

Host defence against *Borrelia*

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University of Cambridge

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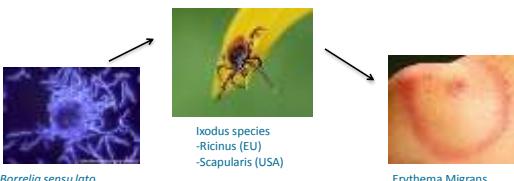
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Lyme disease: after a tick bite



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Borreliosis (Lyme disease)



Borrelia sensu lato

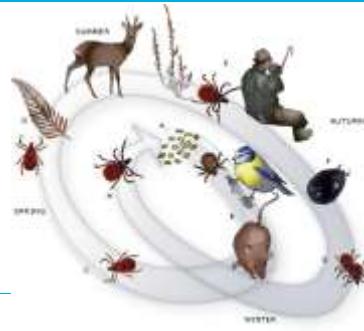
Ixodes species -*Ricinus* (EU) -*Scapularis* (USA)

Erythema Migrans

Lyme Disease

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Life-cycle of ticks



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Summer of 1976

A New Type of Arthritis Found in Lyme

LYME ARTHRITIS

AN EPIDEMIC OF ODEOARTICULAR ARTHRITIS IN CHILDREN AND ADULTS IN THREE CONNECTICUT COMMUNITIES

ALLEN C. STIERER, ROBERT C. MALAWISTA, DALE R. STEPHAN, ROBERT F. WILKE, MARKUS A. ANDERSON, MARTIN S. KLEIN, AND FRANCIS H. ZINK

Calls from hysterical mothers led to discovery of disease affecting Connecticut children

Nature Communications

Otzi's DNA reveals health risks and relations.

Otzi's genome hints at heart disease, bacterial infection and common ancestry with modern-day Sardinians.

Ewen Callaway

28 February 2012

Zink's team found almost two-thirds of the genome of "Borrelia burgdorferi," a bacterium that causes Lyme disease".

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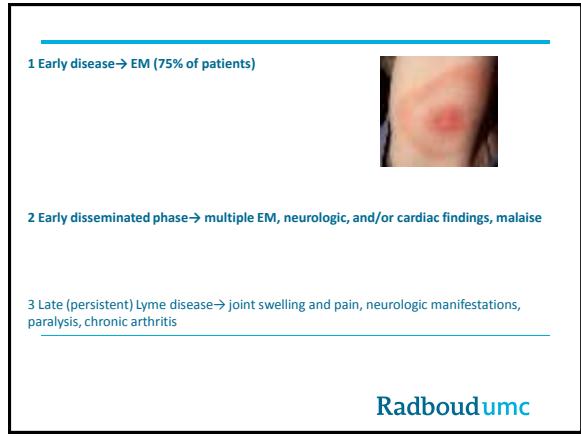
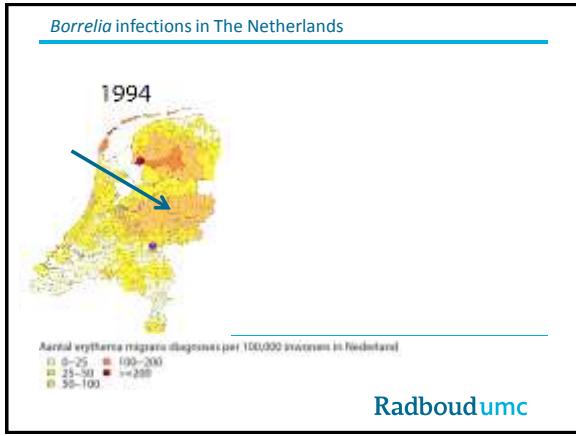
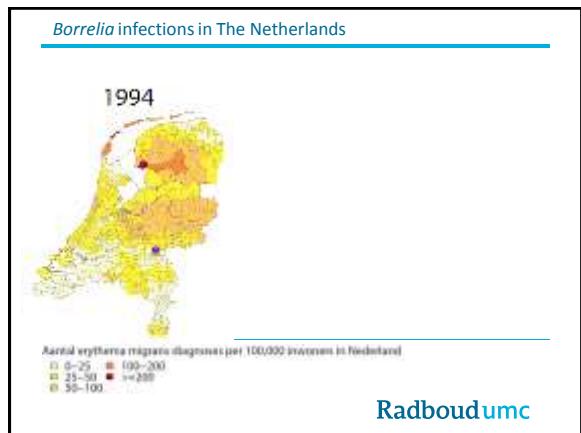
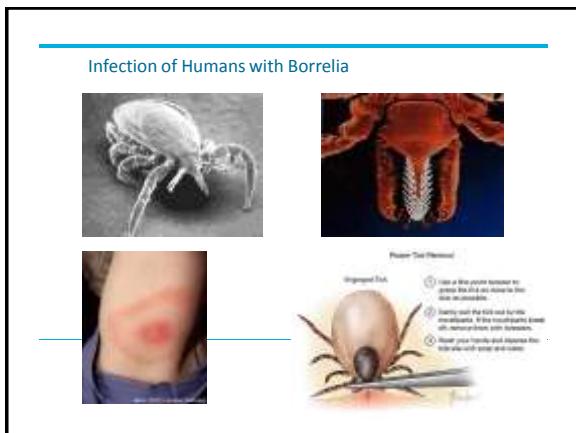
Otzi's genome hints at heart disease, bacterial infection and common ancestry with modern-day Sardinians.

