# Chemical Contaminants and Natural Toxins

# Chemical contaminants

- When food is farmed, processed or manufactured many chemicals are used in the process; they often remain in the food and therefore are consumed

- These chemicals fall into four categories:
  - pesticides
  - veterinary medicines ( like antibiotics)
  - additives (e.g. colouring agents and preservatives)
  - environmental contaminants (like cadmium in fish )

# Chemical  Residues in Foods

- Most countries carry out food residues monitoring schemes to assess consumer exposure and risk
- ● Residues exceeding ADIs mean that the risk of consuming the food is unacceptable
  - ADI: is the amount of (in this case) a pesticide that can be consumed every day for the consumer's entire lifetime with no adverse effects
  - HUGE SAFETY MARGIN
- ● Residues intake estimates are calculated from residues levels in food and food consumption figures (from National Nutrition Surveys).
- Residue cocktail effects are probably important, but little is known about them toxicologically.

# Natural Toxins

- Plants and animals have evolved to survive in hostile environments and they do this, in part, by producing defense chemicals to protect themselves against others in the environment that see them as food.

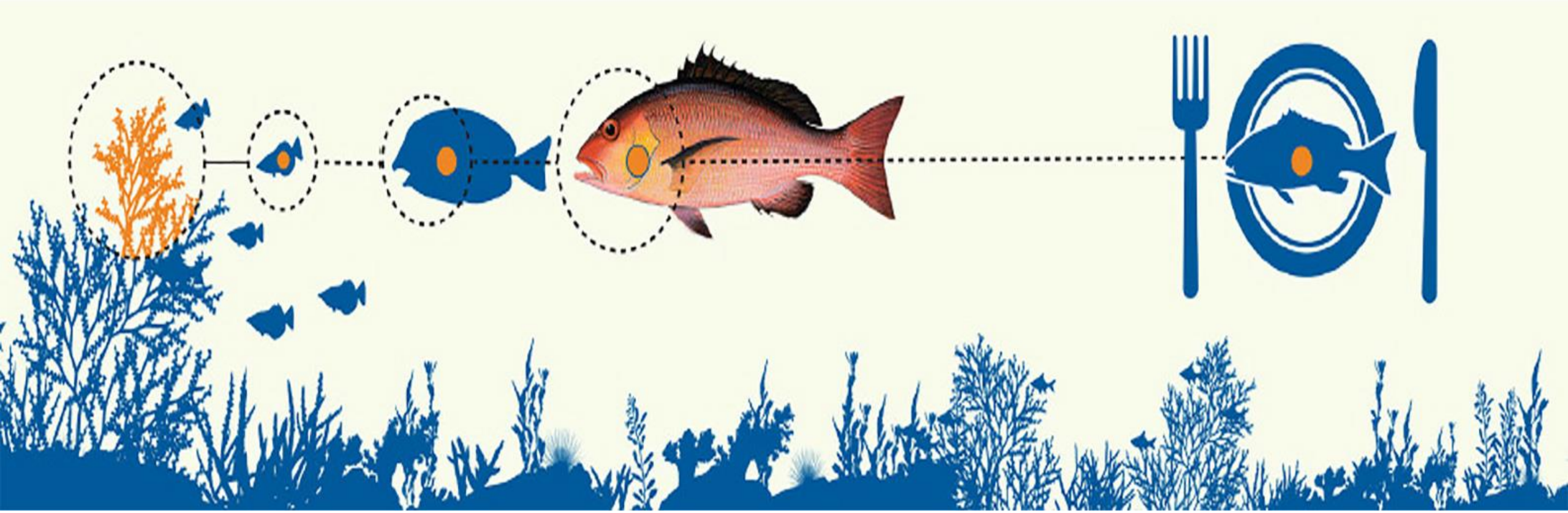
- Many are toxic to human consumers

- Ciguatoxin
- Mycotoxin
- Scrombotoxin
- Allergens

# Cigua toxin

- Caused by eating contaminated tropical reef fish
- The toxin is found in tiny free swimming sea creatures called algae which live among certain reef
- Toxic algae is eaten by fish, stored on the flesh,  skin, and organs → humans eat contaminated fish
- Toxin is heat stable and not destroyed by cooking

- **Symptoms**: vomiting, diarrhea, hot/cold flashes, vertigo



# Scombrotoxin

- Also called histamine poisoning
- Caused by eating foods high in chemical compound called histamine

- Histamine is naturally produced by certain spoilage bacteria when they decompose foods containing the protein histidine.
- Histamine is not inactivated by cooking

# Scombrotoxin

- Transmission in foods: bacteria can break down histidine and cause production of histamine.
  - Leaving fish out at room temperature usually results in histamine production
- Common foods: tuna , sardines, mackerel, anchovies, ….

- Symptoms: dizziness, burning feeling in the mouth, facial rash, peppery taste in mouth, itching, teary eyes, runny nose
- 1-30 minutes

# Mycotoxins

- Most yeasts and molds are spoilage organisms → cause foods to deteriorate
- Some types of fungi produce toxic chemicals called mycotoxins→ Meaning mushroom
- Mycotoxins are produced by fungi (yeasts, mushrooms, molds)

- Many mycotoxins can cause cancer , and many cannot be destroyed by cooking

# Mycotoxins

- Some important type of mycotoxins :
  - Aflatoxin
  - Patulin

# Aflatoxins

- produced by the fungus (mould) *Aspergillus flavus* which grows on stored nuts and grains (particularly peanuts).

