



World Organisation
for Animal Health
Founded in 1924

中华人民共和国农业农村部
Ministry of Agriculture and Rural Affairs of the People's Republic of China

The Situation and Future Prospects of Zoonotic Tuberculosis Prevention and Control

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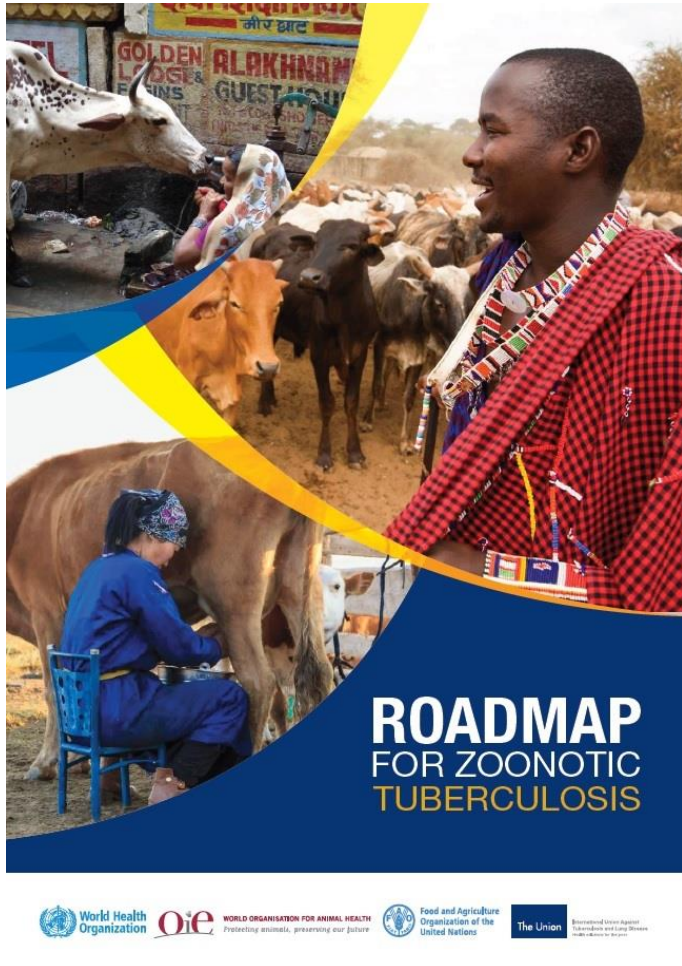
China Animal Health and Epidemiology Center

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Agriculture Research System regarding National Dairy Industry Technology System





Zoonosis tuberculosis (zoonotic TB, zTB)

