Microbial Food Safety Research in China:

Major Achievements & Challenges

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Education:

PhD, Helsinki University Faculty of Veterinary Medicine, 1996
MS, Zhejiang University, Hangzhou, China, 1985
BVSc, Zhejiang University, Hangzhou, China, 1981

Current & past positions:

Professor: Zhejiang University, 1996- present
Post-doctoral fellow: University of Tennessee, 1997-1999
Visiting scientist:
- Royal Veterinary and Agricultural University (2001)
- Harvard University, Department of Microbiology (2006)

Society service

Exec. Board Member: Intl. Committee on Food Microbiol & Hygiene
Deputy Director: Chinese Veterinary Food Hygienists Society

Research interests:

Microbial food safety, infection biology & vaccine development of major swine pathogens.

- ✧ **Current Situations**
- ✧ **Achievements**
- ✧ **Major Challenges**
- ✧ **Collaboration**

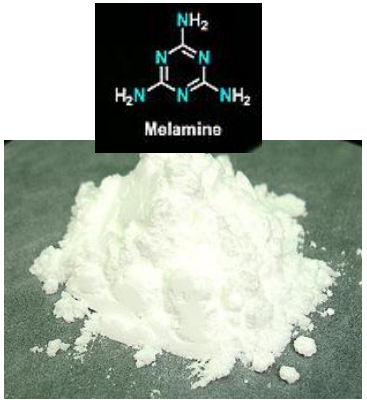
✧ **Current Situations**

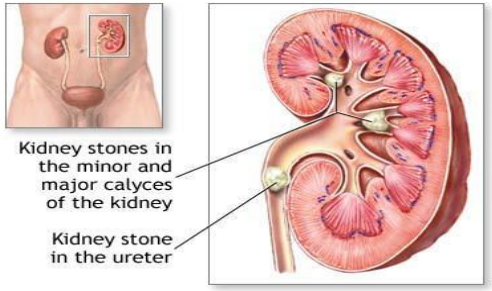
✧ **Achievements**

✧ **Major Challenges**

✧ **Collaboration**

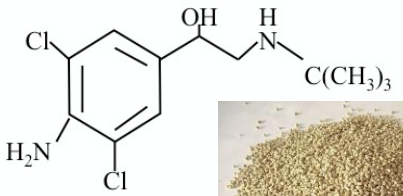
Melamine incident: Spring-Fall, 2008: More than 290,000 children affected





Only 643 out of 1,176 dairies were granted permission

Clenbuterol intoxications from pork



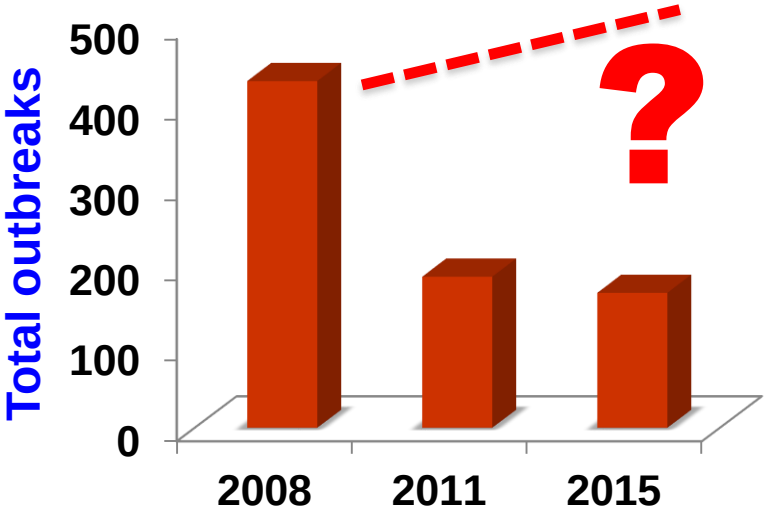
17 cases of intoxication in Hong Kong (1998)

