HAC Presentation:
Food Allergies

Presented by:
Kimberly Concra, LDN
Cape Cod Cooperative Extension
Nutrition & Food Safety

kconcra@barnstablecounty.org
Objectives

• MA Food Allergen Awareness & Training video http://mehaonline.net/member-services/food-allergy-training-video.html
• A look at the numbers
• Hidden Ingredients and Allergens
• The science of food allergies
• Implications for Public Health
“Before placing your order, please inform your server if a person in your party has a food allergy.”

Source: MA Food Protection Program Website.
Restaurant Challenge

Industry/restaurants have no way of knowing whether a consumer was “diagnosed” or has a true food allergy. Science does not enter until a lawsuit is filed.

Current laws don’t help people with allergy to less common food allergens that are present in small amounts.

- Hidden ingredients in restaurants/homes (peanut in sauces, egg rolls)
- Labeling issues (“spices”, recipe changes, errors)
- Cross contact (shared equipment)
Potential Allergens on Menus

Menu
• Chicken Caesar Salad Wrap
• Garlic Bread
• Bread Pudding

Wheat: Chicken (if processed), salad dressing, wrap, garlic bread, bread pudding
Egg: salad dressing, wrap, bread pudding
Soy: Salad dressing, wrap, garlic bread, bread pudding
Fish: Salad dressing (worcestershire sauce: anchovies)
Nuts: Bread pudding
Question:

- What component of a food is responsible for an allergic reaction?
  a. Fat
  b. Protein
  c. Carbohydrate
  d. Trans fatty acids
I have a life threatening food allergy to peanuts, peanut oil and tree nuts (walnuts, cashews, pine nuts, almonds, etc.). Please inform me if any food I ordered contains any of these allergens (nuts/peanuts). Cross contamination of utensils, gloves and equipment can cause me to have a fatal reaction. Thank you very much.

Name (gives reference to chef/manager)
• Severe food-allergic reactions occur within what time period after ingestion?
  a. Within seconds
  b. From two minutes to 12 hours
  c. From within minutes to two hours
  d. Within two days
Activity

- Identify the allergens on food labels
Onion Soup Recipe Mix

- **Ingredients:** Dehydrated Onions, Salt, Maltodextrin, Cornstarch, Hydrolyzed Soya Protein, Onion Powder, Monosodium Glutamate, Caramel Color, Autolyzed Yeast, Partially Hydrogenated Soybean Oil, Disodium Inosinate, And Disodium Guanylate.
The Allergens are:

Onion Soup Recipe Mix

- **Ingredients:** Dehydrated Onions, Salt, Maltodextrin, Cornstarch, Hydrolyzed Soya Protein, Onion Powder, Monosodium Glutamate, Caramel Color, Autolyzed Yeast, Partially Hydrogenated Soybean Oil, Disodium Inosinate, And Disodium Guanylate.

Note: only the top 8 allergens are identified here. Many people are allergic to corn, too.
Prevention in the Kitchen

- Food handling and preparation
  - Hands
  - Gloves
  - Utensils
- Shared Equipment
  - Slicer
  - Grill
  - Knives
- Self service areas
  - Buffets
  - Salad bar
  - Splatters/steam from cooked foods
Media Publicized Incidents

- Amherst - bus incident 2004
- Westhampton – nurse’s office 2004
- Sabrina’s Law – Canada 2003
- Kiss of Death – Canada 2005

Information provided by Dianne Sutherland, RD, UMASS Amherst Dining Services.
Anaphylaxis Statistics

- 300,000 ambulatory visits in children and 150-200 deaths annually*
- 92% reactions are severe or fatal reactions to peanuts or tree nuts***
- 47% deaths from restaurants and food services*
- 51% deaths ages 10-19*
- 31% deaths ages 20-29*

*Statistics from Food Allergy Anaphylaxis Network
*** Managing Life Threatening Allergies in Schools
Adapted from ‘Food Allergies and You’ Dianne Sutherland, RD, UMass Amherst Dining Services
ADVANCES IN RESEARCH
January 2011

Food Allergy News and Notes

National Clinical Trial Seeks Participants: Investigational New Drug for Peanut Allergy Using a Skin Delivery System

USA Today: Special Supplement on Food Allergies
Read FAI Chairman Todd Slotkin's comments on research on page 7

