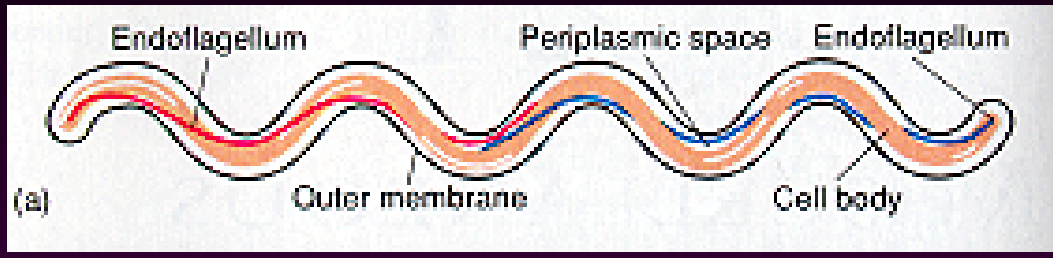
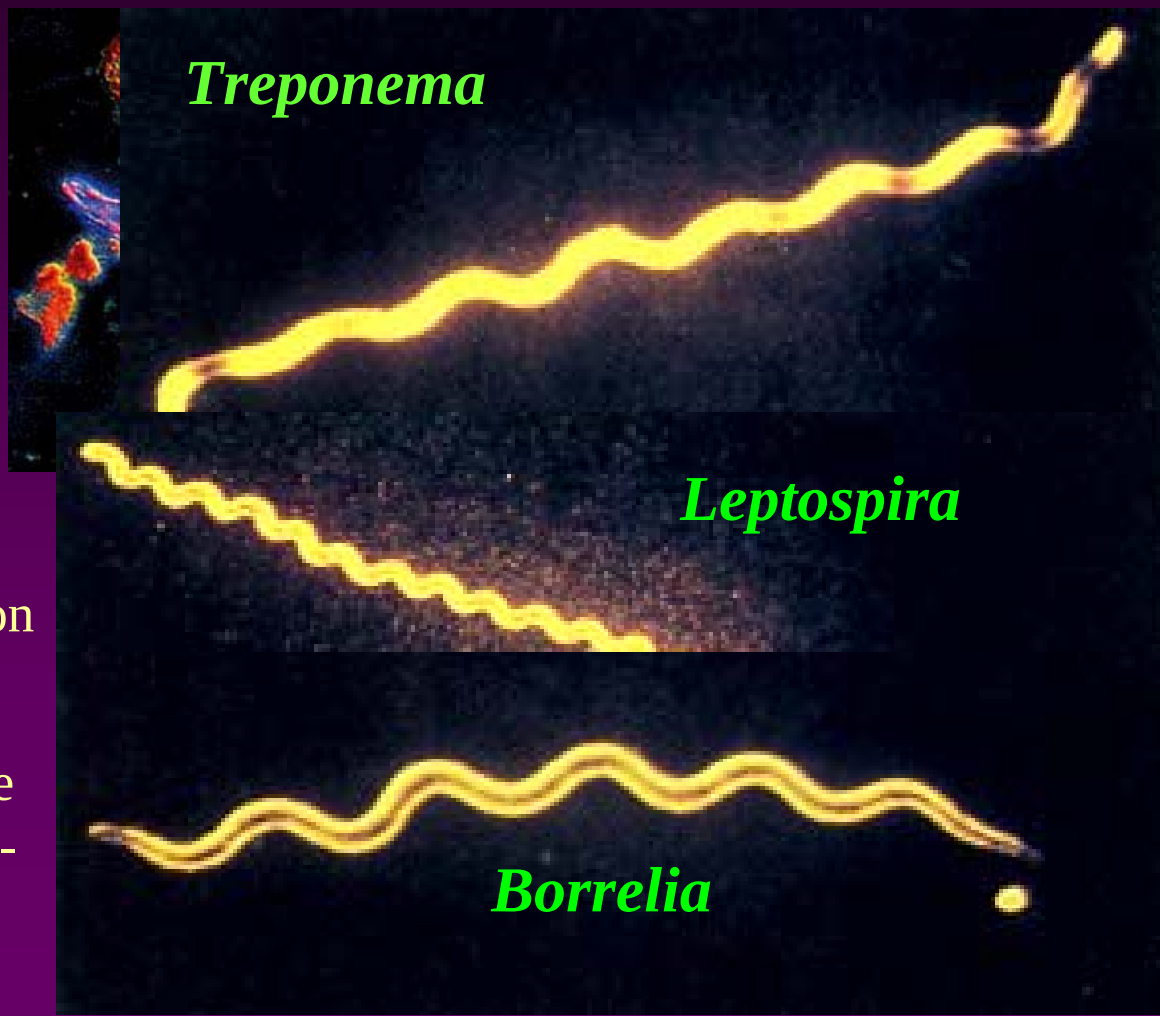
Spirochetes

Gram -- organisms with unique structure and motility, most are free-living, but several human pathogens included

Biology of Spirochetes

- Long slender, flexible helical shape
  - many so thin cannot be seen without darkfield microscopy
- Axial filament
  - periplasmic flagella (endo-flagella)
  - outer sheath with few antigens
    - avoids immune detection
  - extremely motile
    - by flexing of sheath due to rotary action of endo-flagella





