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Development of Rickettsial Antigens Without BSL-3 Facilities: A Platform for Next-Generation Serological Diagnostics

■ Researcher Information

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■**Expertise:** Rickettsial and chlamydial infections
■**Achievements:** Development of diagnostic methods

■ Research Idea / Technology Seeds

Recombinant Rickettsial Antigens Without BSL-3 Facilities: A New Platform for Serological Diagnosis

■ **Technology Concept**
・Baculovirus expression of *Orientia tsutsugamushi* type-specific antigens (TSA)
・TSA is the major serotype-defining antigen for serodiagnosis
・Antigen production achievable under BSL-2 conditions
・Recombinant TSA-expressing cells can be directly used for IFA
”Recombinant antigens for serology without rickettsia-infected cells”

■ **Advantages**
・No BSL-3 facility required
・No purification required; suitable for standardization and mass production
・Applicable to major serotypes (Kato, Karp, Gilliam, Kawasaki, and Kuroki)
”Overcoming BSL-3 dependence and antigen supply limitations”

■ **Validation**
・Good correlation with conventional IFA using infected cells ($R^2 > 0.7$)
・High diagnostic agreement without nonspecific reactions
・Validated using clinical specimens
・Diagnostic performance comparable to conventional methods

■ **Proposal for Collaboration**
・Collaborative development of diagnostic reagents based on BSL-2–compatible recombinant antigens

■ Background and Challenges to be Addressed

■ **Clinical Importance**
・Scrub typhus: 300–500 cases annually in Japan
・ Japanese spotted fever has rapidly increased, surpassing scrub typhus in 2024
・ Fatal cases continue to be reported for both diseases
“Clinical diagnosis relies heavily on exposure history and regional epidemiology”

■ **Current Limitations in Clinical Practice**
・Clinical suspicion based on patient activity and local epidemiology is essential
・ Serology remains indispensable for definitive diagnosis
“ Suspected clinically, confirmed serologically “

■ **Current Limitations in Diagnostic Systems**
・IFA is the established gold standard
However, conventional antigens require infected cells and BSL-3 facilities
Consequently: Antigen supply is limited. Diagnostic reagent development is restricted. Sustainable testing systems are difficult to maintain
“ Antigen supply remains the key bottleneck for wider diagnostic implementation “

Diagnostic methods exist, but limited antigen availability restricts broader implementation

■ Research Overview

■ Conventional infected-cell antigens (BSL-3)→ TSA-expressing baculovirus cells (BSL-2)→ Direct use in serological assays→ Standardization and diagnostic development

■ Future Plans

■ Antigen standardization and reproducibility assessment
■ Development as diagnostic reagents