Gram Positive Bacteria

- Important structural features in Gram positive bacteria include:
  - Capsule formation, e.g. *Streptococcus pneumoniae*
  - Spore formation, e.g. *Bacillus* spp

- A capsule is a layer of material often seen on the surface of cells when using Gram staining
  - It is a well organised, dense structure, usually consisting of polysaccharides
  - It helps bacterium evade the immune system by acting as a protectant against phagocytosis
    - It may also defend the bacteria from desiccation
  - It unusually doesn’t show up on a Gram stain and is instead a clear film around the bacteria
  - The image on the right is *Klebsiella pneumoniae*, a bacterium under a Gram stain. You can see the clear capsule around it:

- Some Gram positive bacteria such as *Clostridium* can develop a special resistant structure – an endospore
  - The spores are formed as the bacteria divides. One side then engulfs the other thus having 2 layers
    - These spores are highly resistant to heat, UV radiation, chemical disinfectants and desiccation
      - Some bacteria with this can survive in boiling water for an hour
  - Spores are impermeable to most stains and thus do not colour in a Gram stain
    - The position of the spore during staining is used to identify the species of bacteria
  - *Bacillus cereus* is an example of a spore former as seen below during a spore stain:

- Below is a table showing some Gram positive bacteria and their associated diseases:

<table>
<thead>
<tr>
<th>Microbe</th>
<th>Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>MRSA &amp; MSSA</td>
</tr>
<tr>
<td><em>Streptococcus pyogenes</em></td>
<td>Sore Throat &amp; Scarlet Fever</td>
</tr>
<tr>
<td><em>Streptococcus pneumoniae</em></td>
<td>Pneumonia</td>
</tr>
<tr>
<td><em>Bacillus cereus</em></td>
<td>Food Poisoning</td>
</tr>
<tr>
<td><em>Clostridium botulinum</em></td>
<td>Severe Food Poisoning</td>
</tr>
</tbody>
</table>