Spirochetes, continued

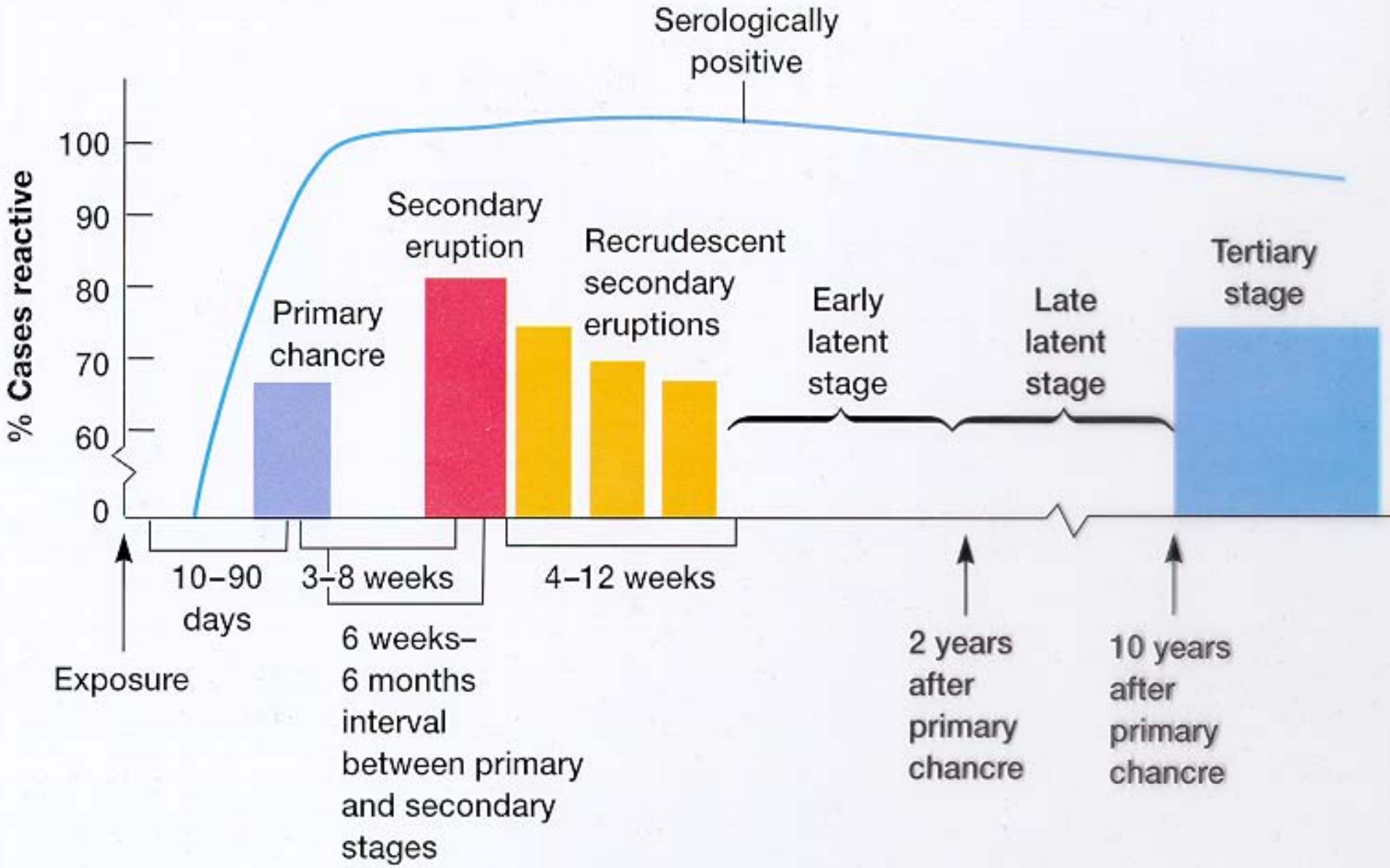
- May be anaerobic, aerobic, microaerophilic
- Ubiquitous: from mud to mouths
- Many are pathogens in humans
  - Syphilis
  - Lyme disease
  - Weill's Disease
  - Yaws, pinta, etc.

Syphilis

- *Treponema pallidum*
  - similar organisms cause pinta, bejel, yaws
- can infect any organ and tissues
- 3 distinct phases
  - the “Great Imitator”
  - more pathogenic in past
  - Major killer before penicillin
  - Still a major disease
  - Crosses placenta
  - Wassermann test
    - public health law!

***Treponema pallidum* in tissues**

The course of untreated syphilis



Epidemiology of syphilis

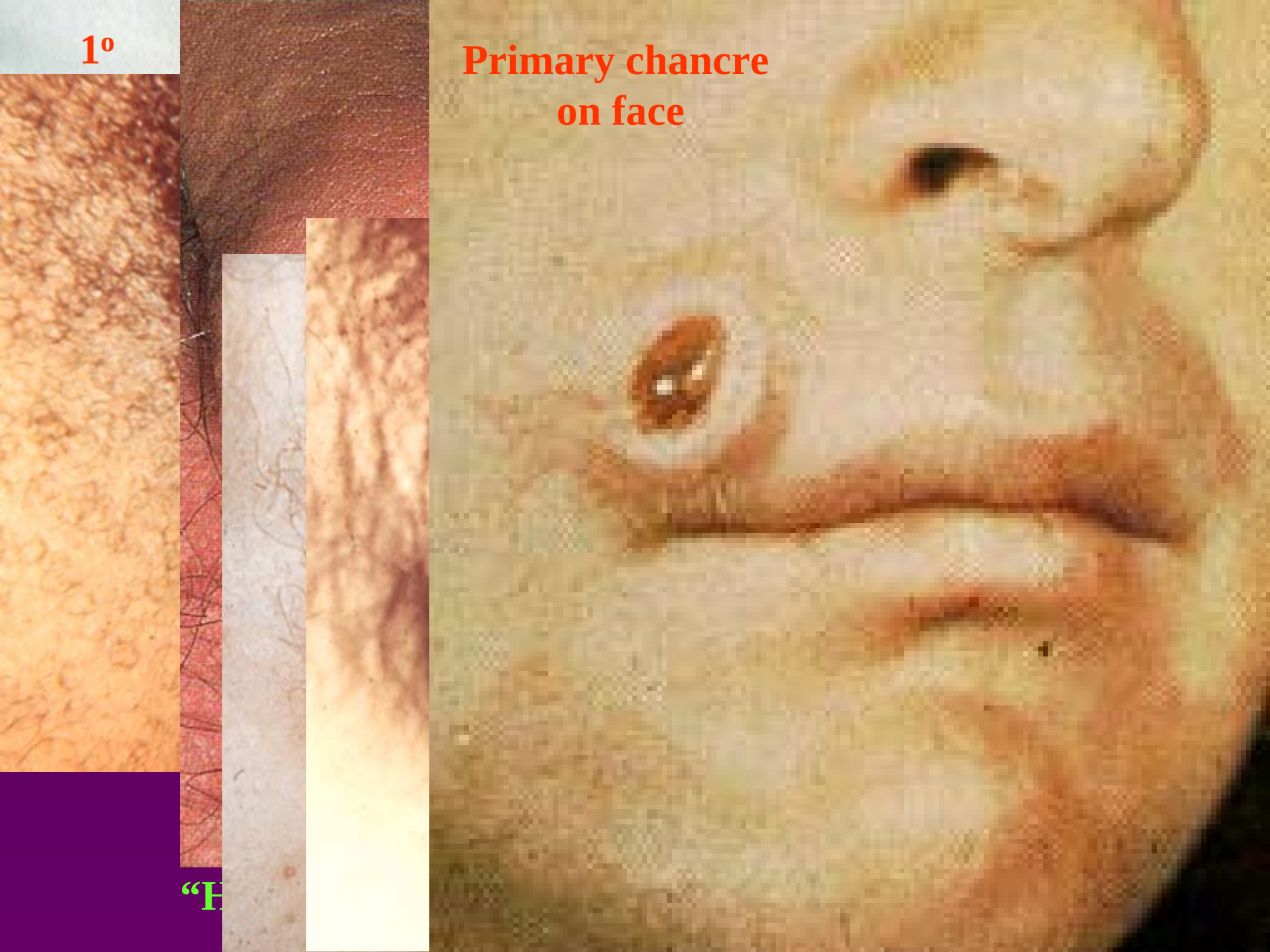
- Cannot be cultured
- humans only infected
- Rich history
  - 16th Century, 25% mortality
  - the Great Pox*
  - major cause of mortality in 1940s
  - 1990s about 130,000 cases per year
  - environmentally unstable
    - *as opposed to small pox
- venereal transmission
  - nonsexual is rare
- Congenital syphilis
- penetrates mucus membranes but not skin
- rapidly spread in body
- lesions due to immune response**
  - prevents reinfection but not pathogenesis

Primary syphilis

- Chancre, 10-90 days after infection **(21 ave.)**
  - **“hard chancre”, with induration**
- ulcer is solitary, painless
- Generally found on genitalia, cervix, mouth, anus, etc.