Food Allergies Cause an ER Visit Every Three Minutes, Study Finds
Food allergies may cause many more visits to the emergency room than previously believed, according to a new study published in the Journal of Allergy and Clinical Immunology. The research team, led by Sunday Clark, MPH, of the University of Pittsburgh, found that food-allergic reactions caused more than 7 million ER visits from 2001 to 2005—an average of 203,000 visits each year. Anaphylaxis, a potentially life-threatening reaction, accounted for some 90,000 visits annually. This means that every three minutes, a food-allergic reaction sends an American adult or child to the ER, while an emergency room visit for food-related anaphylaxis occurs every six minutes.
**TABLE 8. Number of Student Prescriptions Reported to School Nurses (Monthly Average) September 1, 2009 - June 30, 2010**

<table>
<thead>
<tr>
<th>Medication Class</th>
<th>Scheduled (All Districts)</th>
<th>PRN (As needed) (All Districts)</th>
<th>Total (Daily &amp; PRN) Medications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analgesics</td>
<td>21.4</td>
<td>30,103.2</td>
<td>30,124.6</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>289.2</td>
<td>976.4</td>
<td>1,265.6</td>
</tr>
<tr>
<td>Anticonvulsants</td>
<td>158.2</td>
<td>621.7</td>
<td>779.9</td>
</tr>
<tr>
<td>Antihypertensive</td>
<td>63.8</td>
<td>33.6</td>
<td>97.4</td>
</tr>
<tr>
<td>Antihistamines</td>
<td>41.2</td>
<td>6,671.0</td>
<td>6,712.2</td>
</tr>
<tr>
<td>Asthma Medications</td>
<td>444.8</td>
<td>17,329.5</td>
<td>17,774.3</td>
</tr>
<tr>
<td>Epinephrine</td>
<td>0.0</td>
<td>8,817.3</td>
<td>8,817.3</td>
</tr>
<tr>
<td>Insulin</td>
<td>991.4</td>
<td>756.6</td>
<td>1,748.0</td>
</tr>
<tr>
<td>Psychotropic</td>
<td>3,269.7</td>
<td>513.7</td>
<td>3,783.4</td>
</tr>
<tr>
<td>Other Prescription/OTC Meds</td>
<td>1,140.3</td>
<td>10,939.4</td>
<td>12,079.7</td>
</tr>
<tr>
<td>Total</td>
<td>6,420.0</td>
<td>76,762.4</td>
<td>83,182.4</td>
</tr>
<tr>
<td>Row Percent</td>
<td>7.7%</td>
<td>92.3%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
Out of 9 selected school districts: food allergy and asthma rates are high: MA: Essential School Health Services 2010 report

<table>
<thead>
<tr>
<th>Physical/Developmental Conditions</th>
<th>Number (All Districts)</th>
<th>Rate Per 1,000 Students (All Districts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allergies:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bee Sting Allergies</td>
<td>3,471</td>
<td>5.6</td>
</tr>
<tr>
<td>Food Allergies</td>
<td>26,712</td>
<td>42.9</td>
</tr>
<tr>
<td>Latex Allergies</td>
<td>1,293</td>
<td>2.1</td>
</tr>
<tr>
<td>Asthma</td>
<td>77,507</td>
<td>124.5</td>
</tr>
<tr>
<td>Autoimmune Disorders (Arthritis, Lupus, etc.)</td>
<td>1,177</td>
<td>1.9</td>
</tr>
<tr>
<td>Blood Dyscrasias:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Homophilia</td>
<td>133</td>
<td>0.2</td>
</tr>
<tr>
<td>Sickle Cell Disease</td>
<td>684</td>
<td>1.1</td>
</tr>
<tr>
<td>Other Blood Dyscrasias</td>
<td>1,651</td>
<td>2.7</td>
</tr>
<tr>
<td>Cancer</td>
<td>543</td>
<td>0.9</td>
</tr>
<tr>
<td>Cardiac Conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Celiac Disease</td>
<td>840</td>
<td>1.3</td>
</tr>
<tr>
<td>Cystic Fibrosis</td>
<td>226</td>
<td>0.4</td>
</tr>
<tr>
<td>Diabetes Type I</td>
<td>1,863</td>
<td>3.0</td>
</tr>
</tbody>
</table>
Hospital discharges with a diagnosis related to food allergy increased significantly over time from 1998–2000 through 2004–2006.