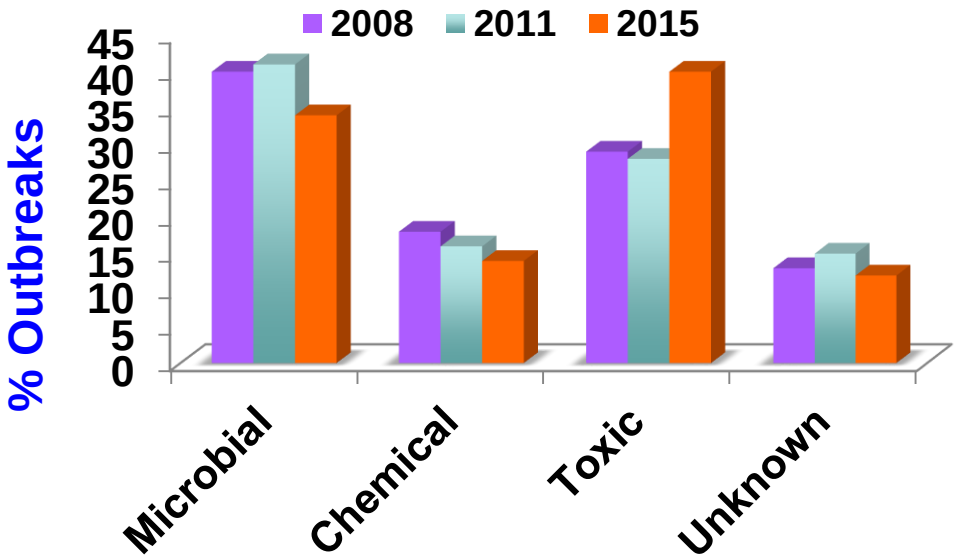
> 300 cases in Shanghai (2006)

70 cases in Guangzhou (2013)

Beta-Agonist for lean meat

Foodborne diseases in China: ↗ or ↘ ?





	Outbreaks	Cases	Death
Microbial	57	3181	8
Chemical	23	597	22
Toxic	68	1045	89
Unknown	21	1103	2
	169	5926	

Major pathogens:

***Salmonella* spp., *Vibrio parahaemolyticus*, *Bacillus cereus*, *Staphylococcus aureus*, *pathogenic E. coli*, Botulism.**

Source: Chinese CDC

Major Safety Issues

- ✧ **Microbial contamination: Predominant**
- ✧ **Intoxications due to chemical residues: Sporadic**

Green book 2007

Report on Food Safety in China

Food Safety in China: Current situations, problems & strategies

Special Report by the Chinese Academy of Engineering 2016

Food safety is improving, but still vulnerable because major weakness still exists along the chain:

1. **Microbial contamination:** dominant;
2. **Pestisides and veterinary drugs:** sources from farms & unordered;
3. **Heavy metals & mycotoxins**: long-term implications;
4. **Illegal adulteration or use of prohibited chemicals:** eminent.

Long-term strategic plan (2016-2030) with special focus on R&D for novel technologies & integrated approaches for safer food.