- The Chancre:
  - lasts 3-6 weeks
  - teeming with organisms
  - highly infectious
  - lymphadenopathy
    - lasts for months
- Homosexual males reservoir for-
  - lesion is usually in anus, and is painless

1º

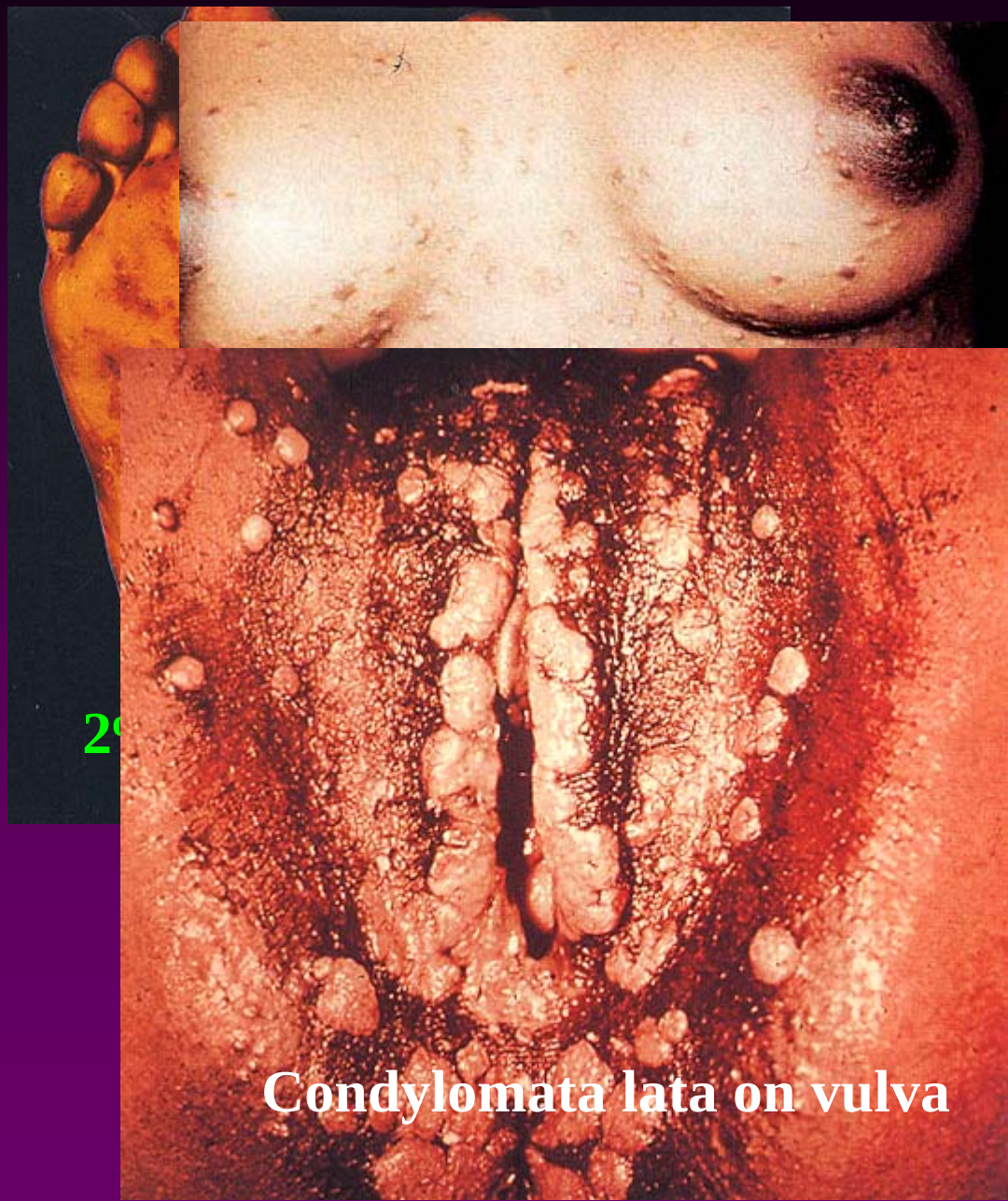


Primary chancre
on face

"H

Secondary syphilis

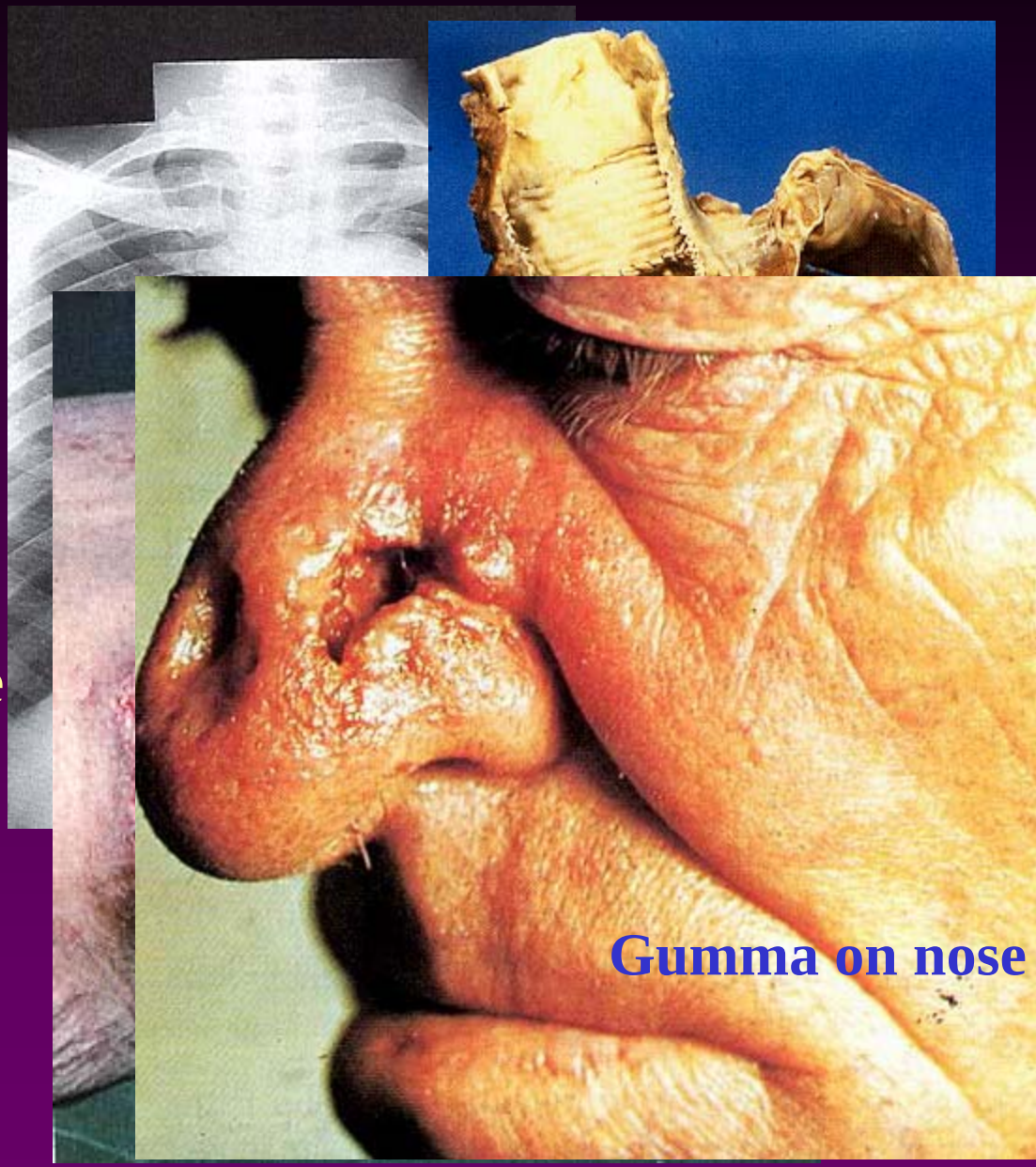
- Generally 2-6 weeks after 1^{o} lesion
- mucocutaneous lesions & generalized symptoms
  - fever, malaise, sore-throat, headache, etc.
  - mimic measles, psoriasis, condylomata lata looks like hemorrhoids