Ewen Callaway

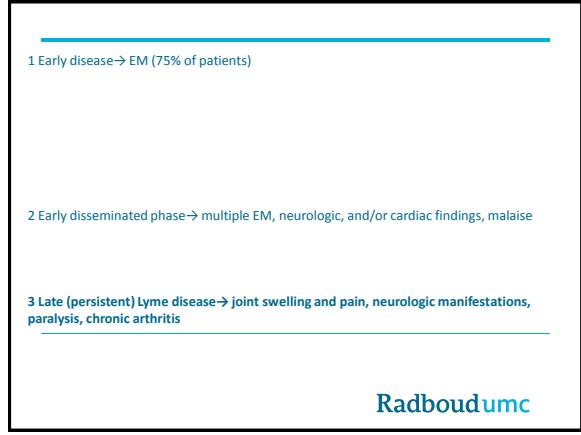
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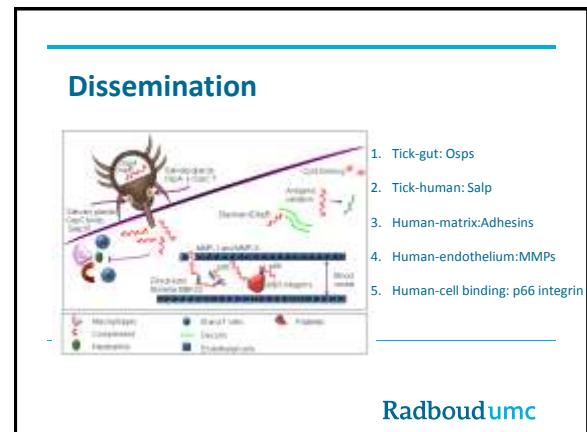
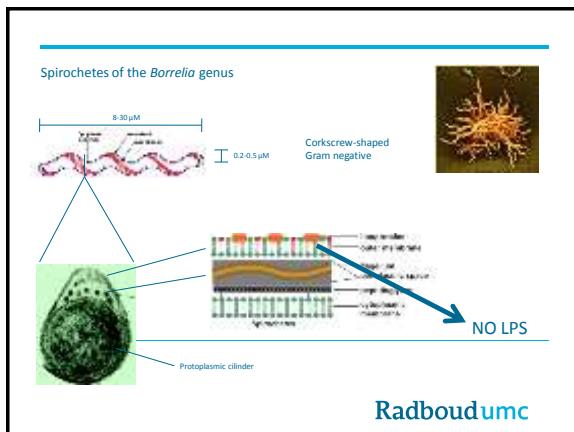
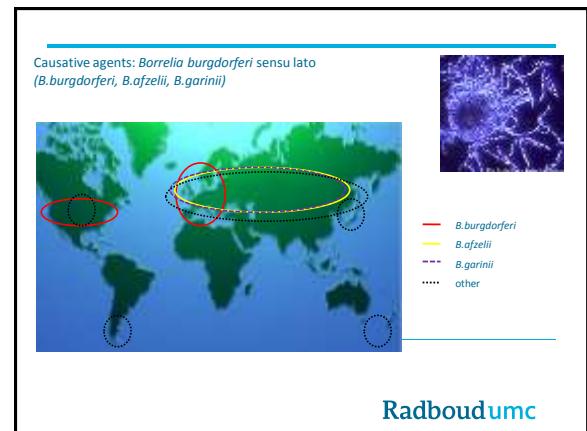