✧ Current Situations

✧ **Achievements**

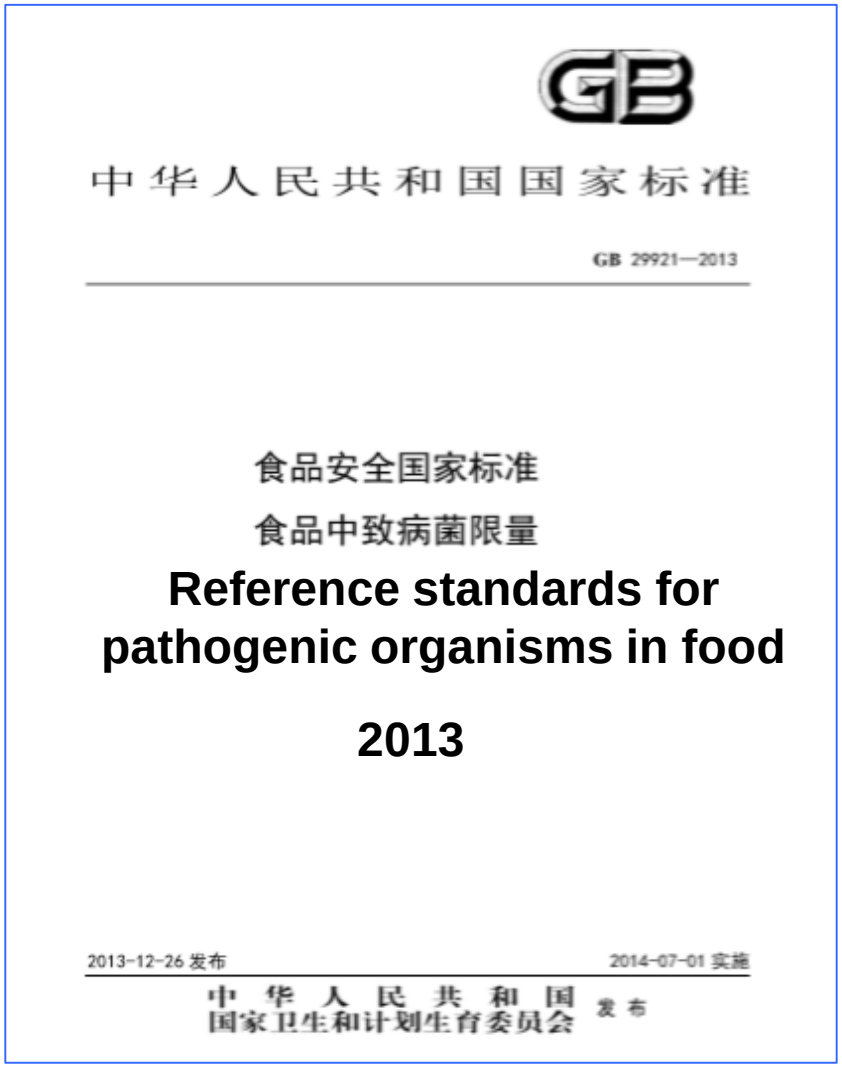
✧ Major Challenges

✧ Collaboration

Achievements in the past 15 years

- ✧ Laws & regulations
- ✧ Infrastructure covering major cities
- ✧ Molecular detection techniques
- ✧ Validation of methods for chemical residues & mycotoxins
- ✧ Prevalence of major pathogens in food
- ✧ Molecular source-tracking technologies, such as PFGE, MLST, MLVA, etc.
- ✧ Product traceability systems available
- ✧ Risk assessment in progress