  - liver infection looks like hepatitis
  - Latent syphilis
    - lasts for years



Condylomata lata on vulva

Tertiary syphilis

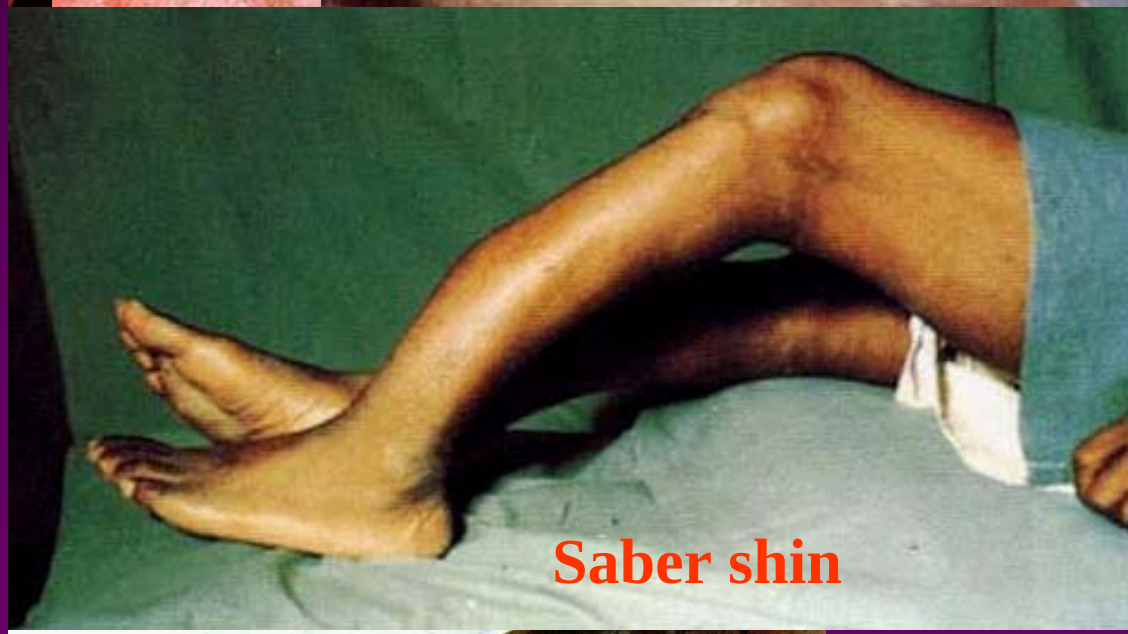
- 2 to 20 years later
  - 30% of untreated cases become tertiary
- CNS & cardiovascular
  - syphilis dementia
  - aneurysms & valvular incompetence
- Gummas
  - granulomas of any tissue
    - due to delayed CMI
    - progressively destructive to heart, brain, **death!!**
  - AIDS & neurosyphilis
- Treatment
  - penicillin, malaria, *Borrelia*?



