and endemic threshold, and arguments regarding likely animals as sources of the virus - probably about 4,500-5,000 years ago - exactly the same arguments are presented for other seemingly ancient diseases in the human population

Some observations on Newly Emerging Diseases

- **Observations**
  1. Sudden and unprecedented appearance - e.g Marburg Virus
  2. Isolated cases identified retrospectively (prior to epidemic phase) - e.g HIV/AIDS
  3. Frequently associated with unknown pathogens - e.g. Marburg Virus

- **Explanations?**
  1. Pathogen always present but not recognised - e.g. too low a level to recognise, occurring in an isolated area, confused symptoms with another disease, etc.
  2. Pathogen virulence enhanced by some event (e.g. genetic mutation) - disease agent that has circulated for a long time in the human population but unable to cause disease until this event
  3. Environmental and behavioural changes (allowing the disease to flourish), as with Lyme Disease

**Lyme Disease**

1. First identified in 1975 in the town of Old Lyme, Connecticut, New England - cluster of childhood arthritis in the area gave indication of some new disease
   - Now know that it is caused by the bacterium *Borrelia burgdorferi*
2. Transmitted to humans by a tick vector (deer = maintenance host of the ticks)
3. Clinical manifestations: cutaneous lesions (acute stage) treated reasonably effectively with antibiotics; however if treatment is too late or not implemented at all, childhood arthritis can occur (secondary disease)
4. Emergence associated with ecological changes in northeastern and Midwestern US
   - In the 18th and 19th centuries, large portions of these regions were cleared of forest cover to make space for agricultural land
   - Into the 20th century, large tracts of this agricultural land was abandoned, eventually allowing recolonisation of forests
   - With this saw the return of deer into the forests, thus bringing the ticks which they carry
   - Urban settlement in these areas in the late 20th century brought humans into close contact with the deer and ticks, thus causing outbreaks of Lyme Disease

**Hantavirus Pulmonary Syndrome (HPS):**

- A disease first recognised in the human population in 1993, occurring in the ‘Four Corners’ region of Southwestern US - intersection of New Mexico, Arizona, Utah and Colorado
- The patients seemed to go down with respiratory failure and rapid death following this
- At the time was an unknown disease
- Subsequent investigations revealed it was caused by a virus, that was carried in nature by particular types of mouse
- It seems that the virus has been carried by mice in this area for millennia, raising the question of why the disease appeared for the first time in the 1990s if it had been carried among rodents for such a long time beforehand - what are the factors facilitating the emergence of HPS in the human population? (Facilitating factors examined in next lecture)