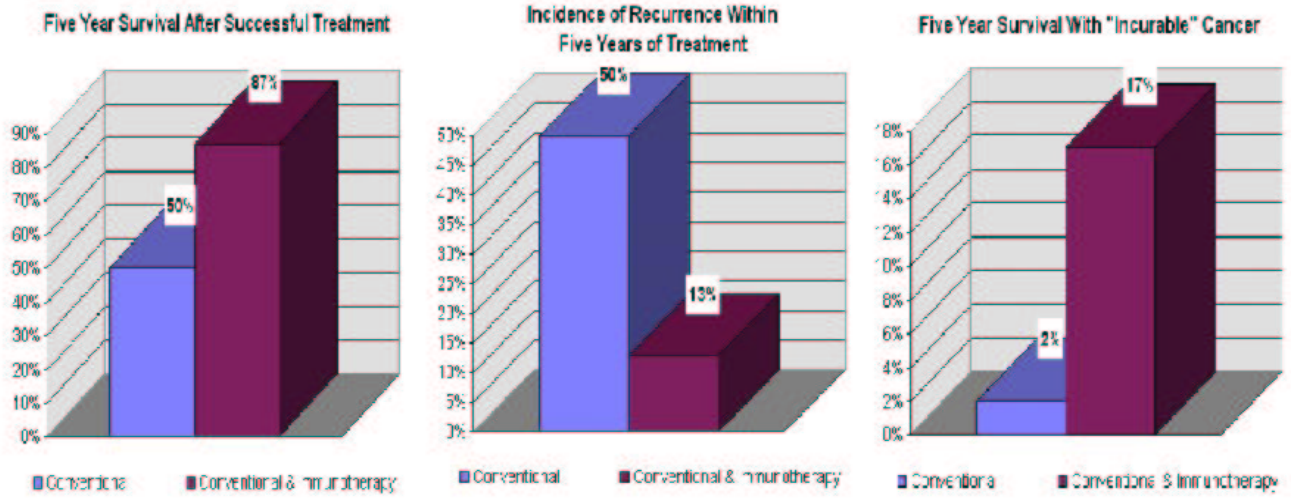
Importance of the Immune System: Clinical Evidence

From the ISSELS FOUNDATION: A restoration of the immune functions can reduce the incidence of relapse from about 50% (World Statistic) to 13% by combined conventional treatments and comprehensive immunotherapy.



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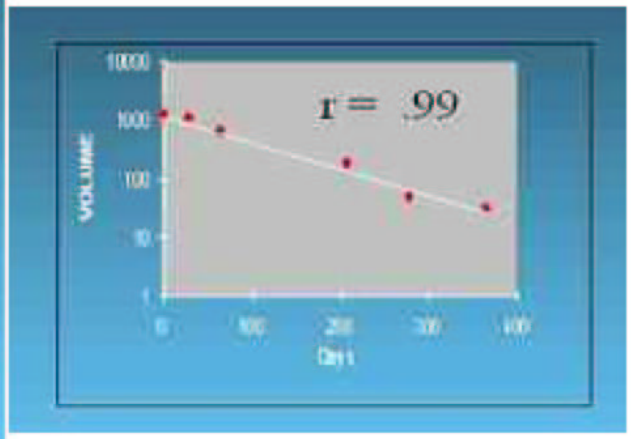
Importance of the Immune System: Clinical Evidence

Example: Clinical Response to Anti-CD3

Pt. 5: MRI Studies of a 42 y.o. woman with recurrent progressive left temporal astrocytoma, gr iii treated with anti-CD3, 50 mcg. q28d x 4



Treatment: Day 0 - Anti CD-3 10-75 mcg iv/60 min
Day 1 - Cyclophosphamide 300 mg/m^2
Day 28 - Re-evaluate, MRI, re-treat

