Biology of the Black Death

Modern Perspectives on a Medieval Pandemic

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Historical Context

In the mid 14th century, a deadly plague swept through China, central Asia, India, the near East, and Europe. The Black Death, as it came to be known, was utterly devastating. The total death toll is estimated to have been anywhere from 75-200 million; this massive global loss of population was a pivotal moment, setting the stage for the cultural changes of the latter Middle Ages and the Renaissance.

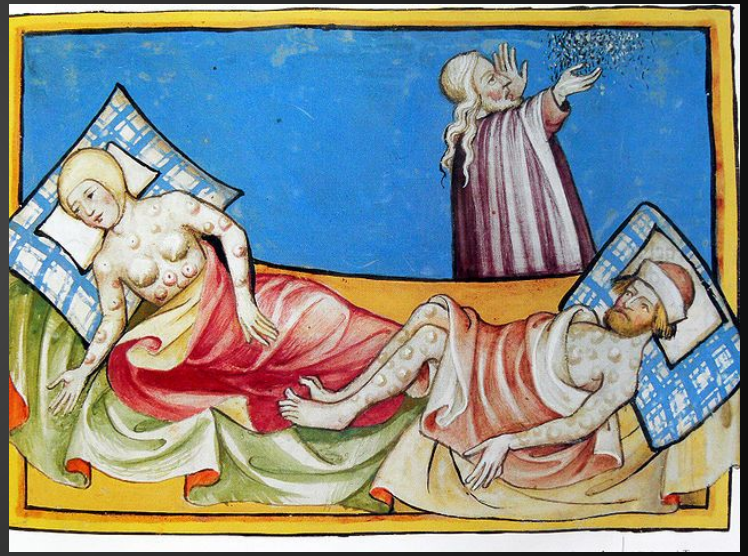
Different forms of infection

Medieval records note three distinct forms of the plague:

- Bubonic
- Pneumonic
- Septicemic

Symptoms: Bubonic

- Incubation period prior to noticeable symptoms
- Fever, headache, and chills
- Lymph node swelling (buboes) -- these can turn black and occasionally burst
- Death within ~2 weeks
    - Mortality rate historically of ~60-80+% [figures vary widely]



Symptoms: Pneumonic

- Fever, chills, lethargy
- Coughing and chest pain, especially coughing bloody sputum
- Death within several days
  - Typical mortality rate 90-95%

Symptoms: Septicemic

- Delirium, fever
- Often no visible symptoms prior to death
- Death within hours to a day
  - Mortality rate essentially 100%

Recent Findings

Modern genomic techniques have enabled scientists to identify pathogens associated with archaeological remains. Using PCR amplification to search for known *Yersinia pestis* plasmid genes in tooth pulp and bone samples taken from skeletons exhumed from “plague pits,” a team was able to definitively identify *Yersinia pestis* as the pathogen responsible for the plague.

Yersinia pestis

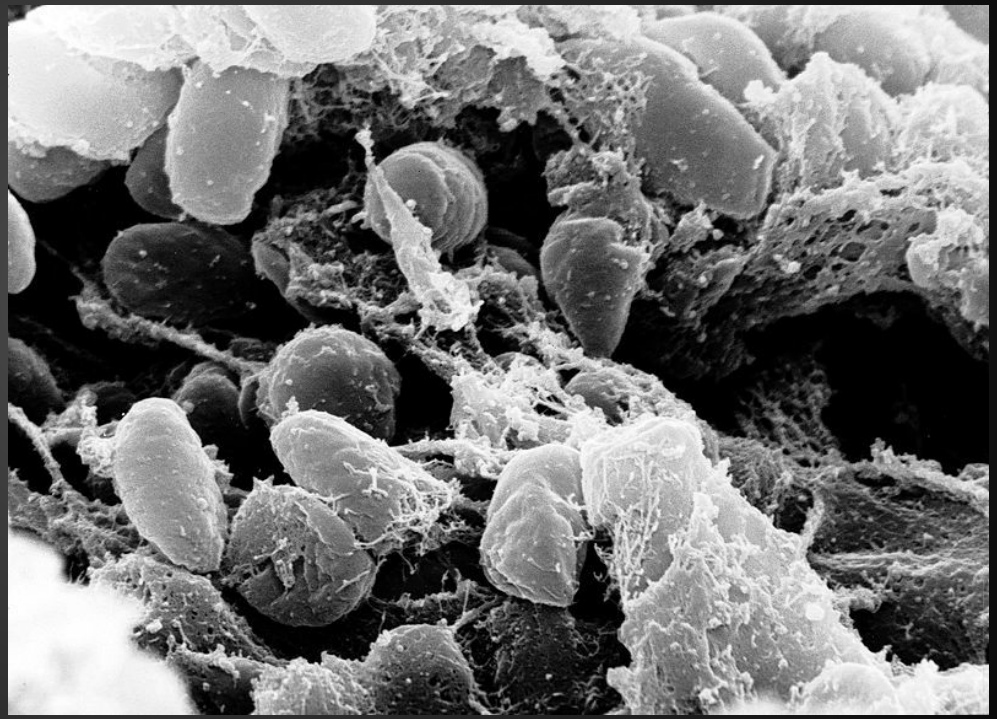
Bacterium

Reservoir hosts

- Small mammals

Vector

- Fleas



Epidemiology

The plague was spread both person to person and through contact with infected fleas.

Some areas were not impacted by the plague, notably Poland. Poland instituted extreme quarantine measures, which appeared to have worked. This may be evidence that vector transmission was relatively unimportant.

Implications of Recent Findings

A complete sequencing of medieval *Yersinia pestis* reveals that:

- the Black Death strain of *Y. pestis* is ancestral to all modern pathogenic strains
- there is no genetic evidence for increased virulence of the medieval *Y. pestis* strain

Oh, by the way

Yersinia pestis isn’t exactly extinct.

Why was the plague so deadly?

Life in the medieval period was not always awesome:

- Early 14th c. famine
- Urbanization without sanitation

We have antibiotics now, which is objectively pretty great.

References / Further Reading

Haensch, S. et al. “Distinct clones of Yersinia pestis caused the Black Death.” PLoS Pathogens vol. 6, e1001134 (2010) <http://www.plospathogens.org/article/info%3Adoi%2F10.1371%2Fjournal.ppat.1001134>

References / Further Reading

Schuenemann, V. J. et al. “Targeted enrichment of ancient pathogens yielding the pPCP1 plasmid of Yersinia pestis from victims of the Black Death.” PNAS USA doi:10.1073/pnas.1105107108 (29 August, 2011).

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References / Further Reading

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