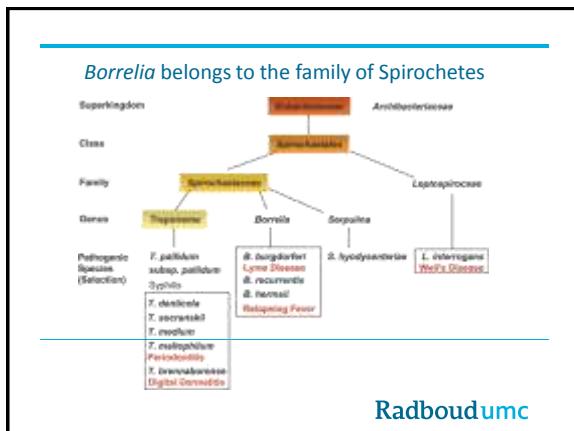
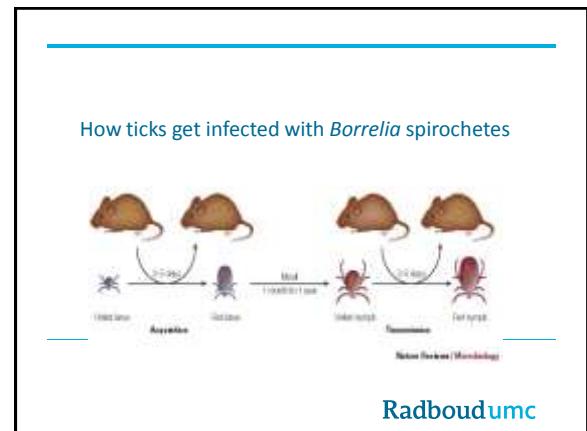
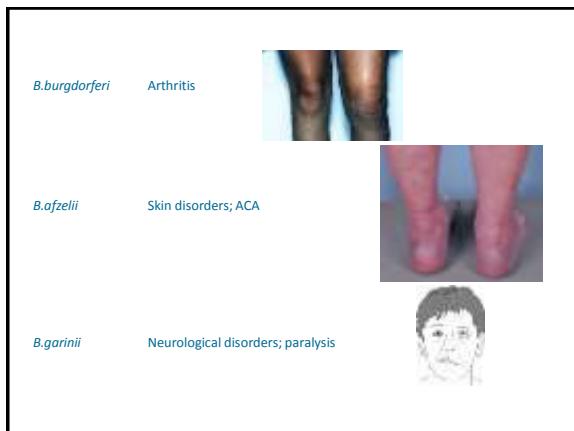
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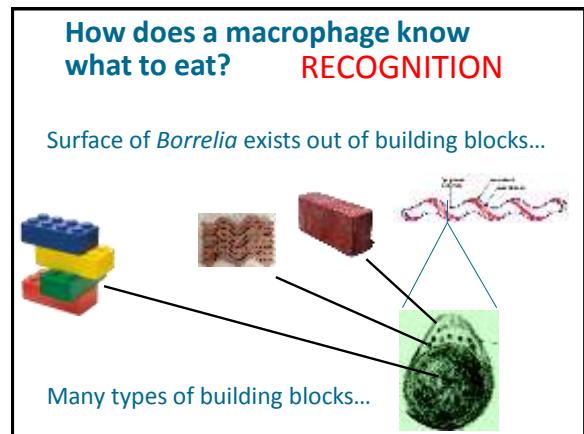
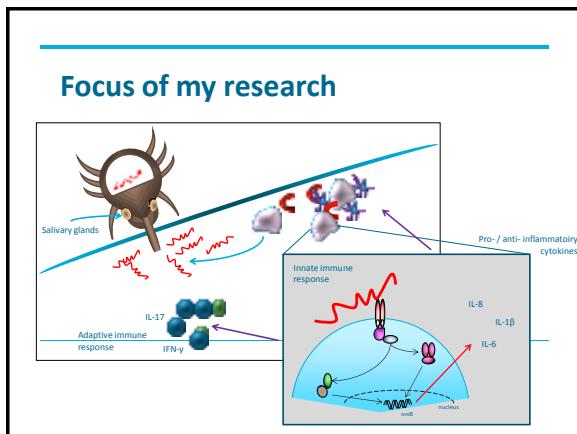