Food Allergy Among U.S. Children: Trends in Prevalence and Hospitalizations
UMass Students with Allergies:
courtesy of Diane Sutherland, RD at UMass Amherst Dining Services

<table>
<thead>
<tr>
<th>Allergy or Intolerance</th>
<th>2007-2008</th>
<th>2008-2009</th>
<th>2009-2010</th>
<th>2010-2011</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>18</td>
<td>22</td>
<td>13</td>
<td>17</td>
<td>70</td>
</tr>
<tr>
<td>Peanut/Tree Nuts</td>
<td>21</td>
<td>17</td>
<td>46</td>
<td>59</td>
<td>143</td>
</tr>
<tr>
<td>Fish/Shellfish</td>
<td>6</td>
<td>4</td>
<td>22</td>
<td>30</td>
<td>62</td>
</tr>
<tr>
<td>Milk</td>
<td>9</td>
<td>3</td>
<td>9</td>
<td>16</td>
<td>37</td>
</tr>
<tr>
<td>Egg</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Multiple</td>
<td>16</td>
<td>6</td>
<td>21</td>
<td>32</td>
<td>75</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>6</td>
<td>32</td>
<td>12</td>
<td>55</td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
<td>60</td>
<td>145</td>
<td>172</td>
<td>452</td>
</tr>
</tbody>
</table>

452 is about 80% of students who have food allergies on campus. Still many who have not notified that they have allergies.
USDA’s Food Safety and Inspection Service (FSIS) has overseen 27 recalls for undeclared ingredients in the first six months of 2011; 20 are the result of undeclared allergens. In the preceding two years combined, FSIS issued recalls for a total of 32 undeclared allergens.

FSIS has instructed its inspectors to make poultry and meat establishments aware of the importance and prevalence of undeclared allergens in meat and poultry products, and how to best ensure labels are kept accurate and current. [http://www.fsis.usda.gov/](http://www.fsis.usda.gov/)
• Food And Drug Administration Amendments Act of 2007, which created the Reportable Foods Registry, helps the FDA better protect public health by tracking patterns of food and feed adulteration and targeting inspection resources. Data from the first year (2008-2009) of operation of the RFR suggest two particularly significant issues in multiple commodity(food) groups that require attention: *Salmonella* and undeclared allergens/intolerances.
Commodity/Food Safety Hazards of note: *E. coli* O157:H7, *Listeria monocytogenes*, *Salmonella*, Uneviscerated Fish, Foreign Object, Undeclared Allergens/Intolerances*, Other

*Intolerances is typically considered to be sulfites in the report

- 39.6% from Salmonella
- 30.2% undeclared food allergens/intolerances

53 of the 229 primary reports were caused by ingredients from foreign sources...21 countries. The top 8 at issue:

China: 13  Mexico: 5  Canada: 4  India: 4
Turkey: 4  Guatemala: 2  Poland: 2  Russia: 2

from the Reportable Food Registry Annual Report FDA

http://www.fda.gov/Food/FoodSafety/FoodSafetyPrograms/RFR/ucm200958.htm#fig11
What it looks like:

- Note similarity of risk % from salmonella and undeclared food allergens/intolerances
There were 80 primary RFR entries of which 69 were due to undeclared allergens and 11 were due to undeclared sulfites.

From FDA’s RFR: number of reports by specific allergen/intolerance.
Who has allergies?

• 12 million Americans (4% of US population or 1:25) of which 4 million (1:17) are children*
  – 39% of children have severe reactions, 30% have multiple FA
• 3.1 million Americans are allergic to nuts (1% US population)
• 6 - 8% school age students have allergies (300-400 in school district of 5000 students)*

Note: ‘severe reaction’ typically anaphylactic reaction

*Statistics from Food Allergy Anaphylaxis Network and Managing Life Threatening Food Allergies in Schools

Childhood food allergy study: rate is as high as 8%

- 38.7 percent of the children in the survey had a severe or life-threatening allergy
- 30.4 percent had multiple food allergies
- Children with food allergies were most commonly allergic to peanuts (25.2 percent), milk (21.1 percent) and shellfish (17.2 percent), followed by tree nuts (13.1 percent), and egg (9.8 percent)
- Severe reactions were most common among children with a tree nut, peanut, shellfish, soy, or finfish allergy
- Children aged 14-17 years were most likely to have a severe food allergy
- Food allergies affect children in all geographic regions
- Asian and African American children were more likely to have a convincing history of food allergy, but were less likely to receive a formal diagnosis when compared to white children

Definitions

• Food intolerance

• Food allergy
Food Intolerances:

Generally don’t involve an immune response but symptoms may mirror F.A.

