

STANDARD DEVIATIONS: Who is Eunice Rivers?

Part 1

Greetings,

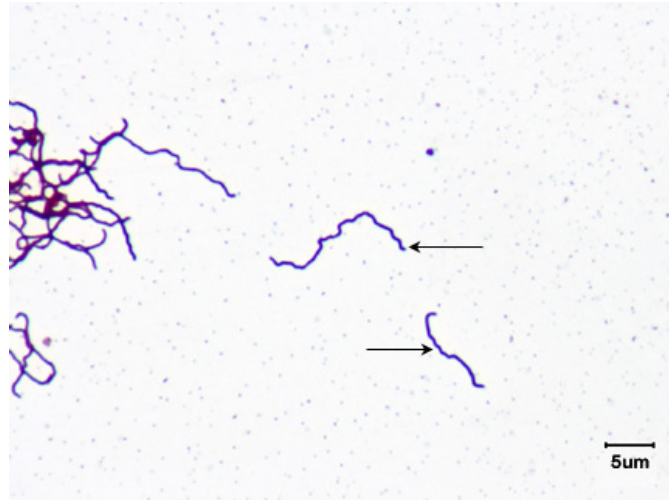
This is the story of Eunice Rivers. Ms. Rivers was a black nurse in Alabama during the middle part of the last century. She is the only person involved in the infamous Tuskegee Syphilis Study for its entire 40 year duration. Today I begin at the beginning, with syphilis.



{Eunice Rivers 1899-1986.}

Syphilis is a human disease. It's caused by a spiral-shaped, Gram-negative, highly mobile bacterium, *Treponema pallidum* (first identified in 1905).





{*Tr. pallidum* spirochetes, Geimsa.}

It has a relatively small genome (1.14 Mbp) and lacks metabolic competency; it needs a host. For a bacterium, it has a slow doubling time of around 30 hours.

Syphilis originated in the New World and migrated to the European continent with returning mercenaries of Christopher Columbus. It has become a global pathogen. Syphilis has killed untold millions of people over the past 5 centuries, millions are currently infected and infection rates have been rising in recent years.

The spirochete is able to pass through intact mucous membranes or compromised skin. Syphilis is transmitted primarily by sexual contact or during pregnancy from mother to fetus. Disease presents in four stages (primary, secondary, latent, and tertiary).

Tr. pallidum cannot be cultivated artificially, but the pathogenic strain (Nichol's strain) can be grown in the testicles of rabbit. Diagnostic identification is commonly performed serologically but Direct Fluorescent Antibody (DFA) and PCR are direct confirmatory assays. Testing does not distinguish the stages of disease.

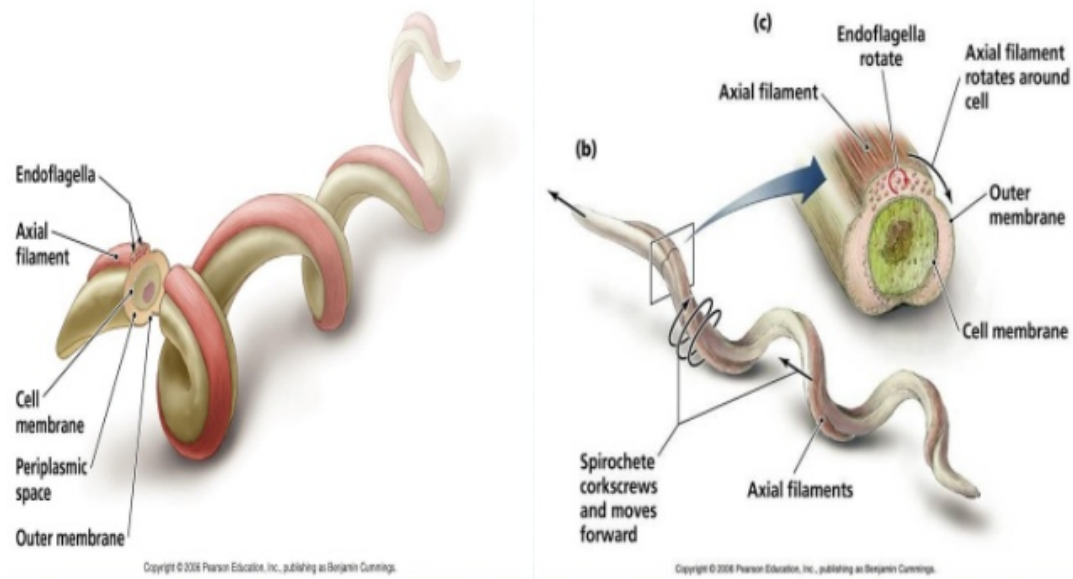
Syphilis is usually treatable with antibiotic. Intramuscular penicillin, Doxycycline, and tetracycline are commonly used and ceftriaxone (3rd gen cephalosporin) is effective. Emergence of clinically significant azithromycin resistance has resulted in treatment failures, thus precluding the use of this second-line drug.

