The significance of understanding the relationship between leptospires and their reservoir hosts of infection



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Presentation conducted during the International Workshop of the Oswaldo Cruz Institute/FIOCRUZ for Leptospirosis Research Based on Country Needs & the 5th Global Leptospirosis Environmental Action Network (GLEAN) Meeting on November 10-12, 2015, in Rio de Janeiro, Brazil.

Rats are carriers of leptospires

THE RAT AS A CARRIER OF SPIROCHÆTA ICTERO-HÆMORRHAGIÆ, THE CAUSATIVE AGENT OF WEIL'S DISEASE (SPIROCHÆTOSIS ICTEROHÆMORRHAGICA).*

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(Received for publication, February 20, 1917.)

WEIL'S DISEASE (SPIROCHÆTOSIS ICTERO-HÆMORRHAGICA) IN THE BRITISH ARMY IN FLANDERS

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Reprinted from THE LANCET, January 27, 1917



Reservoir host

- Wild & domestic animal species
 - Rats
 - Cattle
 - Dogs

• Asymptomatic

Gold standard diagnosis = Culture
MAT negative animals can be culture positive

Specific biological equilibrium

- <u>Rattus norvegicus</u> & L. interrogans serovar Copenhageni
- <u>Bos taurus</u> & L. borgspetersenii serovar Hardjo (North America & Europe)
- *Rattus norvegicus* is not susceptible to (experimental) infection with *L. borgspetersenii* serovar Hardjo

Acute

V

Chronic

Guinea Pig – Incidental infection Day 5 post-infection



Rat – Chronic infection Day 21 post-infection



Dissemination of leptospires

Renal colonization

Expression of O-ag In Situ: Guinea Pig and Rat Kidney

Anti-leptospire

Anti-Oag

Anti-leptospire + anti-Oag











Leptospires adapt to the reservoir host

- Leptospires modulate gene and protein expression in response to environmental signals.
 - Temperature, pH, Fe, Serum, Osmolarity.
- Leptospires modulate gene and protein expression in response to mammalian host signals.
 - Cell lines, implanted dialysis membrane chambers, small laboratory animals (acute & chronic)
- Leptospires modulate gene and protein expression during acute disease compared to <u>chronic disease</u>.

Differential antigen expression by leptospires: Immunoblot with Rat Serum



Differential antigen expression by leptospires: Immunoblot with Rat Serum



Genes essential for renal colonization

- Murray GL. The molecular basis of leptospiral pathogenesis. Curr Top Microbiol Immunol. 2015;387:139-85.
- Mutants (4) failed to colonize renal tubules but still lethal in the acute model.
 - The role of the "hypothetical protein".

What factors facilitate biological equilibrium?

- Leptospires
 - Genes
 - Lipopolysaccharide
 - Proteins
 - Protein & respective post-translational modifications
 - Outer membrane proteins
 - LipL32
- Host immune response
 - Allows persistent renal colonization

H_o: These factors will facilitate improved diagnostics and vaccines

Bos taurus & L. borgspetersenii serovar Hardjo

Epidemiol. Infect. (2015), 143, 1538–1541. © Cambridge University Press 2014 doi:10.1017/S0950268814002416

SHORT REPORT First isolation of *Leptospira noguchii* serogroups Panama and Autumnalis from cattle

G. MARTINS¹, A. P. LOUREIRO¹, C. HAMOND, M. H. PINNA², S. BREMONT³, P. BOURHY³ and W. LILENBAUM¹* (North America & Europe)



SHORT REPORT

Genotyping of *Leptospira* directly in urine samples of cattle demonstrates a diversity of species and strains in Brazil

C. HAMOND¹, C. P. PESTANA², M. A. MEDEIROS² and W. LILENBAUM¹*

"biological equilibrium"



Thank you for listening.