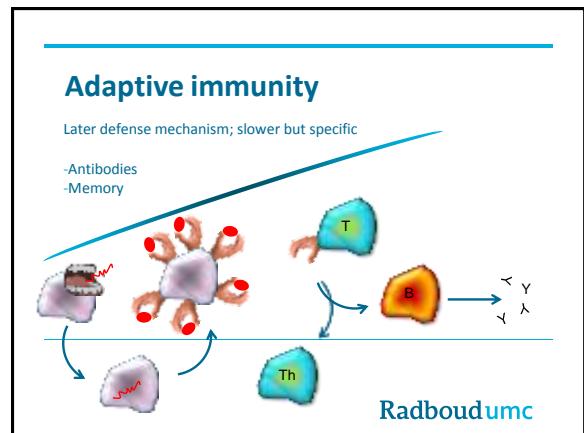
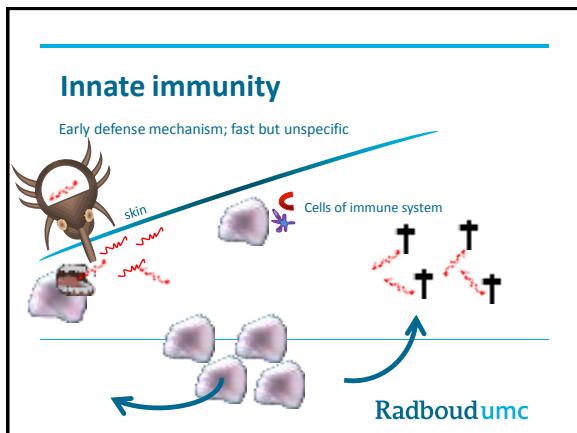
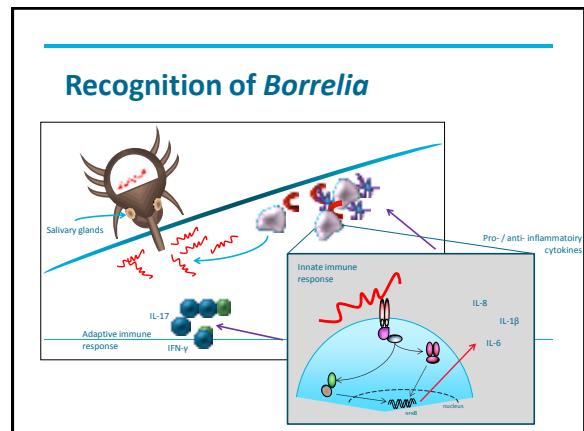
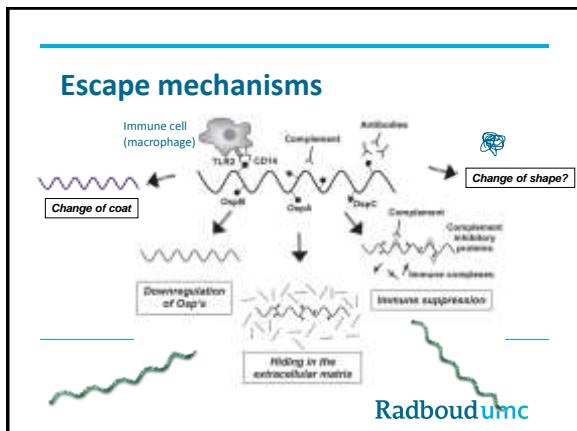
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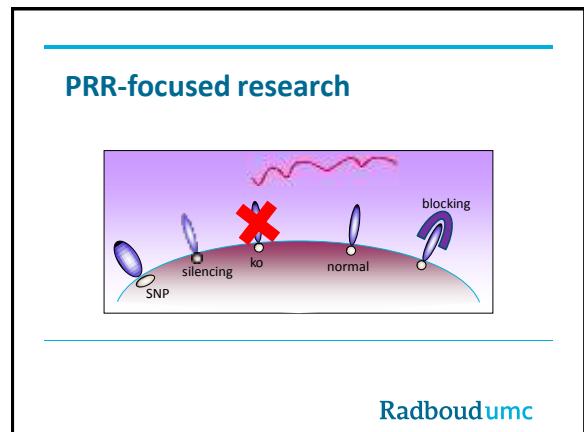