The Organism

Tr. pallidum has a spiral shape with a protoplasmic cylinder surrounded by a cytoplasmic membrane, which is enclosed by a loosely associated outer membrane. Flagella are located in the periplasmic space, between the cytoplasmic membrane and the outer membrane. Flagellar structural detail and mechanism of motility are still largely unknown. There are very few outer membrane proteins and this is why it is so stealthy.



Periplasmic Flagella Diagram

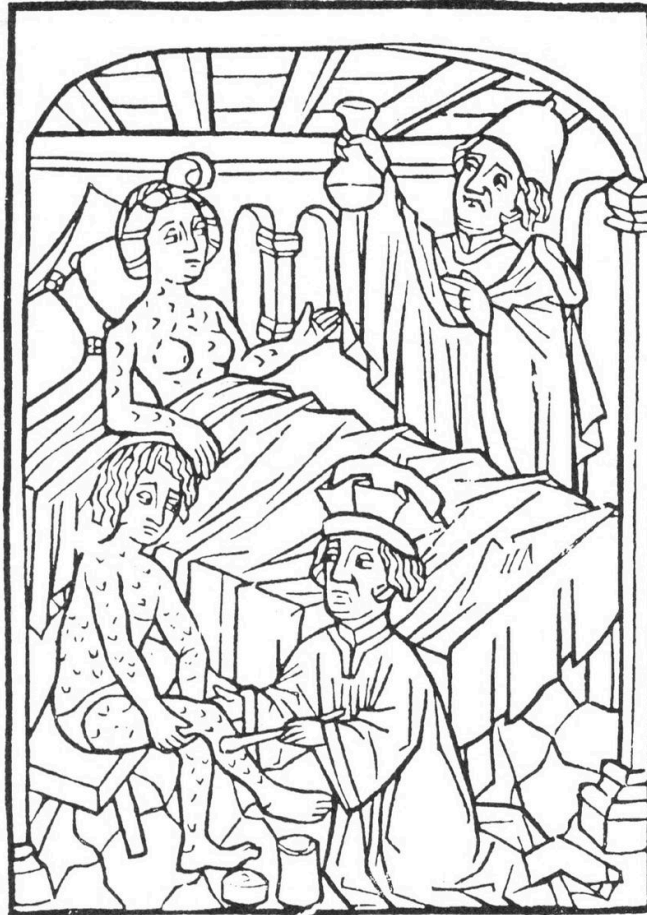


{Still not well understood.}

The Disease

There are arguments about the origins of syphilis. Until the siege of Naples in 1495, there are no good descriptions of the disease in Europe. But, an epidemic resulting in 5 million deaths spread from Italy up through the continent at exactly the time when siege mercenaries had returned from Columbus' first expeditions. From that moment forward, the literature and art reflect the arrival and progress of disease. **The symptoms and death of Columbus are entirely consistent with tertiary syphilis.**





{Earliest known medical illustration of people with syphilis, Vienna, 1498}

Global epidemiology is stuck in 1999 when the guesses by the UN suggest 12 million cases. Nearly 2% of all pregnancies were syphilis-positive. All indicators suggest that rates are rising in every demographic in every region.

In 2018, a total of 35,063 cases of syphilis were reported in the United States, yielding a rate of 10.8 cases per 100,000 population. This rate represents a **71.4% increase compared with 2014**.

Approximately 30% to 60% of those exposed to primary or secondary syphilis will get the disease. Left untreated, it has a mortality rate of 8% to 58%.

Here are characteristics of each stage:

Primary syphilis

The first sign of syphilis is a small sore, called a **chancre**. The sore appears at the spot where the bacteria entered your body.



The chancre will heal on its own within three to six weeks.



{Primary oral chancre}

Secondary syphilis

A **rash may develop** within weeks of infection. This rash is usually not itchy and may be accompanied by wart like sores in your mouth or genital area.