Gumma on nose

Congenital syphilis

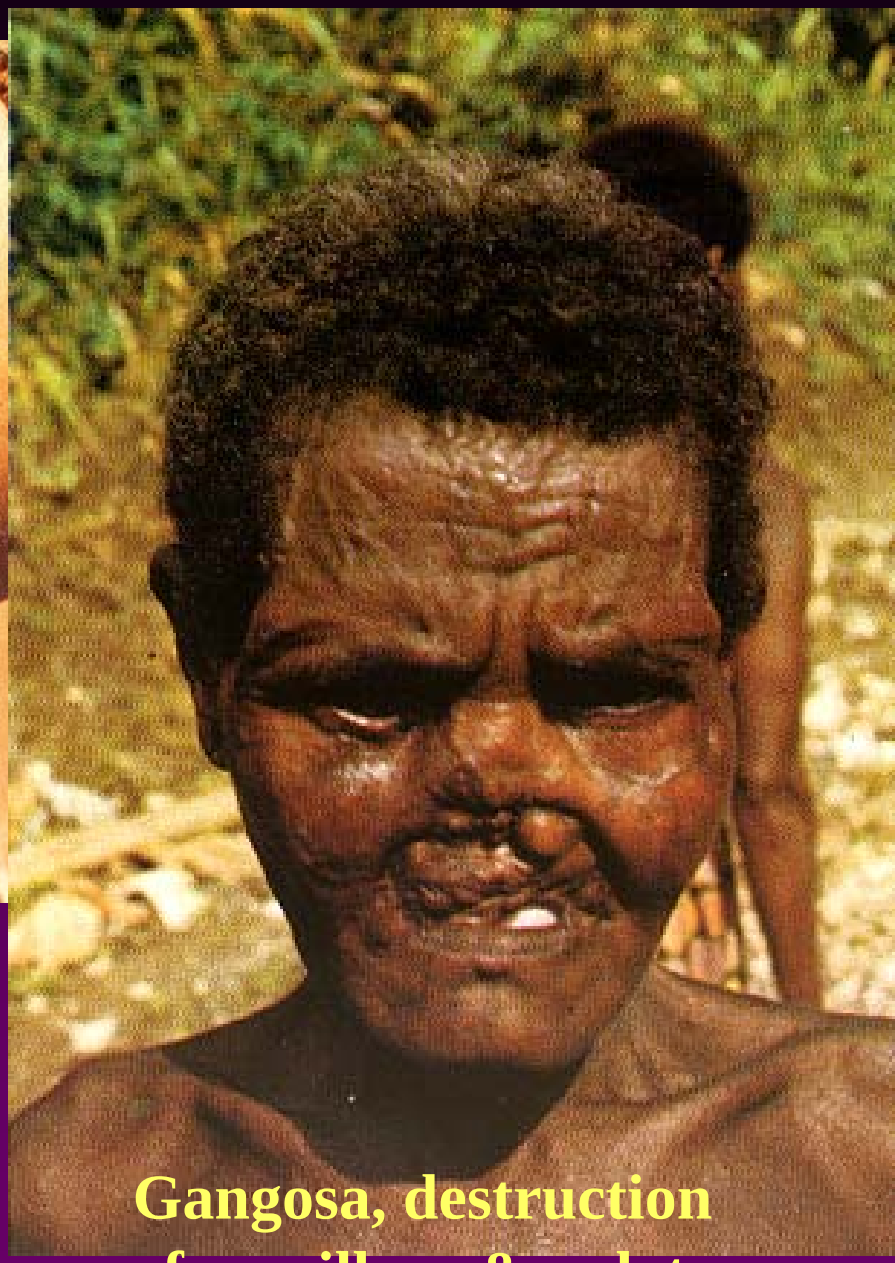
- Crosses placenta in 1º, 2º & latent stages*
  - (must be in blood)
- affects joints, bones, cartilage of nose
  - saddle nose, Hutchinson's teeth & saber shin
- spontaneous abortions common



Yaws

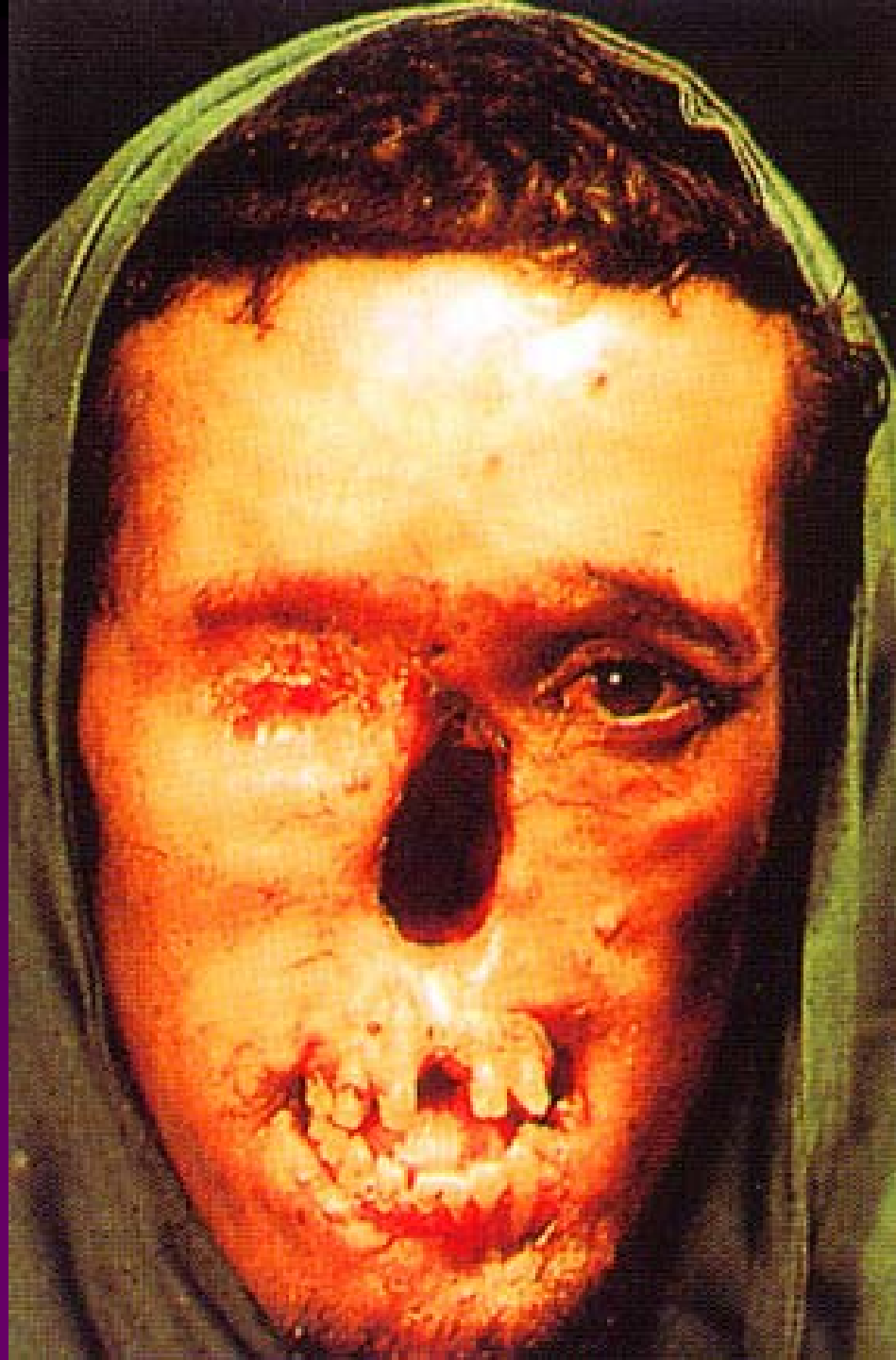
Skin lesions of yaws

Destruction of tibia



Gangosa, destruction of maxillary & palate

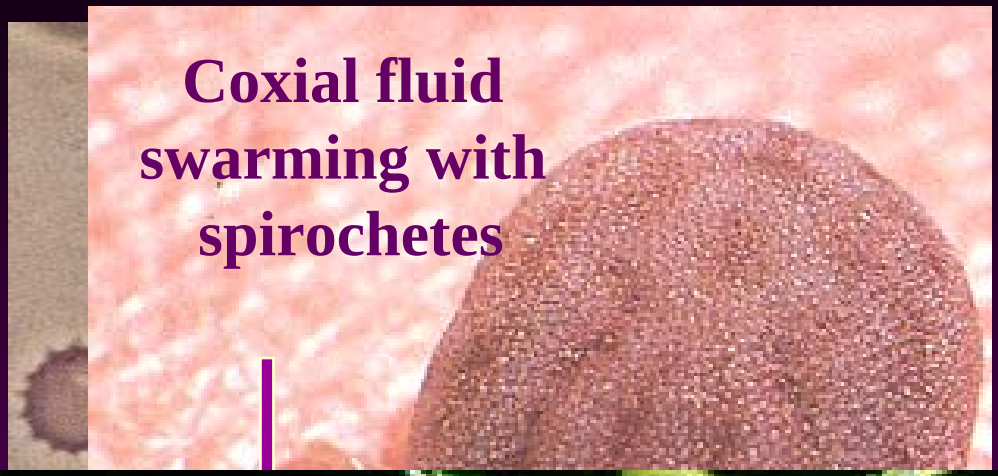
Yaws, Bejel, and Pinta are caused by essentially the same organism that causes Syphilis, but is not sexually transmitted.