1. What we have done
2. What we are doing
3. What we will do



1

What we have done

- e m p h a s i s
- u n d e r s t a n d i n g

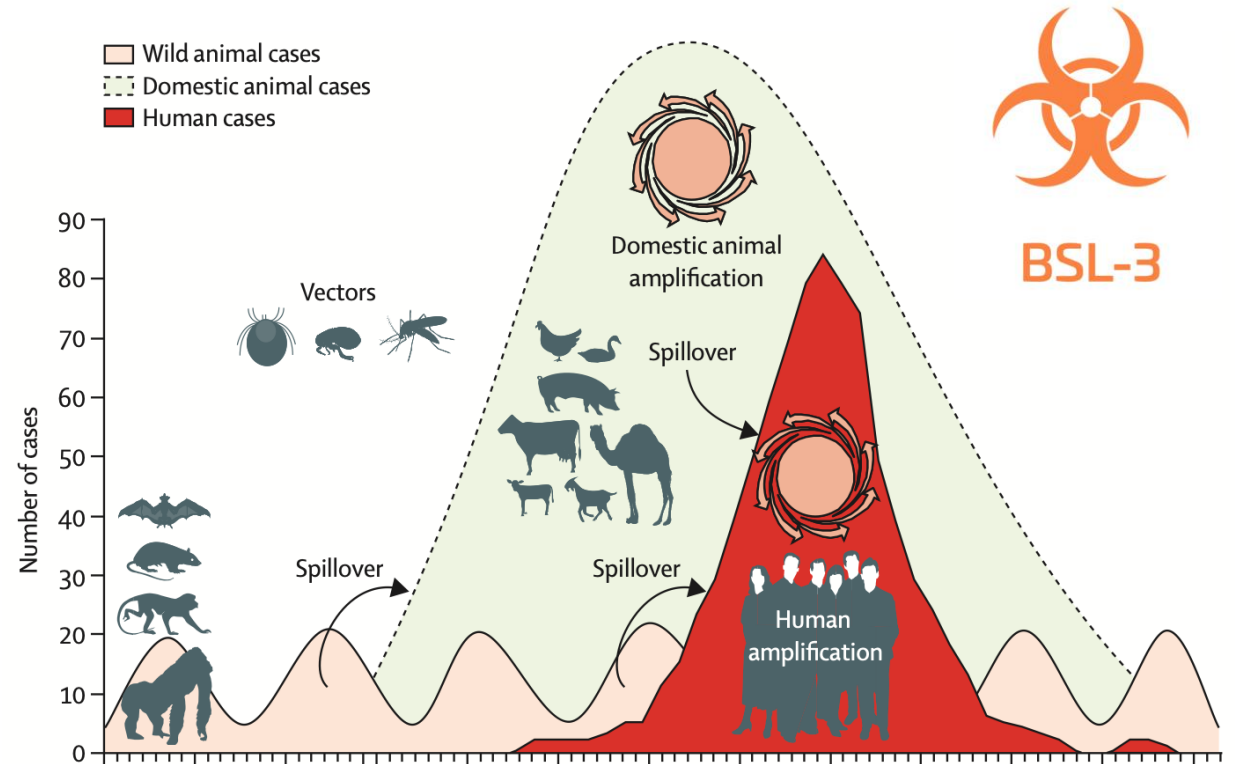


1.1 Laws and Regulations

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- Animal Epidemic Prevention Law of the People's Republic of China
- Biosecurity Law of the People's Republic of China
- List of Class I, II and III Animal Epidemic Diseases
- National Plan for the Prevention and Control of Zoonoses among Livestock 2022-2030
- Annual surveillance and epidemiological investigations of bovine tuberculosis

- ✓ **Bovine tuberculosis is one of the eight key zoonotic diseases for prevention and control**
- ✓ **Control zoonotic tuberculosis from the animal origin**