- Lactose intolerance: lactase deficiency
- Food additives: MSG, sulfites
- Gluten intolerance: B-R-O-W
- Histamine toxicity: scombroid poisoning
- Ulcers/cancers of GI tract: symptoms worse when or right after eating food.

http://www.niaid.nih.gov/topics/foodAllergy/understanding/Pages/allergicRxn.aspx
What is a food allergy?

A food allergy occurs when the immune system responds to a harmless food as if it were a threat. The first time a person with food allergy is exposed to the food, no symptoms occur. But the body has been now been primed, and when the person eats the food again, an allergic response occurs.

http://www.niaid.nih.gov/topics/foodAllergy/understanding/Pages/allergicRxn.aspx
Food Allergy 2 step:

• Step 1:
• The first time you are exposed to a food allergen, your immune system makes specific immunoglobulin E (IgE) antibodies to that allergen. IgE antibodies circulate through your blood and attach to types of immune cells called mast cells and basophils. Mast cells are found in all body tissues, especially in your nose, throat, lungs, skin, and gastrointestinal (GI) tract. Basophils are found in the blood and also in tissues that have become inflamed because of an allergic reaction.

• Step 2:
• The next time you are exposed to the same food allergen, the allergen binds to the IgE antibodies that are attached to the mast cells and basophils. The binding signals the cells to release massive amounts of chemicals such as histamine.
• Depending on the tissue in which they are released, these chemicals will cause you to have various symptoms of food allergy. The symptoms can range from mild to severe. A severe allergic reaction can include a potentially life-threatening reaction called anaphylaxis.

http://www.niaid.nih.gov/topics/foodAllergy/understanding/Pages/allergicRxn.aspx
How do we get food allergies?

‘Spontaneous’ - when the body reacts to a food upon first exposure and the body ‘remembers’ the food and the immune system overreacts in a potentially life threatening way.

‘Atopic’ - Also known as ‘classic’, involves inheriting a predisposition to develop food and other allergies. This is the case particularly where one or both parents have hay fever (allergic rhinitis), asthma or rashes (atopic dermatitis).

Risk Assessment:

Generally, there is a greater risk for developing a food allergy if you come from a family in which allergies—including food allergies and other allergic diseases such as asthma or eczema—are common. Having two parents who have allergies makes you more likely to develop food allergy than someone with one parent who has allergies.

http://www.niaid.nih.gov/topics/foodAllergy/understanding/Pages/allergicRxn.aspx
First exposure:

- Usually, you are first exposed to a food when you eat it, but sometimes a first exposure or subsequent exposure can occur without your knowledge.
- This may be true in the case of peanut allergy. A person who experiences anaphylaxis on the first known exposure to peanut may have previously had contact with peanuts in any of the following ways:
  - Touching peanuts
  - Using a peanut-containing skin care product
  - Breathing in peanut dust in the home or when close to other people eating peanuts

http://www.niaid.nih.gov/topics/foodAllergy/understanding/Pages/allergicRxn.aspx
Adverse Food Reactions

Toxic / Pharmacologic

- Bacterial food poisoning
- Heavy metal poisoning
- Scombroid fish poisoning
- Caffeine
- Alcohol
- Histamine

Non-Toxic / Intolerance

- Lactase deficiency
- Galactosemia
- Pancreatic insufficiency
- Gallbladder / liver disease
- Hiatal hernia
- Gustatory rhinitis
- Anorexia nervosa
- Idiosyncratic

Adverse Food Reactions

IgE-Mediated (most common)
- Systemic (Anaphylaxis)
- Oral Allergy Syndrome
- Immediate gastrointestinal allergy
- Asthma/rhinitis
- Urticaria
- Morbilliform rashes and flushing
- Contact urticaria