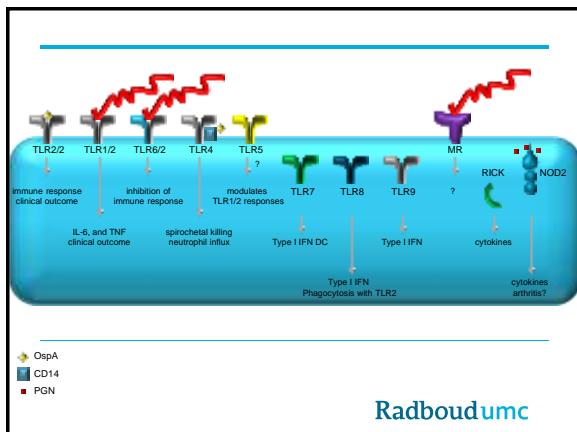
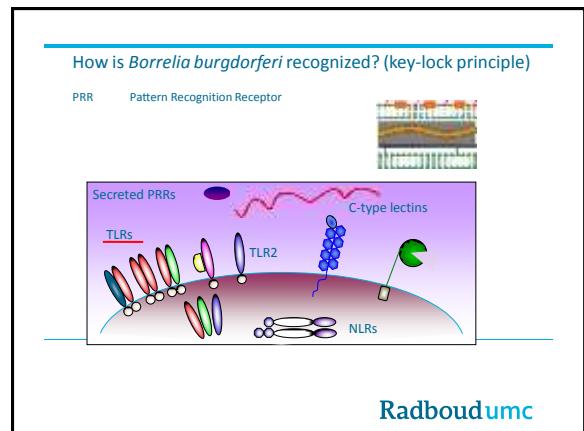
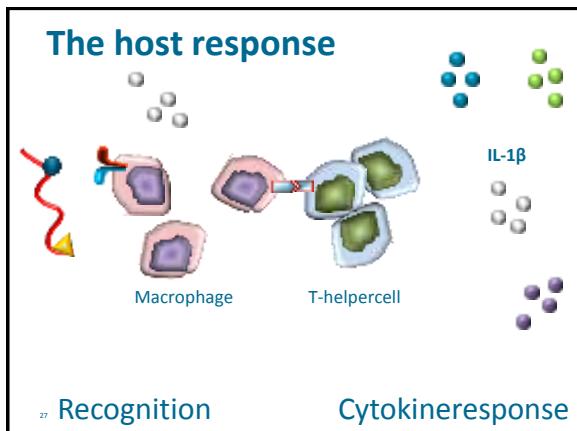
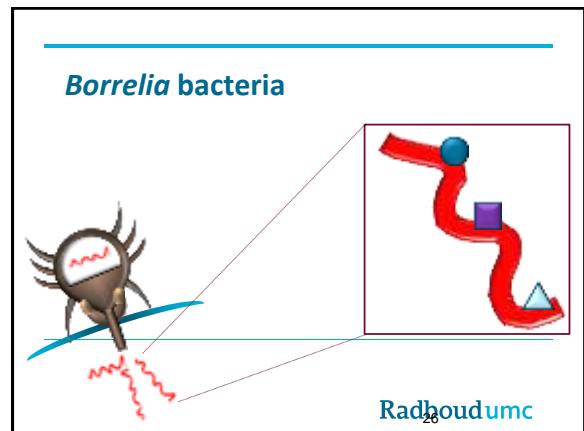
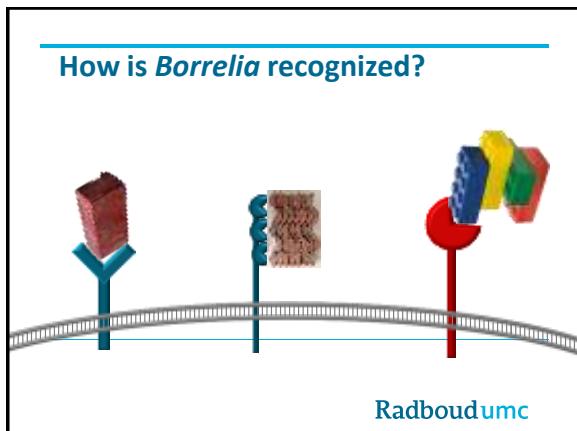