Laws in place and standards revised or improved



Infrastructure better but requires further coordination

Food Safety Committee of State Council

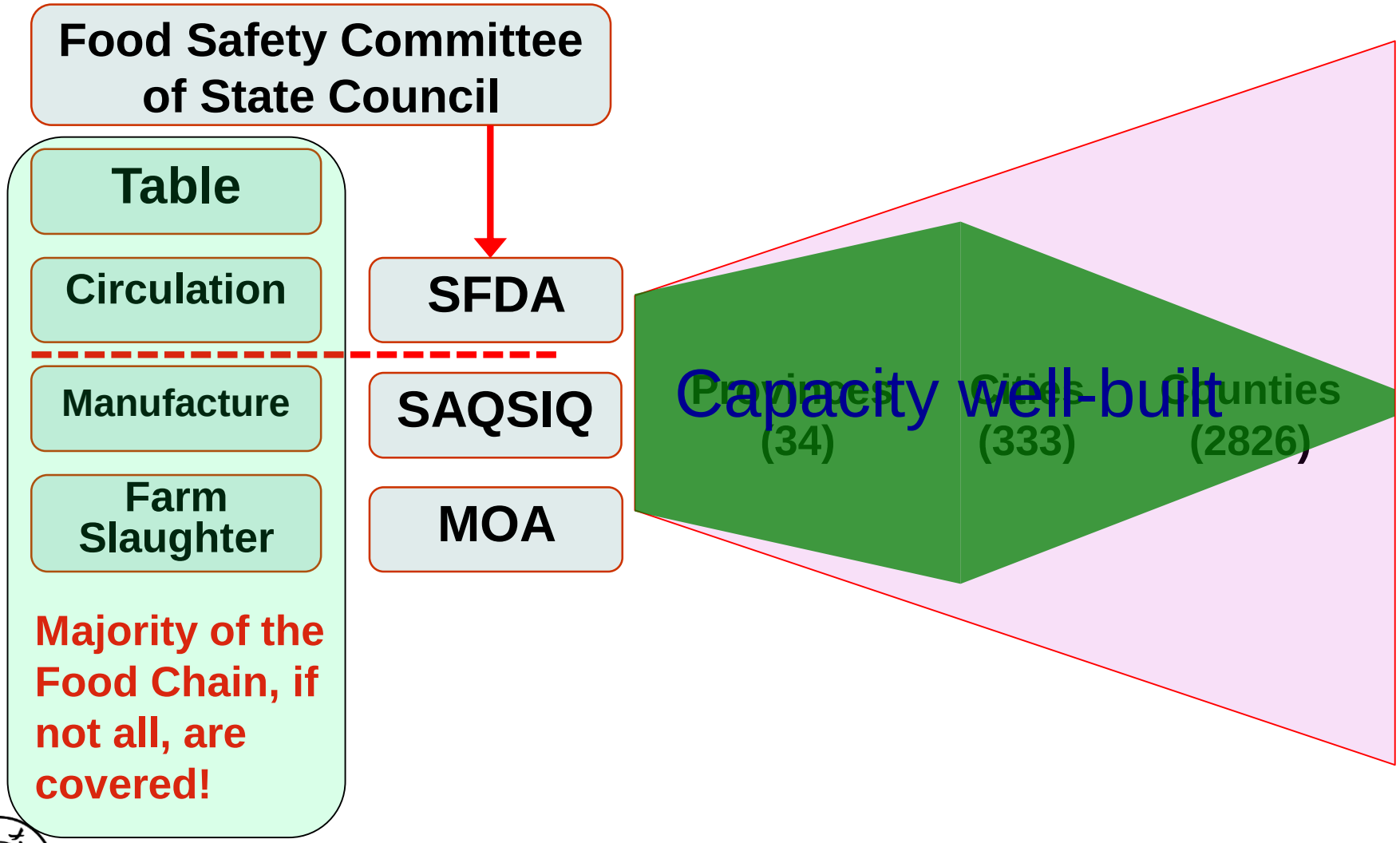
Table	
Circulation	SFDA
Manufacture	SAQSIQ
Farm Slaughter	MOA

国家食品药品监督管理总局 CFDA
China Food and Drug Administration

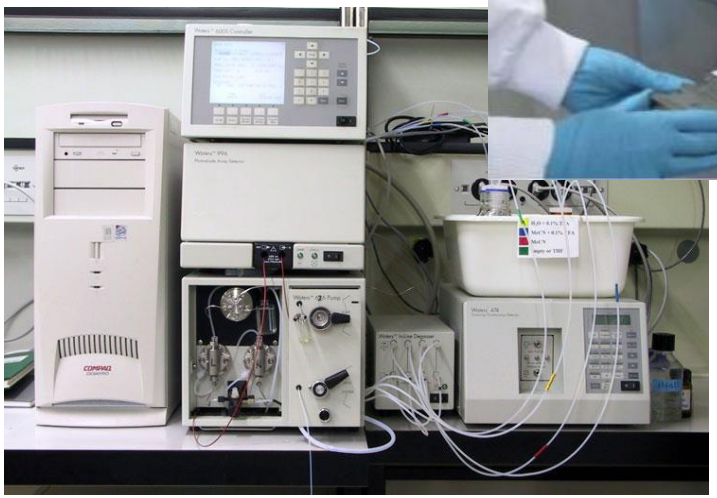
国家质量监督检验检疫总局
General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China