Non-IgE Mediated
- Eosinophilic esophagitis
- Eosinophilic gastritis
- Eosinophilic gastroenteritis
- Atopic dermatitis

Cell-Mediated
- Protein-Induced Enterocolitis
- Protein-Induced Enteropathy
- Eosinophilic proctitis
- Dermatitis herpetiformis
- Contact dermatitis

The Biology:

The mucosal immune system has developed two anti-inflammatory strategies: immune exclusion by the use of secretory antibodies to control epithelial colonization of microorganisms and to inhibit the penetration of potentially harmful agents; and immunosuppression to counteract local and peripheral hypersensitivity against innocuous antigens, such as food proteins.

The mucosal epithelial barrier and immunoregulatory network are poorly developed in newborns. The perinatal period is, therefore, critical with regard to the induction of food allergy. The development of immune homeostasis depends on windows of opportunity during which innate and adaptive immunity are coordinated by antigen-presenting cells. The function of these cells is not only orchestrated by microbial products but also by dietary constituents, including vitamin A and lipids, such as polyunsaturated omega-3 fatty acids.

Exclusive breastfeeding for 4 months and mixed feeding thereafter will probably promote tolerance to food allergens in newborns.

Food Allergy: Separating the Science from the Mythology by Peter Brandtzaeg. Nature Reviews Gastroenterology and Hepatology 7, 380-400 (July 2010)
Immune Mechanisms

- Protein digestion
- Antigen processing
- Some Ag enters blood

**IgE-Mediated**

- IgE-receptor
- Mast cell
- Histamine

**Non-IgE Mediated**

- APC
  - TNF-α
  - IL-5

- B cell
- T cell
Sensitization Stage

1. Antigen (allergen) exposure
2. Plasma cells produce IgE antibodies against the allergen
3. IgE antibodies attach to mast cells and basophils
During an allergy attack:

The immune system produces IgE from a prior exposure to a food. This protein is called a food-specific antibody, and it circulates through the blood.

- The food-specific IgE then attaches to mast cells and basophils which are found in blood. Mast cells are found in body tissues, especially in areas that are typical sites of allergic reactions ie: nose, throat, lungs, skin, and gastrointestinal (GI) tract.
- Depending on the tissue in which they are released, these chemicals will cause various symptoms of food allergy. National Institute of Health Publication No. 07-5518 July, 2007.
Numbers of people with Food Allergies seem to be rising. Why?

- Delayed introduction of foods
- The form of food we eat: peanuts
- Increased awareness and testing
- Folate Theory: rise in F.A. parallel the recommendation to increase folate to prevent birth defects.
- GMO foods
- Hygiene Theory…….
Hygiene theory:
Food Allergy: Separating the science from the mythology
Per Brandtzaeg
Nature Reviews Gastroenterology & Hepatology 7, 380-400 (July 2010)
Food Allergy: Separating the science from the mythology
Per Brandtzaeg
Nature Reviews Gastroenterology & Hepatology 7, 380-400
(July 2010)
Biological variables affecting immune response of an infant

Food Allergy: Separating the science from the mythology
Per Brandtzaeg
Nature Reviews Gastroenterology & Hepatology 7, 380-400 (July 2010)
Common Allergens (U.S.)

90% of food allergies are from 8 foods:

- Milk
- Eggs
- Wheat
- Soy
- Peanuts
- Tree nuts
- Fish
- Shellfish
To complicate things:

Cross reactivity: A person with a life-threatening reaction to a certain food should avoid similar foods that may trigger this reaction. For example, in the case of a person with a history of allergy to shrimp, allergy testing may show that an allergy to other shellfish, such as crab, lobster, and crayfish. This is called cross-reactivity.

Oral allergy syndrome (OAS) is an allergy to certain raw fruits and vegetables, such as apples, cherries, kiwis, celery, tomatoes, and green peppers. OAS occurs mostly in people with hay fever. Handling or eating the raw food may start a reaction. Cooking the food may help due to the breakdown of the proteins from the cooking process. However: cooking does NOT breakdown in other foods!