(Secondary syphilis rash)

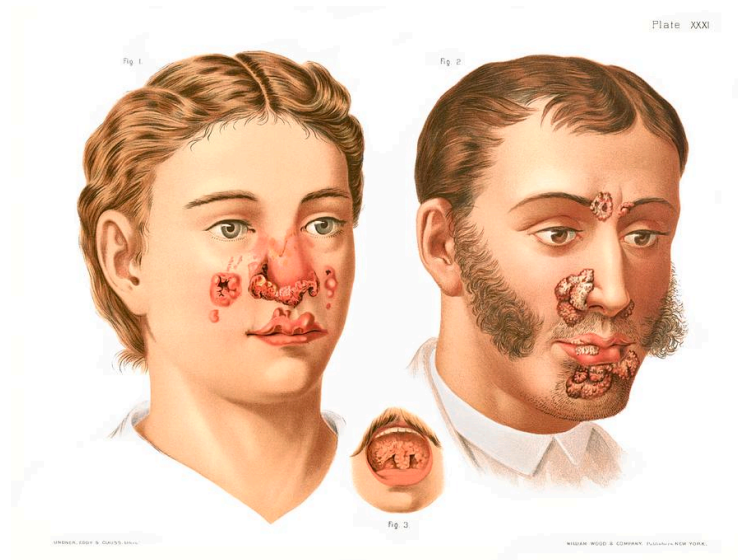


Latent syphilis

Untreated syphilis moves from the secondary stage to the hidden (latent) stage, when you have **no symptoms**. The latent stage can last for years. Signs and symptoms may never return, or the disease may progress to the third (tertiary) stage.

Tertiary syphilis

15% to 30% of people infected with syphilis who don't get treatment will develop complications known as late (or tertiary) syphilis. In the late stage, the disease may damage your **brain, nerves, eyes, heart, blood vessels, liver, bones and joints**. These problems may occur many years after the original, untreated infection.



{Tertiary syphilis. US Nat'l Medical library}

Neurosyphilis

At any stage, syphilis can spread and, among other damage, cause damage to the brain and nervous system (neurosyphilis) and the eye (ocular syphilis).

Congenital syphilis

Babies born to women who have syphilis can become infected through the placenta or during birth. Most newborns with congenital syphilis have no symptoms, although some experience a rash on the palms of their hands and the soles of their feet. Later signs and symptoms may include deafness, teeth deformities and saddle nose — where the bridge of the nose collapses.

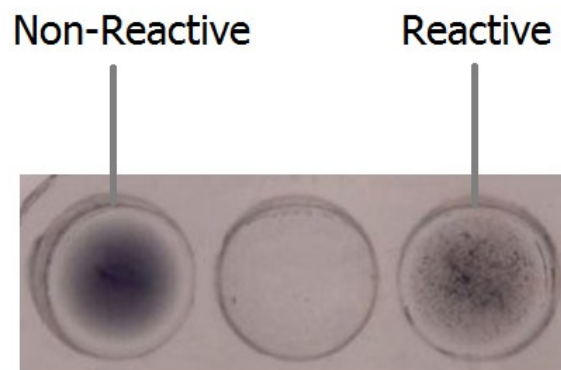




{Congenital syphilis}

Testing

Testing for syphilis is a common lab order and hasn't changed much in decades. Chances are that you've seen or performed the Rapid Plasma Reagin (RPR) assay. This (and VDRL) are non-treponemal antibody tests. They detect cardiolipin-like IgM and IgG. They are rapid, easy to perform and reliably provide semi-quantitative pictures of disease. Kind of like latex, they use antigen-laden charcoal particles to coagulate as black clumps.



{RPR}



DFA and PCR provide direct testing that are confirmatory for the organism. They are much more sensitive and specific but are usually send-outs.

Secretions containing *Tr. pallidum* are a possible source of infection to nurses, doctors and technicians who handle the syphilitic patient, or secretions. The infections are acquired by direct contact with an infected patient. It is a strict parasite; it dies rapidly in water and is very sensitive to drying. Soap and other detergents quickly destroy it. It is readily killed by heat at 41.5°C in an hour. [Biosafety!]

Okay, enough. Now that we have this little background, I can begin to talk about treatment and the study that shook America. Next week: The Tuskegee Study of Untreated Syphilis in the Negro Male.

Have a great week and be safe,

Bryan