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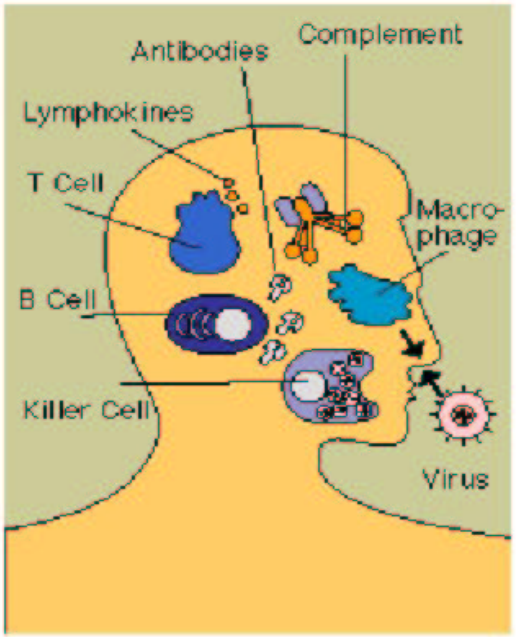
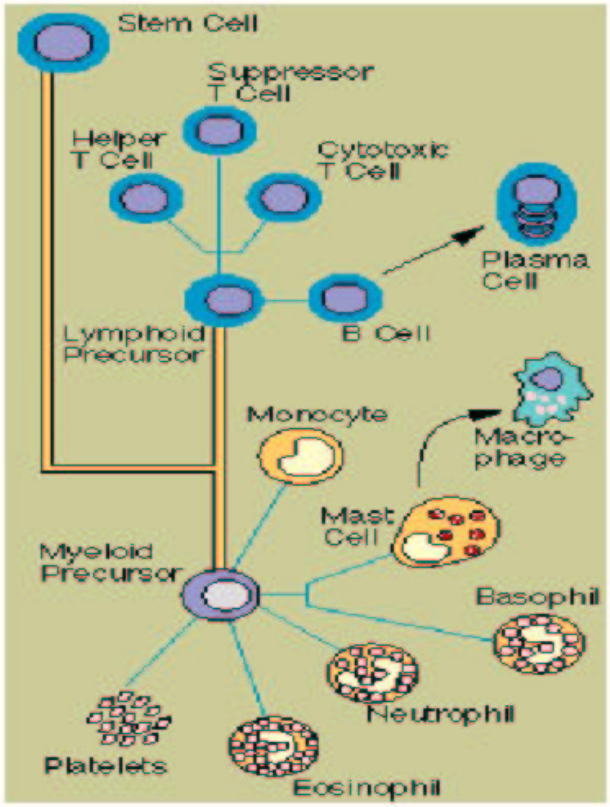
Overview of Immune Response





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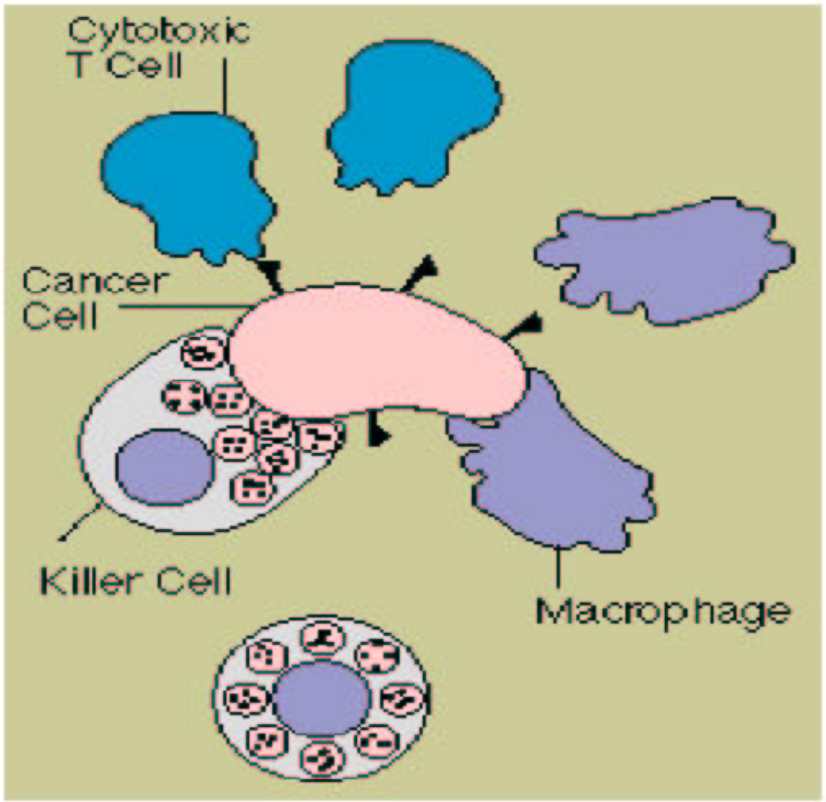
Immune System Targets Cancer