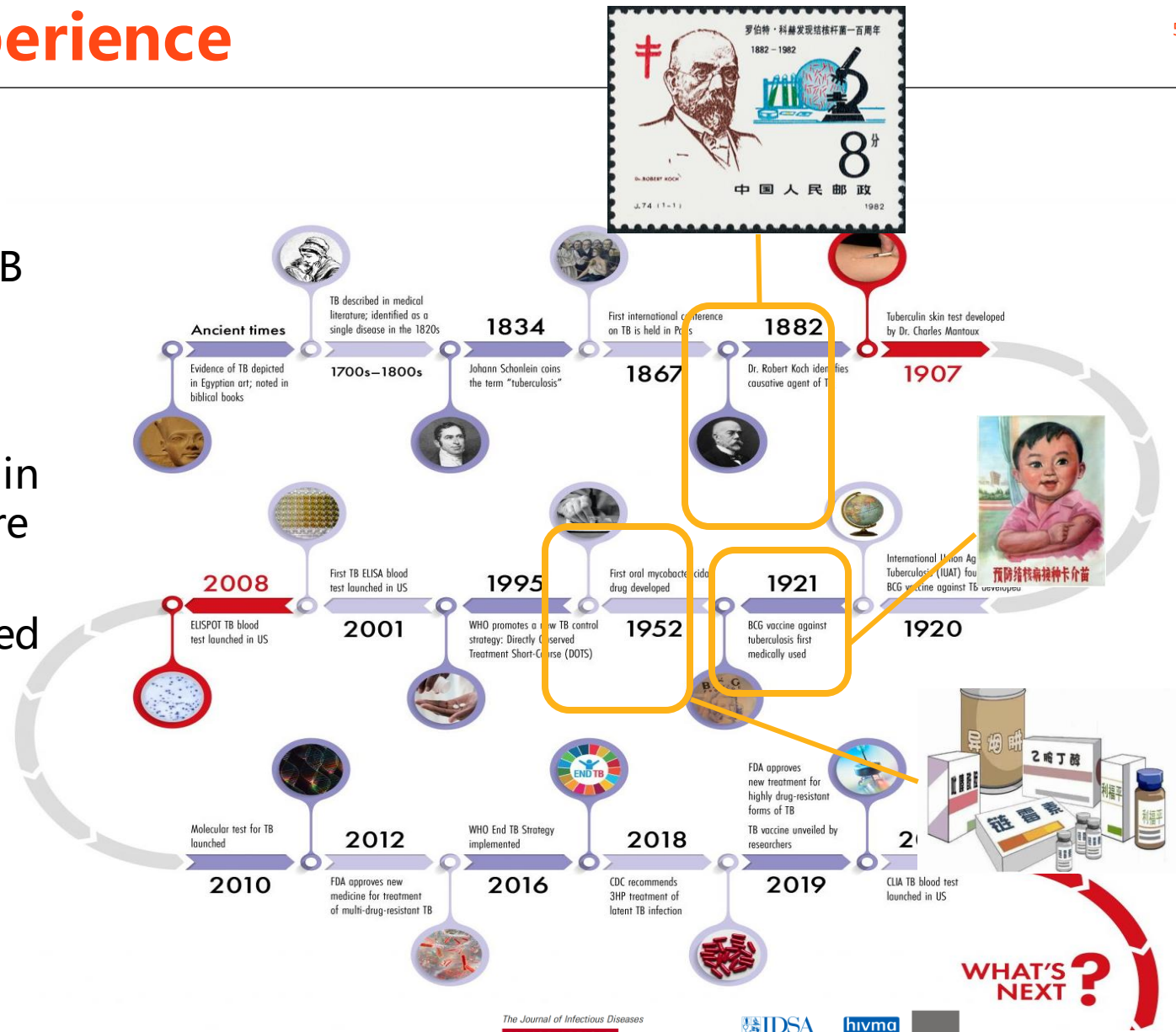




1.2 Knowledge and Experience

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- In 1900, approximately 10% of human TB cases in the United States resulted from human exposure to cattle or related products infected with *M. bovis*
 - In 1947, approximately 30% of TB cases in children under 5 years old in the UK were caused by *Mycobacterium bovis*
 - In the past, zTB was commonly associated with extrapulmonary TB because of unpasteurized milk
- ✓ With the use of BCG, tuberculosis drugs and milk pasteurization, human zTB infection in most parts of the world has been effectively controlled