Gummatous Bejel

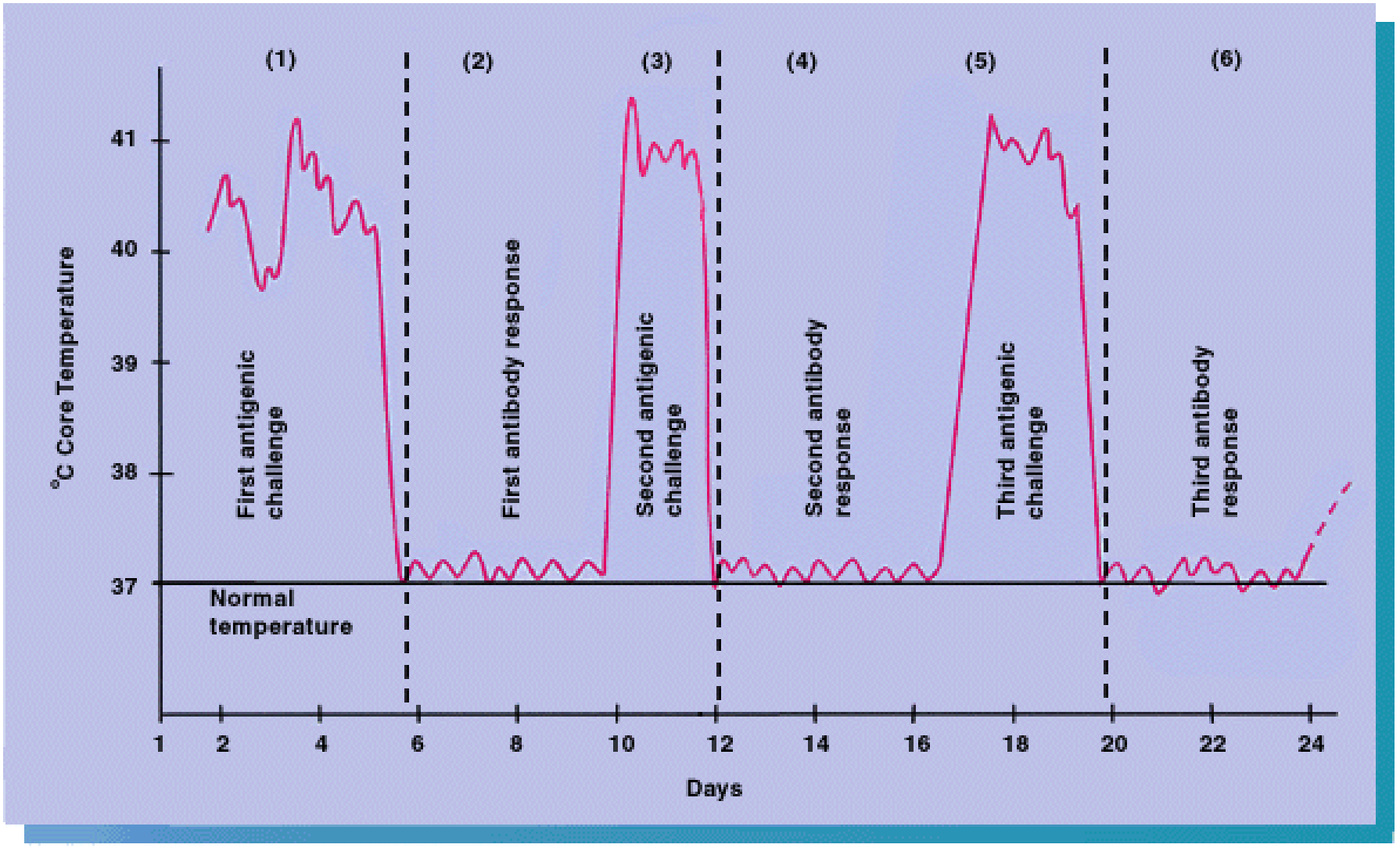
*Borrelia recurrentis, et al.***

- Relapsing Fever
  - Tick-borne (endemic)
    - Argasidae (soft ticks)
  - Louse-borne (epidemic)
    - *Pediculus humanus*
- cardinal signs:
  - high fevers (no LPS), icterus tachycardia, myalgia, splenomegaly
  - 6-9 days with relapses 4-7 days
- Antigenic variation causes relapses
- Relapses continue until cure or death
- Tetracycline, or erythromycin



***Pediculus humanus*, body louse**

The Pattern in Relapsing Fever. Figure 21.10 (T)