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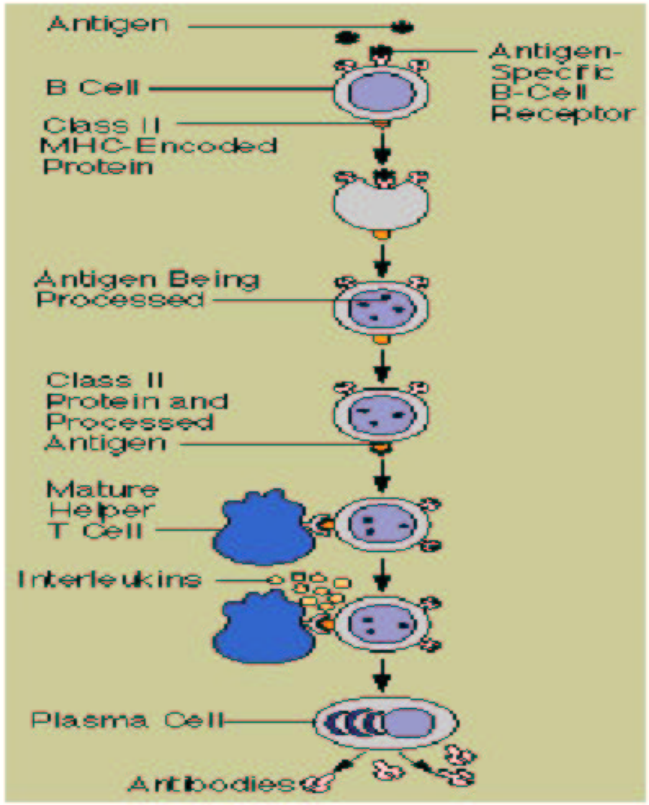
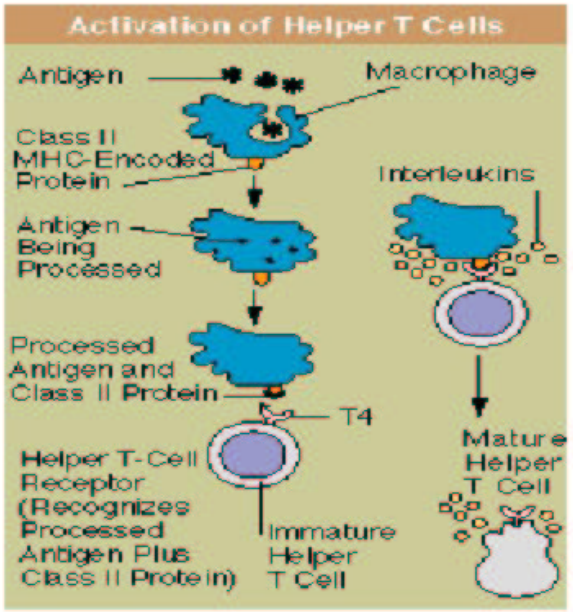
Activation of B and Helper T





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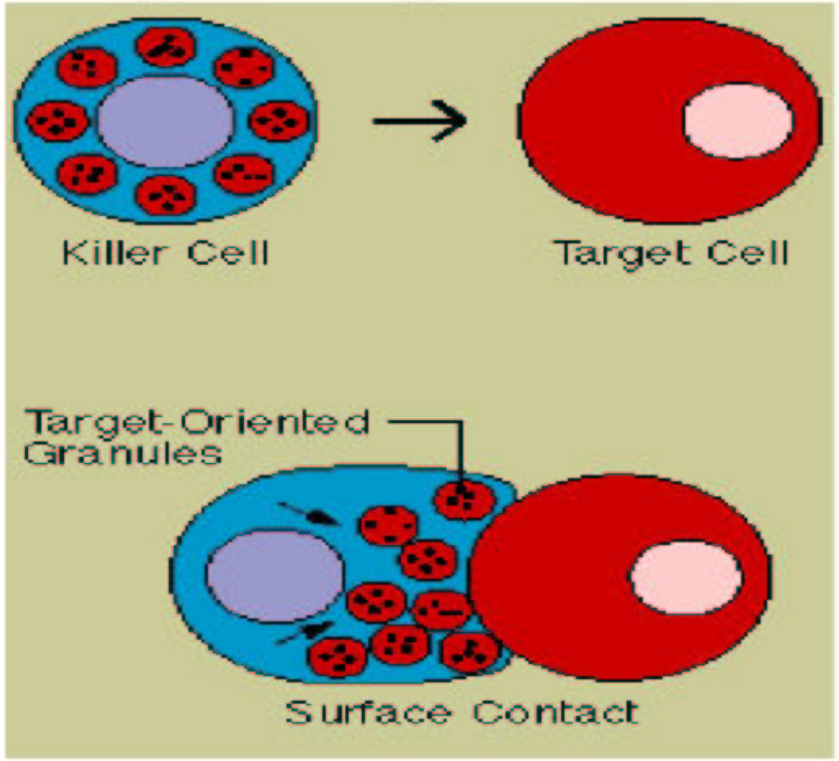
Natural Killer Cells (do not need to recognize specific antigen)



