BIOGRAPHY:

Katherine Gundling, MD, is Associate Clinical Professor of Allergy and Immunology at UCSF, and Practice Chief of the Allergy/Immunology clinic at Moffitt Hospital. After undergraduate studies at Stanford University, she worked for several years in the medico-legal arena and for Linus Pauling before completing premedical requirements, and attending medical school at the University of Rochester. She was Director of Medical Education for the department of Internal Medicine at UC Davis for 8 years, and is the recipient of numerous teaching awards for her work with students and residents. In 2009 she completed editing, “The ACP Guide to Evidence Based Complementary and Alternative Medicine,” and she has performed a clinical trial of immunomodulatory properties of Panax ginseng. Currently she is also building the Allergy/Immunology curriculum for the UCSF community, and investigating the genetic underpinnings of common variable immunodeficiency.
Immunology 101:
The Basics
and Introduction to our Patient
Mini-Medical School, February 27, 2013

Katherine Gundling, MD
Allergy and Immunology
UC San Francisco

Tonight’s Presentation
Review the basic concepts of immunity
Learning goal:
Describe the essential purposes of the immune system

Meet Elizabeth
Learning goal:
Understand how living with a primary disorder of immunity can affect daily life

Apply Elizabeth’s story to our new-found knowledge of the immune system
Learning goal:
Understand which part of her immune system is not working properly

Learn several essential vocabulary words

Why?
Where?
When?
Who?
What?

External Threats

Why?
Where?
When?
Who?
What?

E. coli
Anthrax
US Public Domain

H. pylori
Yutaka Tsutsui
Immune Tolerance

The ability of the immune system to determine friend from foe

Example of an Internal Threat

Apoptosis
Programmed Cell Death (normal)

Cancer
Failure of Normal Cell Death (abnormal)

Another role of the immune system:

Promotion of normal bodily function – Wound repair and tissue clean-up
Why?
Where?
When?
Who?
What?

The Lymphatic System
Major sites of immune activity

This illustration was created by TheEmirr (Wikipedia), modified by cybertory
Immune System Key Cells

Sentinel cells in tissues
Examples: macrophages, dendritic cells, mast cells

Circulating cells
Examples: neutrophils, monocytes, eosinophils, lymphocytes

Tissue cells
Examples: epithelial cells (structural)
Example of the immune system at work:
*With respect to infectious diseases*

- Viruses
- Bacteria
- Fungi
- Worms
- Parasitic protozoa

Innate immunity
- Early responses

Adaptive (acquired) immunity
- Subsequent responses (more specific)

General time course of the immune response to infection

**Innate immunity:** 0-4 hours
- Recognition; response by preformed, non-specific mechanisms

**Early induced response:** 4-96 hours
- More precise recognition of microbes
- Recruitment of inflammatory response

**Adaptive immune response:** >96 hours
- Transport to lymphoid tissue
- Specific identification of microbe
- B and T lymphocytes respond with directed antibodies
  or effector cells

Adapted from Janeway

Innate Immunity
Summary (1)
- Mechanical/Physical barriers
- Chemical barriers and antimicrobial peptides
- Microbiological competition
- Complement system
  - Plasma proteins that “tag” bacteria for destruction
- Toll Like Receptors (recognize general features of the enemy)

Innate Immunity
Summary (2)
- Phagocytes – ingest harmful, foreign particles, and dead or dying cells

Phagocytosis
- “to devour” “cell” “process of”

Phagocytosis - Macrophage
- Macrophage - forming pseudopods
Phagocytosis - Neutrophil

Neutrophil engulfing Anthrax
(Bacillus anthracis)

Volker Brinkmann PLOS Pathogens 2005

Phagocytosis

Neutrophil Chasing Bacterium

Innate immunity
Early responses

Adaptive (acquired) immunity
Subsequent responses (more specific)

Hematopoiesis

Antigen
A substance either within or outside the body that triggers the immune system to produce antibodies against it

Antibody
A protein (immunoglobulin) produced by B lymphocytes in response to specific triggers by “foreign” substances. They identify and neutralize their target
After identifying the invader, lymphocytes generate an immunologic response that specifically and maximally targets that pathogen.

They also generate “memory” cells for future protection.

Meet our Patient
“Common Variable Immunodeficiency”
One in 30,000 to 75,000 people
Diagnosis can occur at any time of life
Infections (especially respiratory infections) are the most recognized complication

Bad colds or “bronchitis”
Sinusitis
Pneumonia

Why respiratory infections?
At least one important part of the immune system is not working properly: Antibody production!

Susceptibility to infection with PREDICTABLE infectious organisms; these “bugs” like to make trouble in the “respiratory tract”

Examples:
• Streptococcus pneumoniae (the most common cause of bacterial pneumonia)
• Haemophilus influenzae
Genetic predisposition?

Most cases of CVID seem to be sporadic, but clear genetic causes have been identified for about 10-15% of patients.

Other diseases of the immune system may have simpler, more predictable genetic defects.

Stay tuned for upcoming talks about genetics!

Summary

Immunity

A condition in humans that permits innate (hardwired) and adaptive (acquired) resistance to disease.

Promotes and maintains health through proper recognition and management of external (infection, pollution) and internal (wound repair, programmed cell death) challenges.

Vocabulary

- Tolerance
- Apoptosis
- Lymphatic system
- Phagocytosis
- Antibody
- Antigen

Learning goals

(Achieved?)

- Describe the essential purposes of the immune system.
- Understand how living with a primary disorder of immunity can affect daily life.
- Understand which part of our patient’s immune system is not working properly.
- Vocabulary!

Examples of things that can go wrong...

- Microbes outsmart the immune system
  - Viruses hide inside cells
- Cancers grow unchecked
  - Appropriate signals for normal cell death fail
- Neutral visitors are viewed as foes
  - Non-toxic substances cause allergies
- The body attacks itself...
  - resulting in autoimmune disease