中华人民共和国农业部
Ministry of Agriculture of the People's Republic of China

Capacity well-built, but requires improvement



Fancy equipment available in high-level laboratories



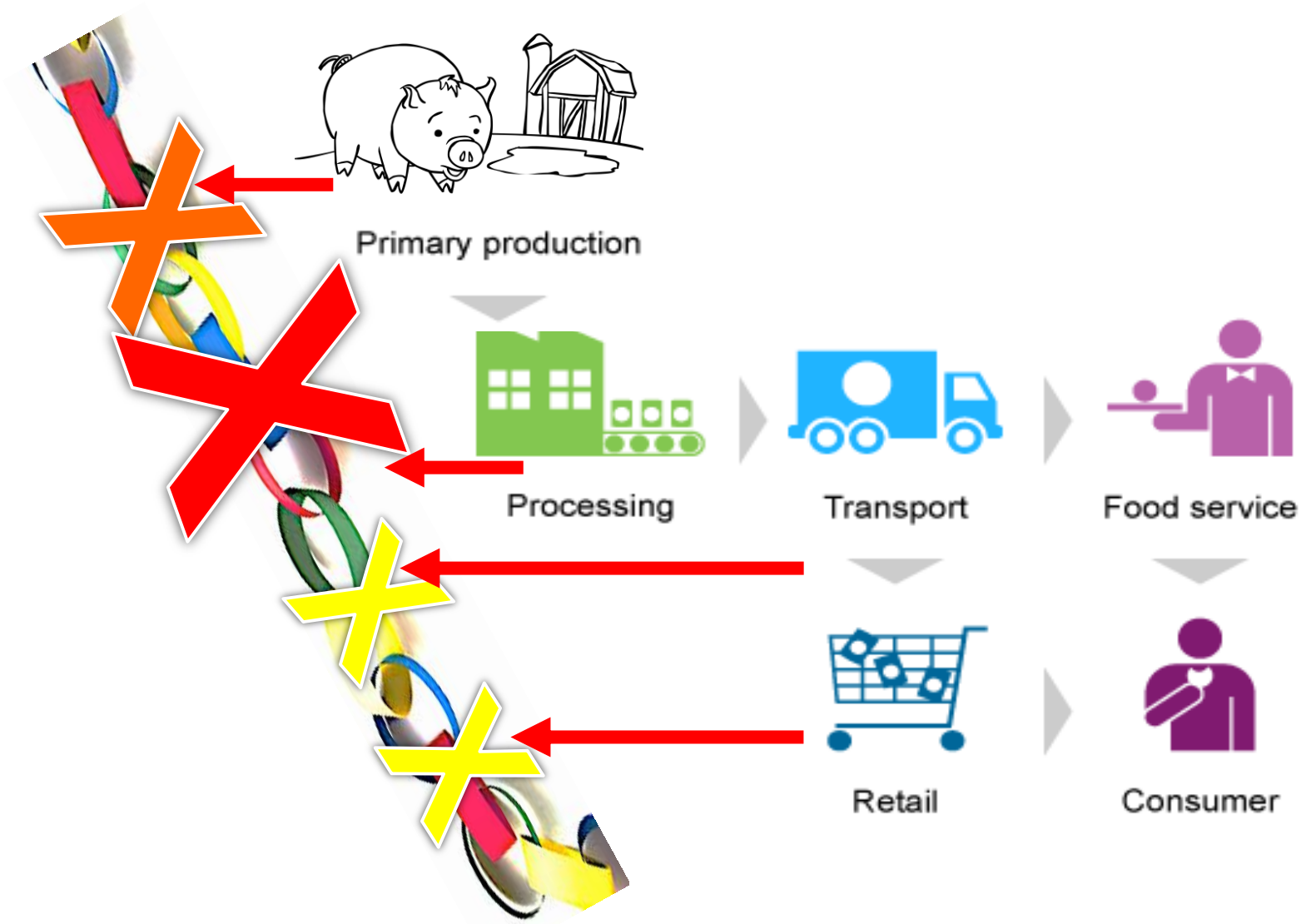
✧ Current Situations

✧ Achievements

✧ **Major Challenges**

✧ Collaboration

Major safety risks along the food chain



Chinese Food Industry (2011)