The Journal of Infectious Diseases
MAJOR ARTICLE

IDSa hivma
Infectious Disease Society of America the medical association
OXFORD

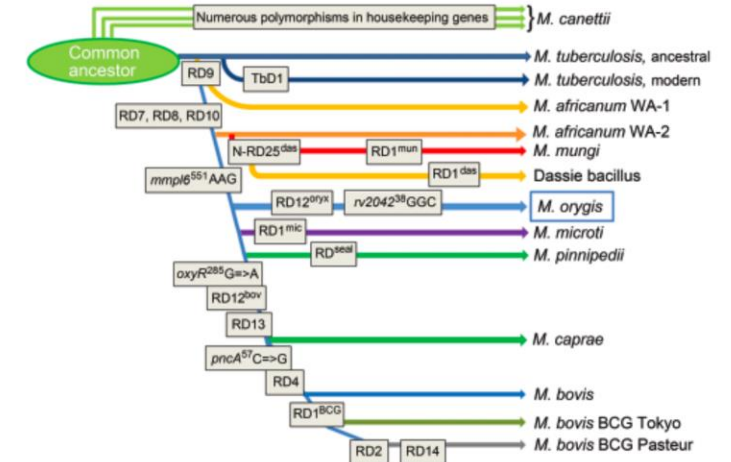
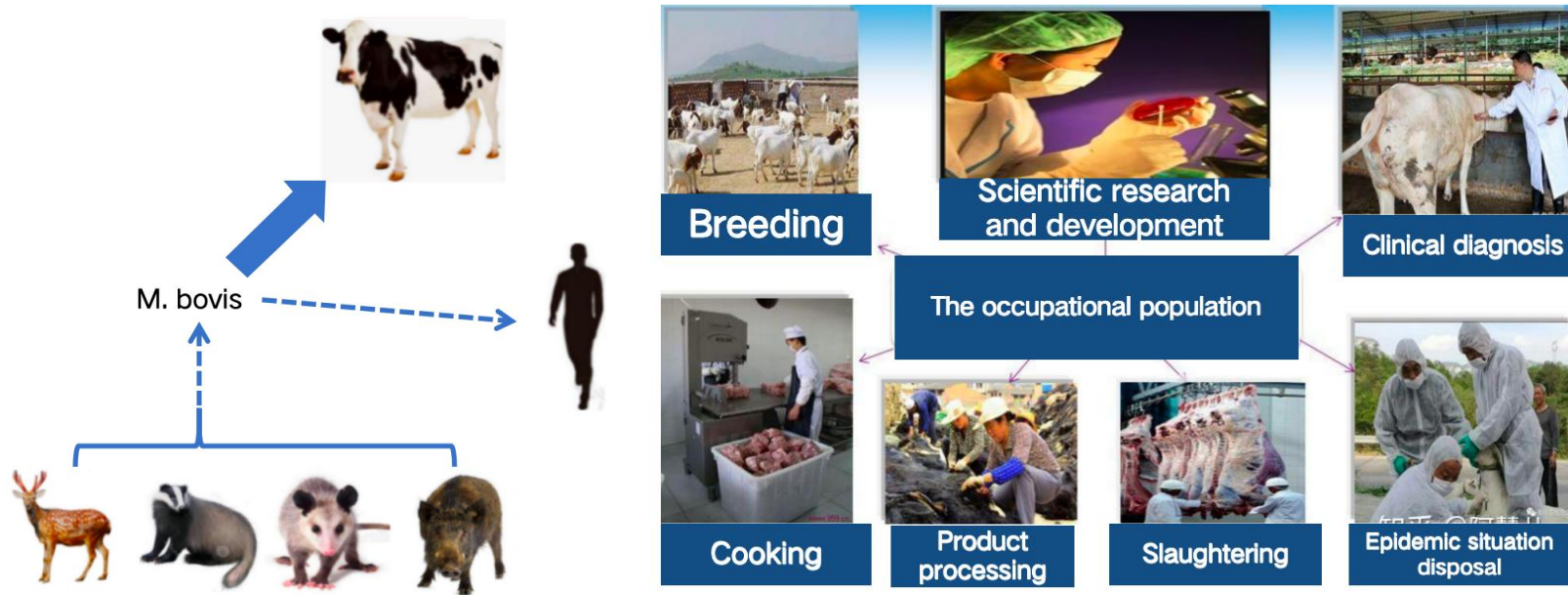
Characterization of *Mycobacterium orygis*, *Mycobacterium bovis*, and *Mycobacterium caprae* Infections in Humans in Western Canada

Nicholas D. Bisset,^{1,2,3} Richard Long,^{1,2,3} Courtney Hoffman,^{1,2,3} Gregory J. Tyrrell,^{1,2,3} Cory Shandru,¹ Vincent Li,¹ Md Rashedul Islam,^{1,2} Michael Stohr,^{1,2} Meenu K. Sharma,^{1,2,3} Ralf Sautthorn,^{1,2,3} and Ryan Cooper^{1,2,3}



1.3 Identification and Investigation

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- **Current human zTB infection data**
- **The influencing factors / burden vary greatly**
 - There are 143,000 new cases of zTB in the world, including 12,500 deaths (WHO, FAO, OIE 2017)
 - Human zTB accounts for 1-28% of the number of TB cases
 - Lack of developing-country surveillance data ($N_{zTB} 10 \times ?$)

- **High risk population**
- **Occupation:** breeding, slaughtering and processing, quarantine, transportation, catering management, scientific research, biological products production
- **Gender:** The male occupation has more frequent contact with animals
- **Disease:** people with immunodeficiency such as AIDS positive are at high risk of zTB



1.3 Identification and Investigation

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Occupational groups:

- Awareness of zoonotic tuberculosis
- Comparison of TB incidence

To be determined:

- Latent tuberculosis infection in occupational groups
- Differential diagnosis of Mycobacterium tuberculosis complex members
- Optimization of measures to TB updates