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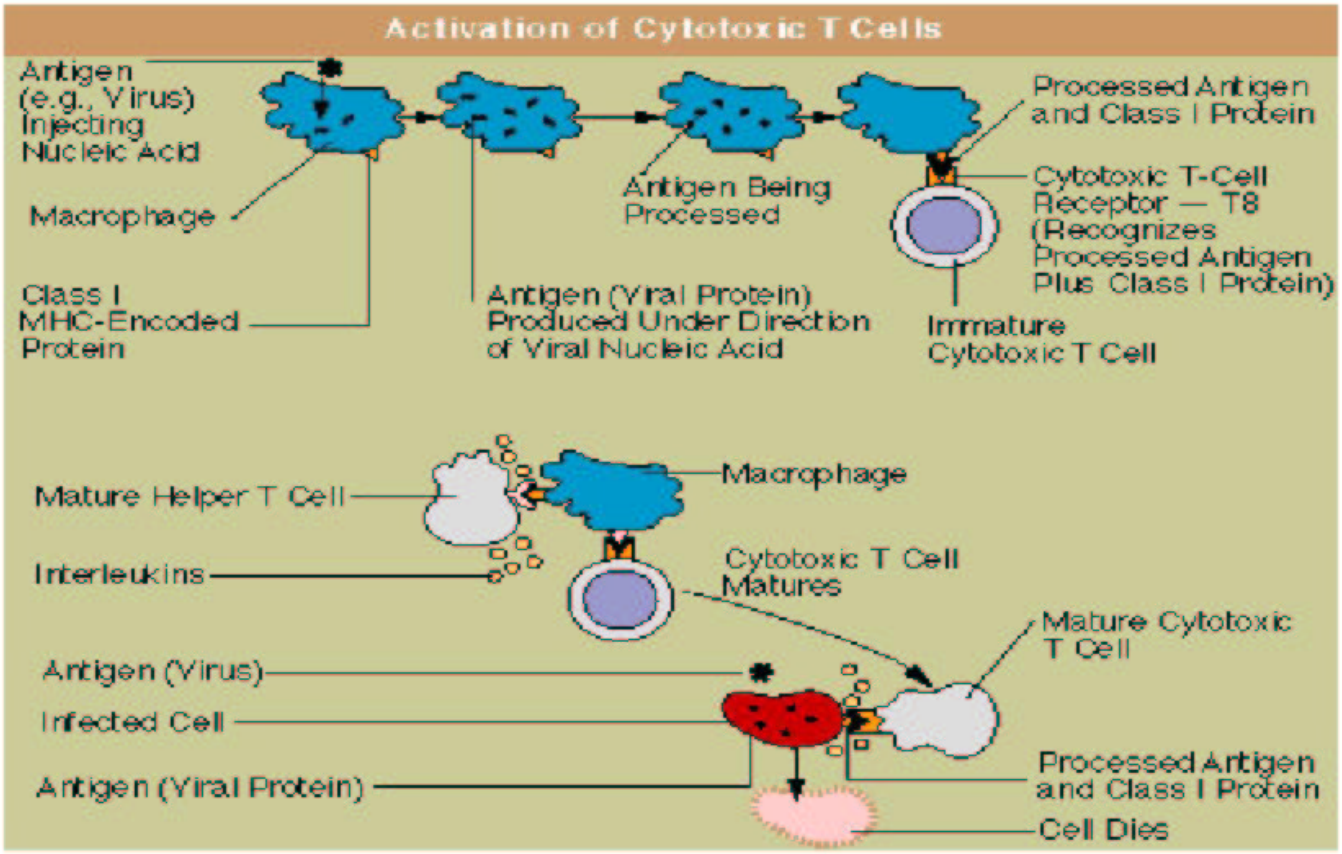
Activation of Killer T-cells



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Flow Chart