- ✧ **Gross sales: RMB 6.9 trillion (or $1.1 trillion)**
- ✧ **Gross industry output value: 8.2%**
- ✧ **Total number of firms*: 400,000 (to 450,000)**
- ✧ **Number of sized firms**: 32,639 (ca 10%)**
- ✧ **Number of employee: 6,740,000 (2%)**

**** Small firms (less than 10 staff): 352,000***
***** Firms with annual sales revenue of >$740,000.***

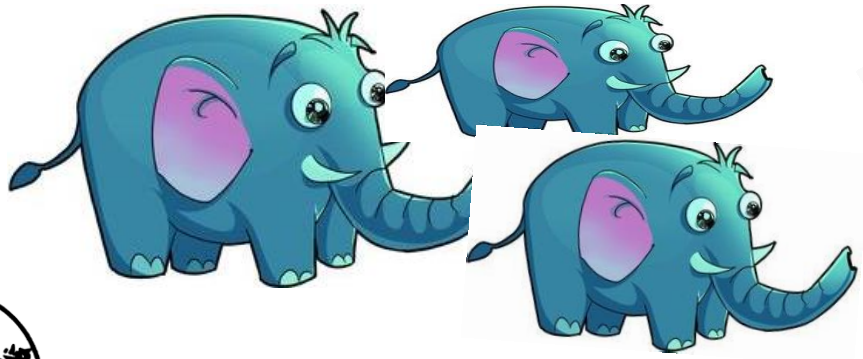
Majority of the food firms are small ones

(400,000 - 450,000)

10-15%

?

85-90%



Farmers markets...fragile

✧ Current Situations

✧ Achievements

✧ Major Challenges

✧ **Collaboration**

Proposed areas of collaboration

1. Integrated approach for control of zoonotic or foodborne pathogens across the food chain.
2. Spoilage microorganisms in chilled meat: Metagenomic profiling and intervention strategies.
3. Transmission dynamics of antimicrobial resistance genes at the human-animal interface via environments and foods.
4. Risk assessment of chronic exposure of mycotoxins in foods using cell models.
5. Novel approaches for remediation of mycotoxins and heavy metals in raw materials for processed foods or feeds.

Integrated approach for control of zoonotic or foodborne pathogens across the food chain

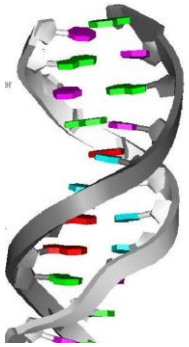
1. Identify major points of microbial contamination along the chain;
2. Set up effective intervention strategies;
3. Evaluate the effectiveness of such strategies in plants, particularly the small- or medium-size enterprises.

Spoilage microorganisms in chilled meat: Metagenomic profiling & intervention strategies

1. **Identify major spoilage organisms in chilled meat;**
2. **Develop novel technologies that could extend shelf-lives of chilled meats.**

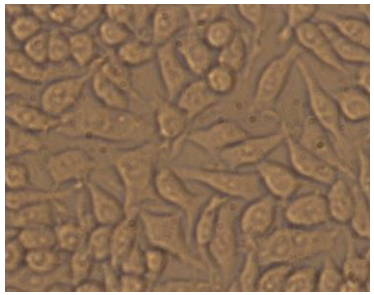
Transmission dynamics of antimicrobial resistance genes at the human-animal interface via environments and foods

1. **Determine the impacts of use of antimicrobial in animals on resistance gene transfer to environmental bacteria or human pathogens via foods;**
2. **Discover novel resistance genes via meta-genomic approach;**
3. **Elucidate the mechanisms of resistance development and resistance gene transfer.**



Risk assessment of chronic exposure of mycotoxins in foods using cell models

1. Develop cell models and novel methods for examination of toxic effects of target mycotoxins;
2. Identify host molecules induced by chronic exposure of mycotoxins using transcriptomic and proteomic approaches;
3. Validation of in vitro cell models in experimental animal models.



Thanks for your attention!