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What we are doing

- s t a n d a r d i z a t i o n
- d e t e c t i o n



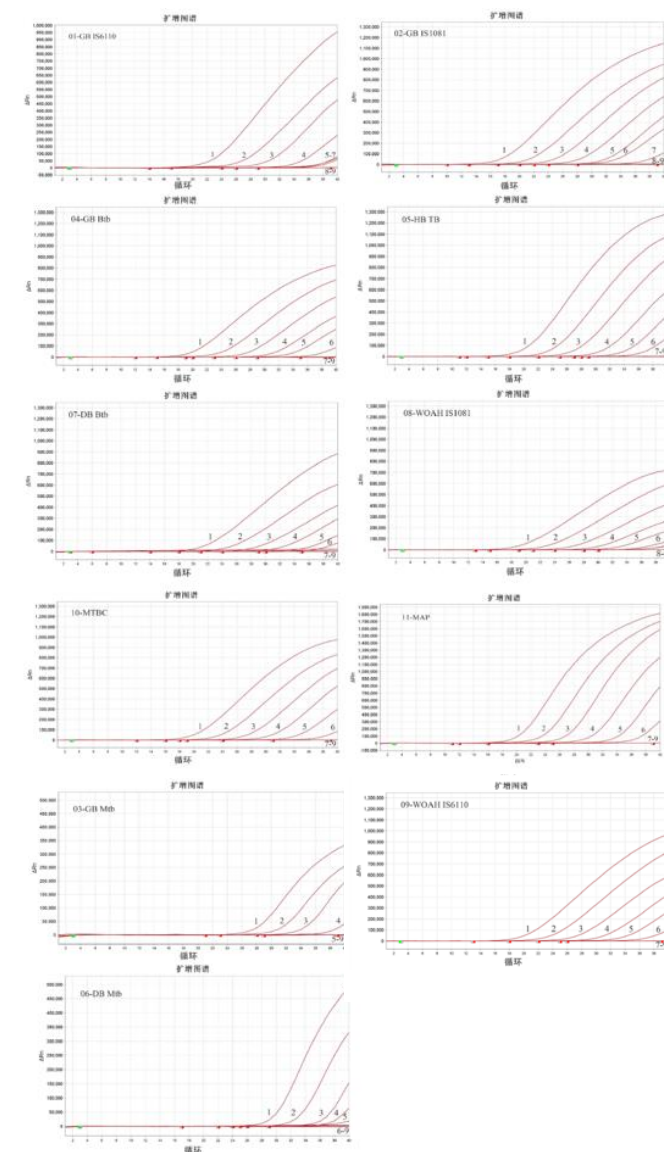
2.1 Reference materials

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01-GB IS6110
02-GB IS1081 ✓
03-GB Mtb
04-GB Btb
05-HB TB
06-DB Mtb
07-DB Btb
08-WOAH IS1081
09-WOAH IS6110
10-MTBC
11-MAP

- Proficiency test
- Quality assurance
- Traceability of measurement values
- Method evaluation
- Reagent selection

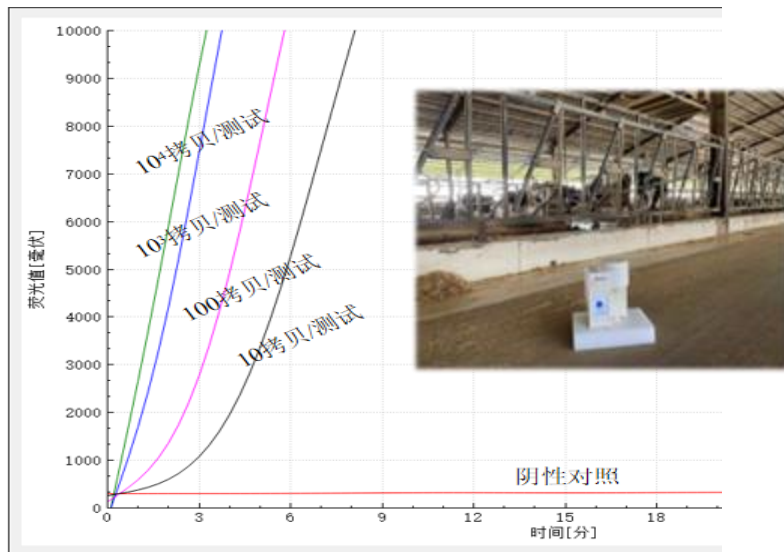




2.2 Rapid detection

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Based on the recombinase-aided amplification (RAA) : included in National standard