Exercise-induced food allergy requires more than simply eating food to start a reaction. This type of reaction occurs after someone eats a specific food before exercising. As exercise increases and body temperature rises, itching and light-headedness start, hives may appear, and even anaphylaxis may develop. Some people have this reaction from many foods, and others have it only after eating a specific food. Crustacean shellfish, alcohol, tomatoes, cheese, and celery are common causes of exercise-induced food allergy reactions.

http://www.niaid.nih.gov/topics/foodAllergy/understanding/Pages/allergicRxn.aspx
Celiac Disease: Gluten-sensitive enteropathy

• Immune-mediated enteropathy triggered by gluten peptides in genetically predisposed patients.

• B-R-O-W Barley Rye Oats Wheat have gluten!
  – ~1/133 people in US have celiac disease – many are currently undiagnosed.
Cross reactivity pollens/foods:

- Birch → Apple, carrot, celery, cherry, pear, hazelnut
- Ragweed → Banana, cucumber, melons
- Grass → Melon, tomato, orange
- Mugwort → Melon, apple, peach, cherry
Natural Latex Allergies: Remember, natural latex is a plant source!

Proteins in foods - similar chemical composition to latex – may trigger reaction

- Banana
- Avocado
- Chestnut
- Hazel Nut
- Kiwi
- Melons
- Passion Fruit
- Fig

- Tomato
- Carrot
- Celery
- Papaya
- Potato
- Pineapple
- Mango
- Peach
More on Allergens

- Proteins in food, pollen or plants that possess homologous IgE binding epitopes across species creating risk.
- Tropomyosins: crustacea, dust mites, cockroach, mollusks
  - Storage mites in flour: anaphylaxis reported!
- Parvalbumins: fish
- Bovine IgG: beef, lamb, venison, cow’s milk
- Lipid transfer protein: fruits (peach, apple), vegetables, peanut, tree nuts
- Profilin: fruits, vegetables
- Class 1 chitinases: fruits, wheat, latex
Anaphylaxis

Causes:
- Food
- Insect Sting
- Medication (Antibiotics/Aspirin)
- Latex

• Which is most prevalent?
Epi-Pen Treatment for Anaphylaxis
Public Health Challenge:
Food Allergens are hard to avoid:

Due to recent cutbacks, several major airlines have eliminated their snack carts.
Challenges: Food Allergies

- No cure
- Drugs offer limited help
- Strict avoidance
- Self-diagnosed or true diagnosis?
- Food Allergens are a Food Safety issue
- Rates of food allergy appear to be rising
Patients with severe food allergy may not receive education on avoidance, self-injectable epinephrine or referral to an allergist at emergency department visits. It is imperative for primary care doctors and allergists to recognize the risks and help patients avoid a future accident.

Hope: future therapies and interventions

- **Heat-killed E. coli encoding mutated allergens**: genetics/molecular biology
- **Chinese herbal remedies (Food Allergy Herbal Formula)**: Induction of tolerance after establishment of peanut allergy by the food allergy herbal formula-2 is associated with up-regulation of IFN-γ. Qu et al. CEA 2007;37:846.
- **Oral tolerance induction**: very small doses over time.
- A randomized, double-blind, placebo-controlled study of Milk Oral Immunotherapy (MOIT) for cow’s milk allergy. Skripak JM et al. JACI 2008;S137
Food Allergy Web Sites

American Academy of Allergy Asthma and Immunology
http://www.aaaai.org/

Asthma and Allergy Information and Research
http://www.users.globalnet.co.uk/~aair/nut_corr.htm

Food Allergy and Anaphylaxis Alliance
http://www.foodallergyalliance.org

Food Allergy and Anaphylaxis Network
http://www.foodallergy.org

Food Allergy Alert! Receive recalls via e-mail

USDA Food and Drug Administration FDA Consumer
http://vm.cfsan.fda.gov/~dms/wh-alrg1.html
Special thanks to Dianne Z. Southerland, RD, UMASS Amherst Dining Services for the use of some of her slides.


Allergy Awareness and Training information from Massachusetts Food Protection Program. Note: Allergen video may be viewed for free at: mehaonline.net/member-services/food-allergy-training-video.html


Food Allergy: Separating the Science from the Mythology by Peter Brandtzaeg. Nature Reviews Gastroenterology and Hepatology 7, 380-400 (July 2010).