Lyme Disease

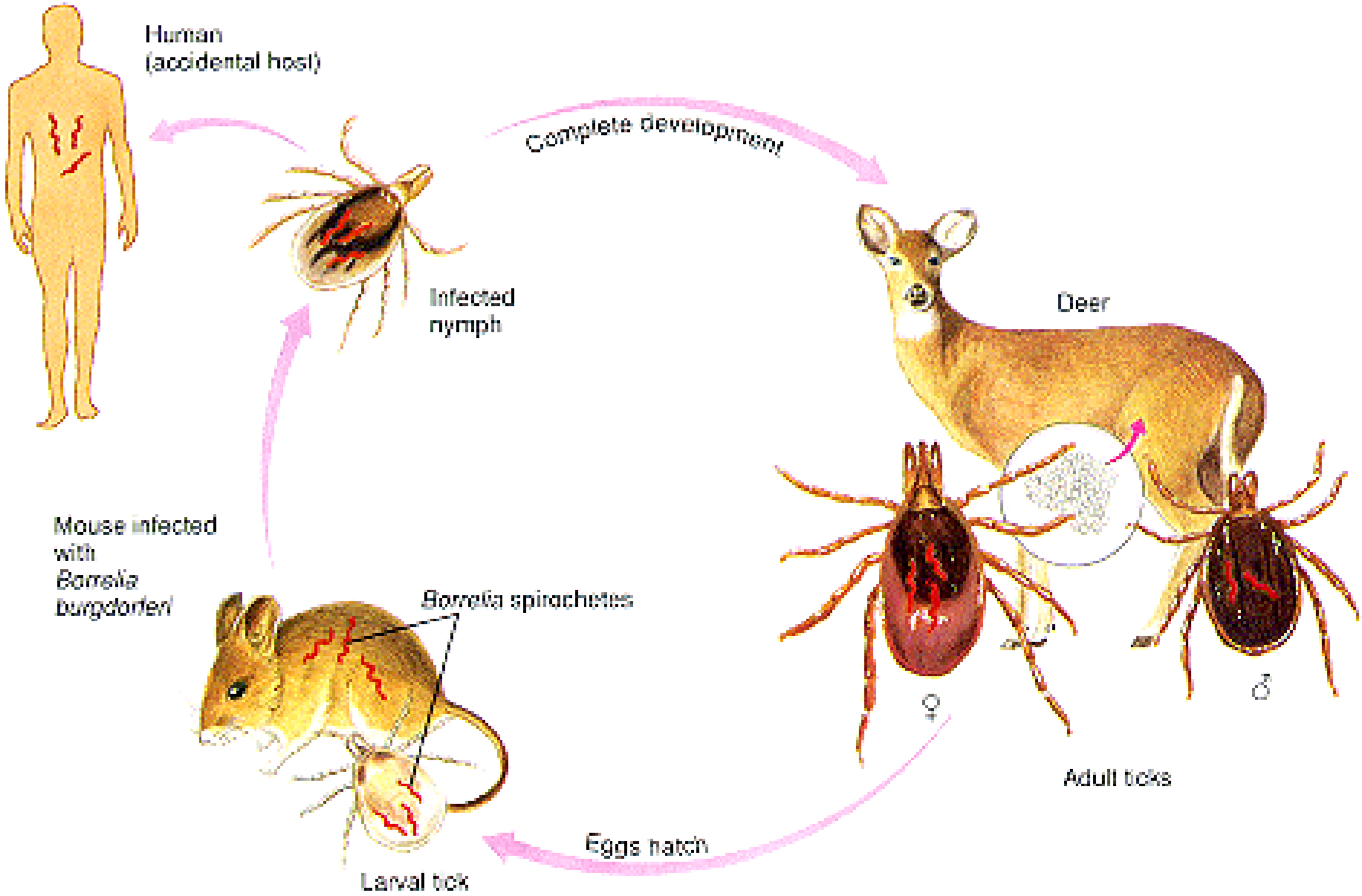
- Emerging disease in USA:
  - Caused by *B. burgdorferi*
  - Tickborne (deer tick)
  - First cases in Old Lyme, CT, in 1975
  - **Initially**, flu-like symptoms and circular rashes (erythema migrans) around the bite site.
  - **5-15%** have neurologic or cardiac involvement
  - **Chronic** poly-arthralgias and myalgia with fevers, may last for years
  - Antigenic variation!!
  - Treatment with penicillin or tetracycline

Old Lyme, Connecticut

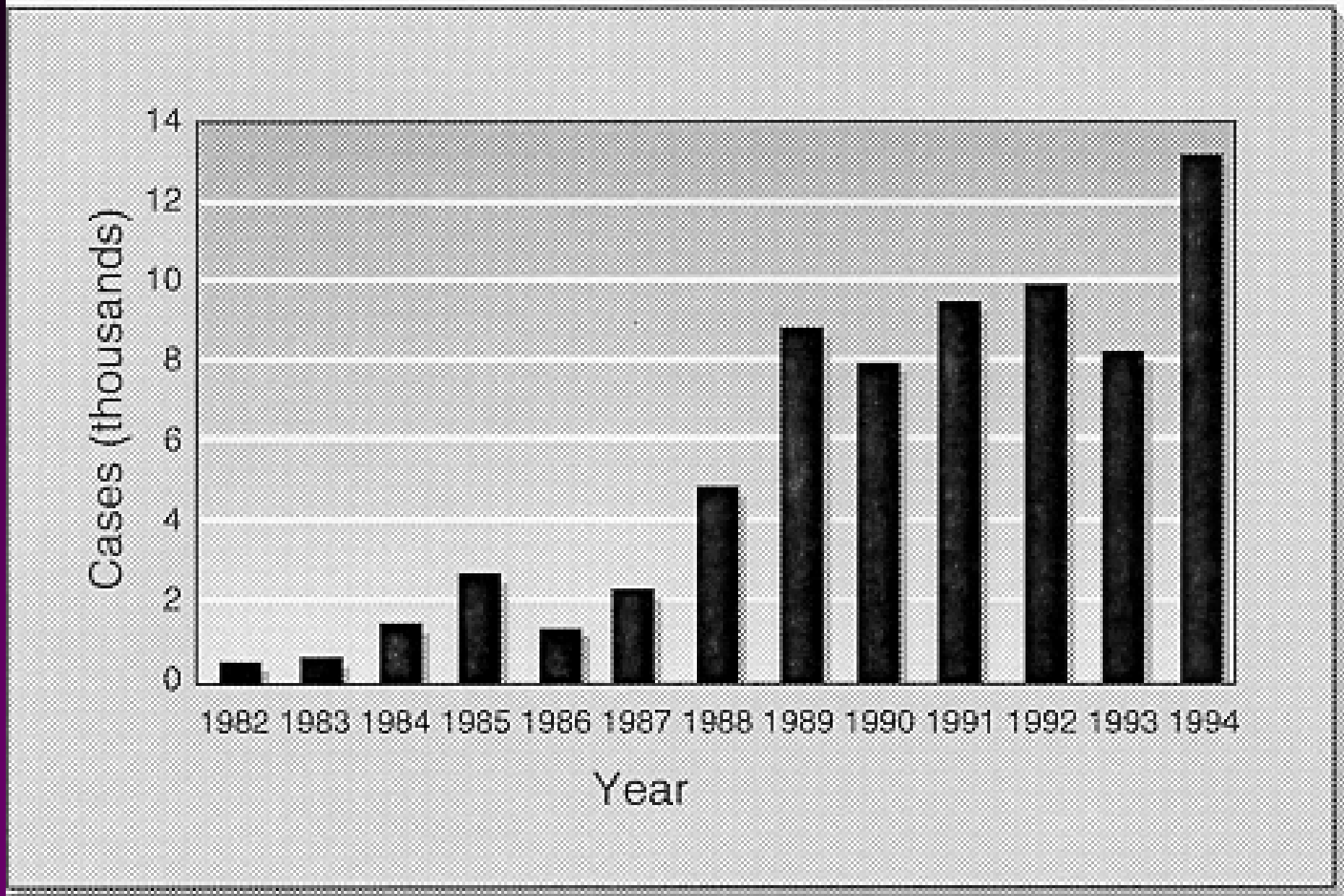

WISCONSIN
THE MILWAUKEE JOURNAL MAGAZINE
TICK,
TICK,
TICK...
The Lyme
disease
explosion