Impact factor: milk sample components on extraction efficiency



- Sensitivity: *Mycobacterium bovis*. 10 copies/reaction
- Specificity: 100%

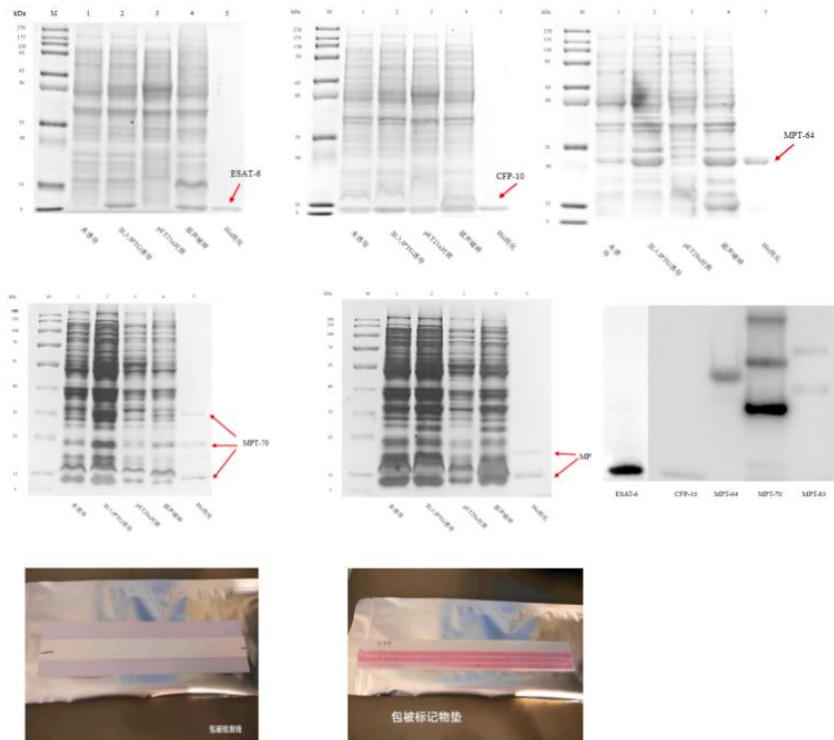
✓ **Integration of on-site rapid detection technology and equipment:** multiple RAA products for the detection of brucellosis, paratuberculosis, tularemia, Q fever, chlamydia, at farms, slaughterhouses, fields, etc..



2.2 Rapid detection

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High-sensitivity fluorescent microsphere immunochromatography strip for TB antibody



- Expression of five tuberculosis proteins, such as ESAT6 and CFP10
- The whole process takes only 15min
- In total 200 samples an hour
- Specificity 100%
- Repeatability CV 3.51-9.23%
- Clinical performance > 90% compared with bovine tuberculosis antibody detection commercial kit





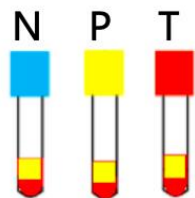
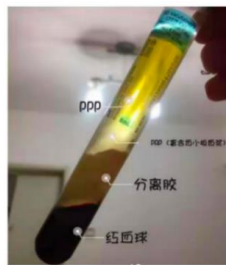
2.3 Optimized detection