- Toxic and carcinogenic at small doses

- very low MRL (15 µg/kg total aflatoxins) has been set to ensure that peanuts with unacceptably high concentrations of aflatoxins cannot be traded

**Table 8.5** Aflatoxin levels in foods from around the world. (Data from IARC Monographs (2002), *Aflatoxins*, **82**, 184–185.)

| Food | [Aflatoxin] range (µg/kg) | Country of origin of food |
|---|---|---|
| Peanut foods | 1–1,500 | India, Malaysia, Philippines |
| Nuts and nut products | 0.3–128 | Japan |
| Sorghum | 0.1–30.3 | India, Thailand |
| Beer | 0.0005–0.0831 | Japan |
| Maize | 0.11–4,030 | China, India, Indonesia, Philippines, Thailand, Vietnam |

# Patulin

- is produced by the fungus *Penicillium expansum* that can grow on apples and pears causing them to rot

- Because rotting apples and pears are unpalatable, patulin is not a problem in fruit directly
- sub- standard fruit (i.e. partially rotted) might be used to manufacture fruit juice and thus patulin might be transferred to the fruit juice;
  - patulin has been found in apple juice at concentrations above 1,000 µg/kg.

# Patulin

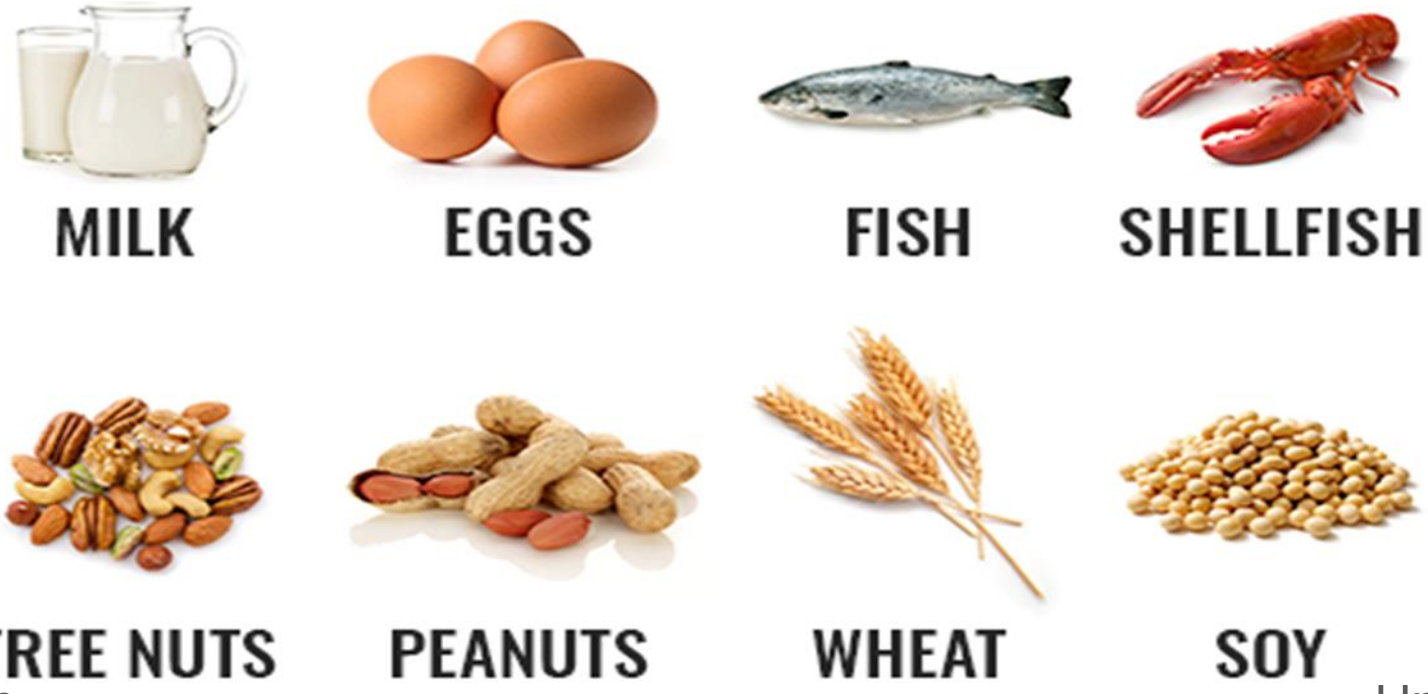
- Patulin is a suspect carcinogen and apple juice is often consumed by babies and infants, either directly as fruit juice or indirectly as a natural sweetening agent for baby food products

- they consume large amounts for their body weight

- Prevention :
- use fresh produce or produce stored in a way that molds do not grow

# Food allergens

- Allergy to certain chemicals in foods and food ingredients
- Causes person's immune system to "over react"



# Food allergy

- The only way for a person who is allergic to one of these foods to avoid an allergic reaction is to avoid the food.

- As little as half a peanut can cause a severe reaction in highly sensitive people

# Food allergens – symptoms

- Skin
  - Hives
  - Rashes
  - Itching
  - Swelling ….
- Digestive tract
  - Vomiting
  - Diarrhea
- Airways
  - Difficulty breathing
  - Wheezing

- These symptoms occur in 5 minutes