1. Rash at bite site	29. Slowed pulse
2. Rashes at other sites	40. Testicular enlargement
3. Fever, chills, sweats	41. Nodules on earlobes
4. Weight change (loss or gain)	42. Stomach distension
5. Vomiting	43. Mouth breathing with mouth open
6. Unexplained hair loss	44. Eye lesions
7. Swollen Glands	45. Nasal stuffiness / restriction
8. Headache	46. Sore throat
9. Testicular pain or Pelvic pain	47. Hypersensitive olfactory organ (sensitive to the slightest odours / smells)
10. Menstrual cycle irregularity or irregularity	48. Feeling drunk without drinking
11. Impaired bladder or bladder dysfunction	49. Not able to concentrate during favorite hobbies
12. Sexual dysfunction or loss of libido	50. Too slow a pulse when resting
13. Upset stomach	51. Rapid pulse with slightest exertion
14. Impaired heart function, constipation	52. Pain in the joints when you go skiing
15. Chest pain or rib soreness	53. Muscle pains, cramps or charley horses
16. Shortness of breath, cough	54. Pains switching from one side of the body to the other
17. Dizziness, lightheadedness, dular skips, heart block	55. Endocrine gland problems
18. Joint pain or swelling	56. Stiff aching neck
19. Muscle pain or cramps	57. Changes in vision
20. Tingling of the face or other muscles	58. Generalized weakness
21. Headaches	59. Limbs, especially arms feel heavier than normal.
22. Neck creaks and cracks, neck stiffness	60. Diminished or absent reflexes
23. Back pain, stiffness, backache	61. Bell's palsy
24. Tingling, numbness, burning or a stabbing	62. Poor coordination/ataxia
25. Facial paralysis (mouth is crooked on one side when you talk	63. Continual infections
In front of a mirror or in a Palsy)	64. Poor concentration
26. Vision doublets, blurriness, increased floaters (specks in	65. Decreased ability to spell correctly
front of vision)	66. GI distress/abdominal pain
27. Ear/hearing: ringing, buzzing, ear pain	67. Poor word retrieval/Aphasia
28. Balance, balance, increased motion sickness	68. Arm/leg cramps
29. Light-headedness, wooziness, difficulty walking, clumsy	69. Difficulty swallowing
bumping into objects)	70. Nausea/vomiting
30. Confusion, difficulty in thinking, difficulty in concentrating,	71. Anorexia
difficulty with sticking with the	72. Vasculitis
31. Decreased short term memory	73. Loss of muscle tone
32. Decreased short term memory	74. Obesity/taste or smell
33. Disorientation: driving past your turn, getting lost, going to	75. Obsessive Compulsive symptoms
34. Disorientation: driving past your turn, getting lost, going to	76. Panic attacks
35. Difficulty with speech	77. Cerebral embolism/blood flow/brain waves
36. Mood swings, irritability, depression	78. Number reversal
37. Through cycles sometimes too much, too little, early awakening- goes	79. Light Sensitivity
through cycles sometimes too much	80. Transient Ischaemic Attack (TIA)
38. Exaggerated symptoms or worse/hangover from alcohol	81. Dilated cardiomyopathy
	82. Loss of temperature control