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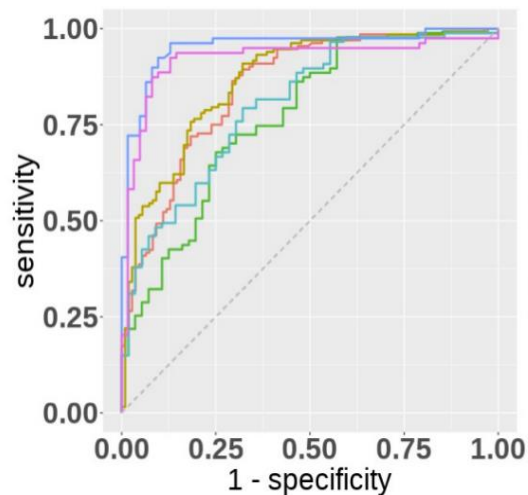
Interferon gamma release assay (IGRA)



simplif
y



X	AUC	95%CI(下限)	95%CI(上限)	最佳阈值	特异度	灵敏度
1	0.849	0.8	0.898	0.346	0.679	0.894
2	0.866	0.821	0.912	0.328	0.679	0.909
3	0.769	0.69	0.849	0.538	0.75	0.678
4	0.803	0.731	0.876	0.51	0.679	0.793
5	0.953	0.917	0.989	0.287	0.871	0.962
6	0.92	0.868	0.973	0.528	0.871	0.924



total cost

Commercial kit Self-developed

¥ 200/test



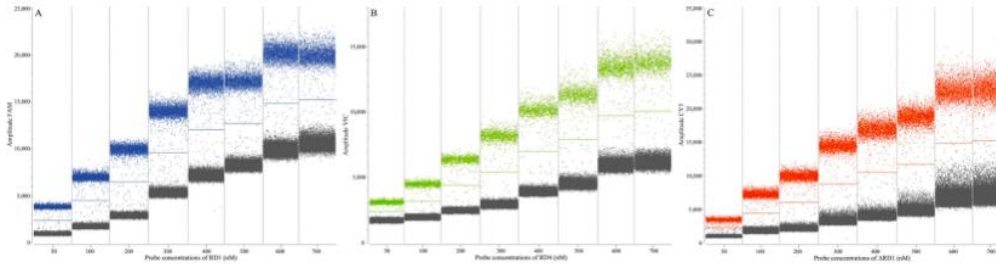
¥ 50/test



2.4 Precise detection

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Droplet digital PCR



- *M. tuberculosis*: 5.43 copies/μL
- *M. bovis*: 5.79 copies/μL
- BCG : 2.64 copies/μL
- ✓ To detect low abundance targets in milk, environmental samples and mixed samples

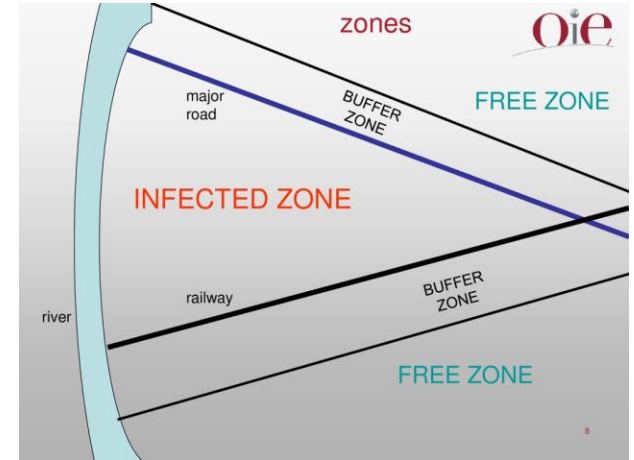
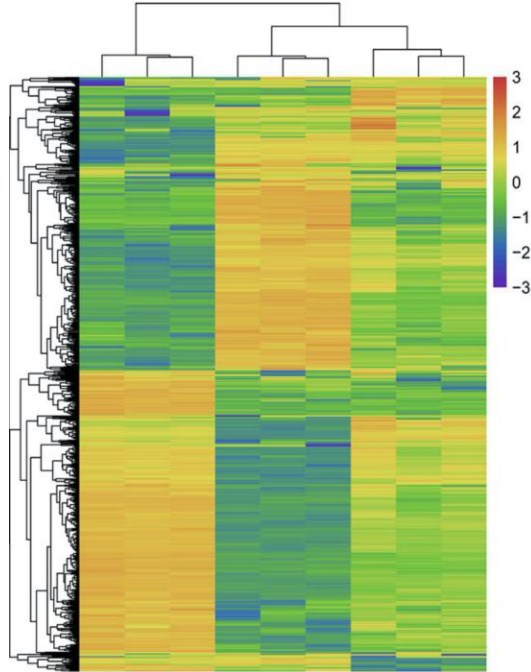
- The methods of sequencing, detection and bioinformatics analysis of bovine tuberculosis pathogens have been established
- Whole genome sequencing time of 1-3 months in the company has been reduced to 1-3 days in the local laboratory
- It improves the ability of accurate diagnosis, phylogenetic and phylodynamic analysis