Former farm lands now suburban living space

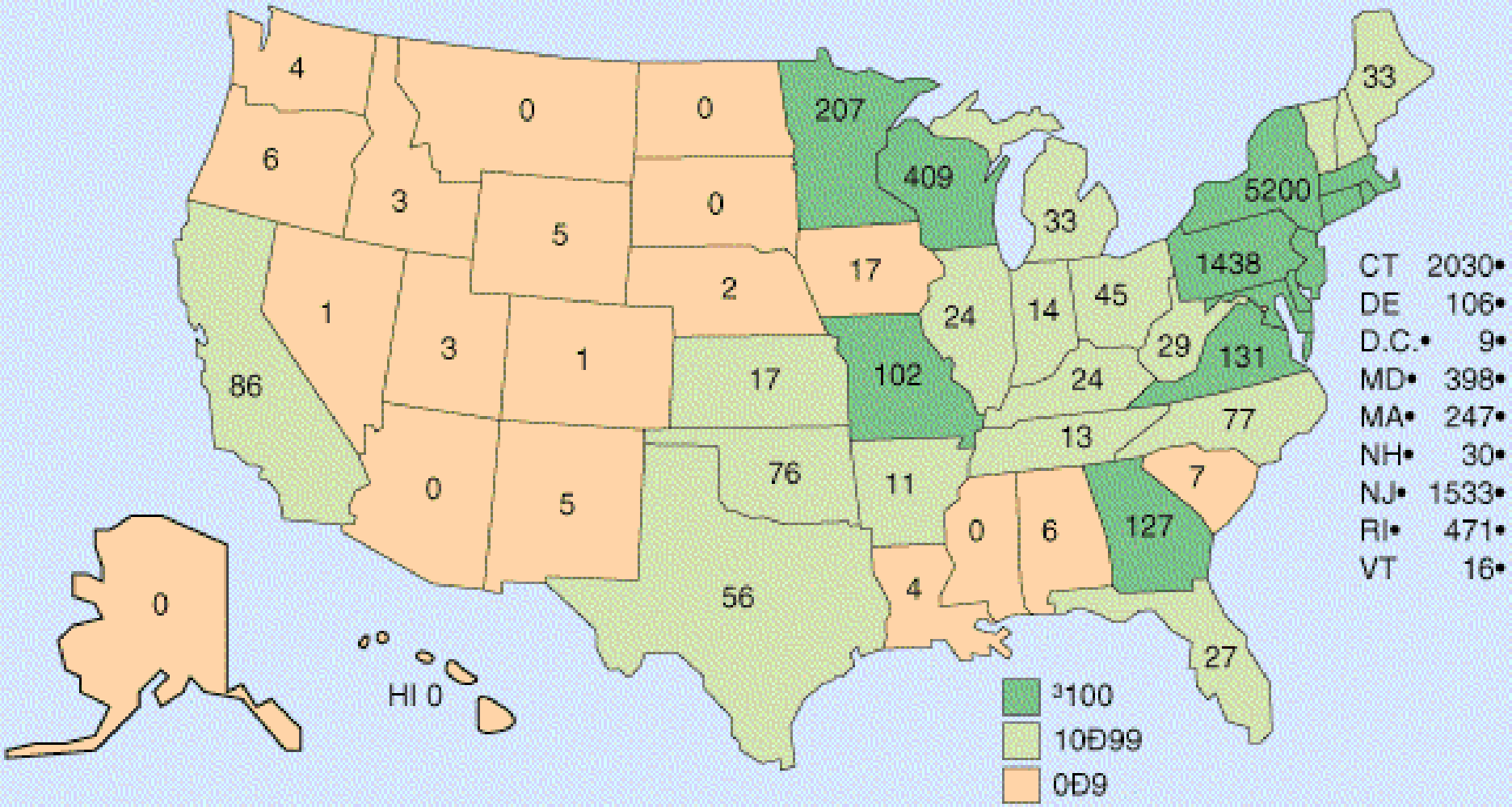
Life-cycle of Lyme Disease



3 Figure 17-8 Reported cases of Lyme disease in the U.S. from 1982 through 1994.



Incidence of Lyme Disease, 1994




Deer tick nymph taking
blood meal


B. burgdoferi


Initial lesion


Erythema migrans

Leptospirosis, Weil's Disease

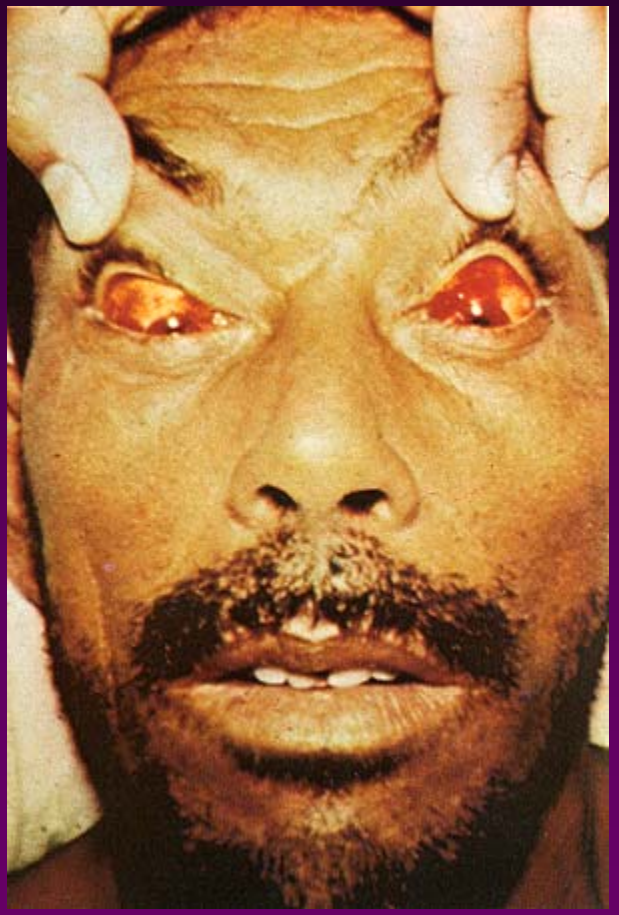
- *L. interrogans*, a **zoonosis that infects kidneys, liver**
  - icteric is highly fatal also anicteric form, less serious
  - Large # bacteria are passed in urine
- Infection via urine
  - common in sewer workers
  - May induce kidney failure & death
- Penicillin, tetracycline
- temporary renal dialysis
- Prevent by limiting exposure to urine

Jaundice and subconjunctical hemorrhages of leptospirosis

Leptospirosis, Weil's Disease

- 

Jaundice due to liver damage



Conjunctival hemorrhages in Weil's

Leptospirosis in USA