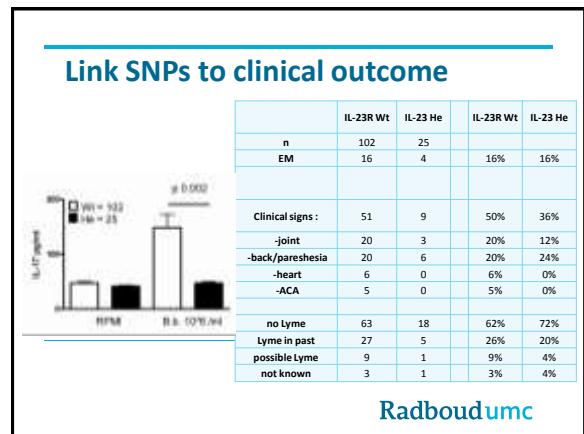
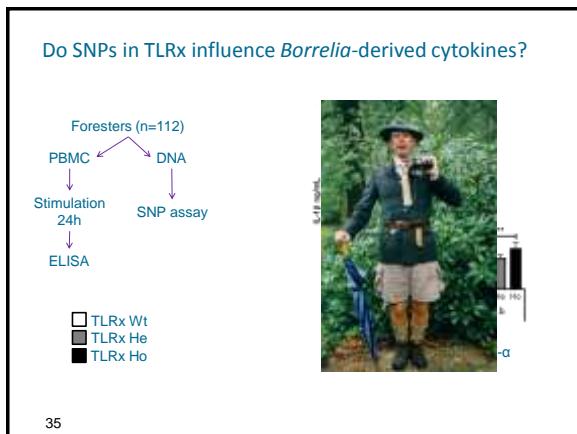
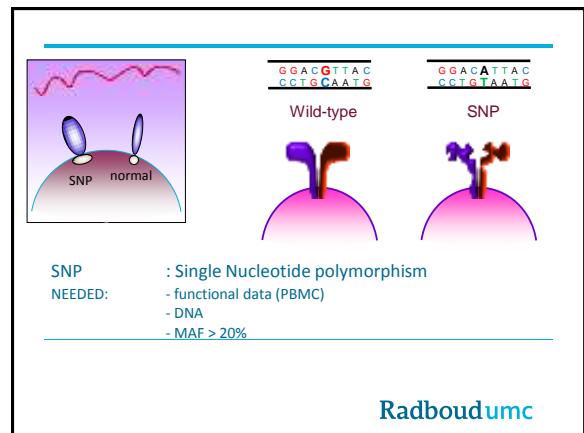
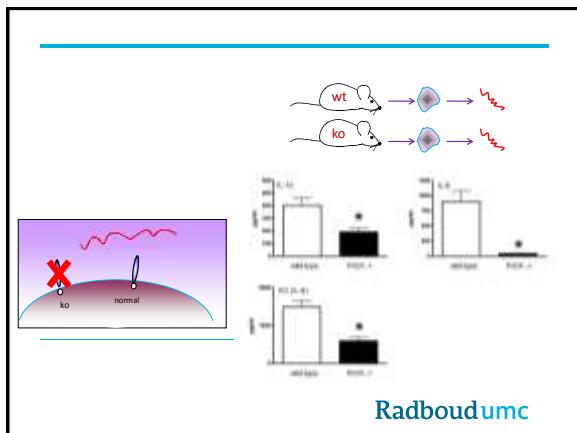
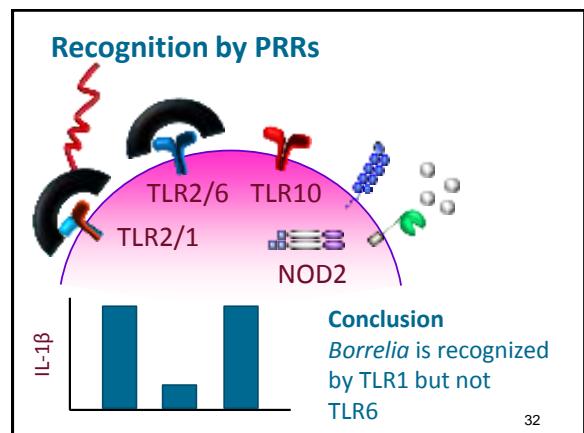




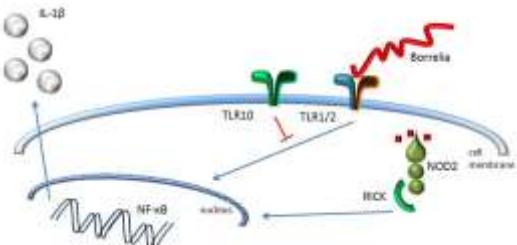


Research using blocking antibodies

Example: PBMC



What we demonstrated so far



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Future plans

Study effect of microbiome and habits on immune responses



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-blood	functional data (PBMC, macrophages, transcriptomics) RNA sequencing Next generation sequencing (SNP analysis) metabolomics (plasma samples)
-swabs	microbiome analysis
-urine	metabolomics
-faeces	microbiome and fungal-biome analysis
-questionnaires	demographic, education, illnesses, allergies, food, etc

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What can we do with this knowledge?

-In the future: inhibit or prevent infection with *Borrelia*

-Screen patients on variants to predict clinical outcome

-Personalize treatment strategies

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Acknowledgements

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