Whole genome sequencing



2.5 Further detection, vaccination, compartment management¹



- Omics analysis for potential biomarkers
- BCG immunization in cattle and wild animals reservoir
- Zone and Sub-zone: TB free
- Farms: TB elimination

3

What we will do

- c o o p e r a t i o n
- i m p r o v e m e n t



3.1 International communication and cooperation

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WOAH bovine tuberculosis reference laboratory twinning project

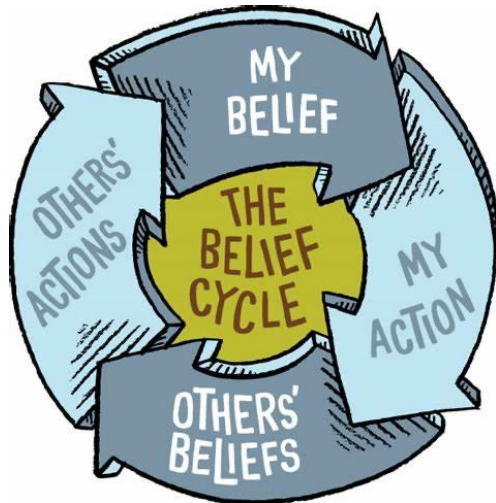
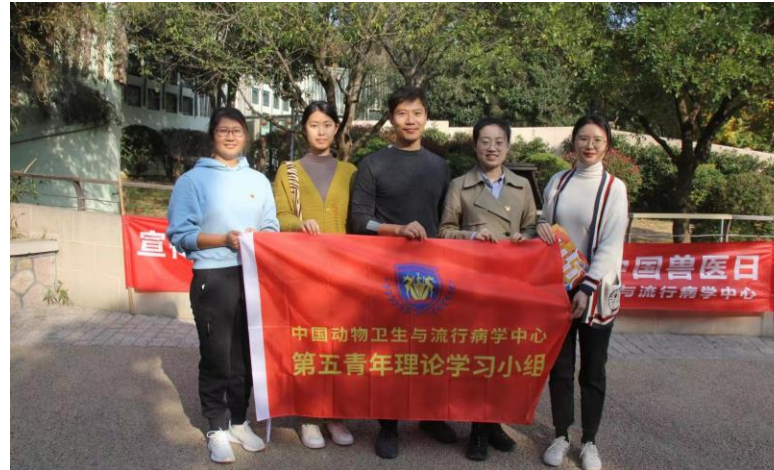


Policy, Surveillance, Detection, Laboratory diagnosis, prevention and control measures



3.2 Stakeholder communication

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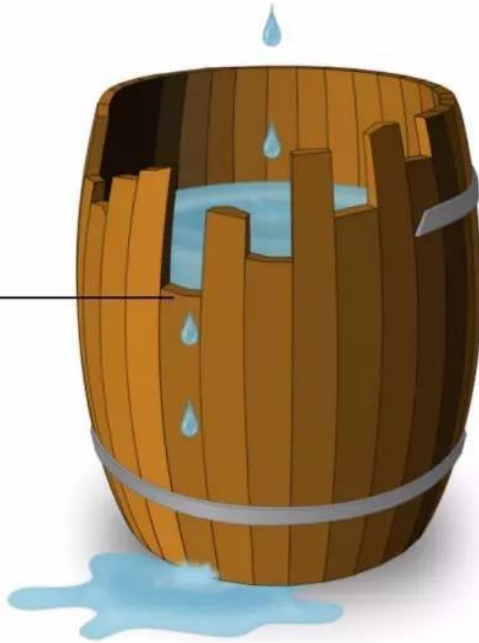


3.3 Risk management

Risk recognition, control, mitigation

surveillance, epidemiological investigation, test-slaughter, biosafety and biosecurity, compartment management

Risk





World Organisation
for Animal Health
Founded in 1924

Thank you!

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