MICROBIAL SURVIVORSHIP ON CELL PHONES

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PROBLEM

• Not much thought is given to the amount of bacteria present on your cell phone.
• Some studies have shown that cell phones house more bacteria than a doorknob and toilet seat.
CELL PHONE CONTACT

- Phones come in contact with face and hands
- Can easily cause illness when they come in contact with the face
- From the hands, bacteria can easily be transferred to another person
- Cell phones being used in this study: **Version ENV2**, Apple iPod touch, Verizon Treo, Verizon Motorola Droid
PREVIOUS STUDIES

• “Bacterial Contamination of Mobile Phones: When Your Mobile Phone Could Transmit More Than Just a Call” by Dr. Daniel N Tagoe, Mr. Vincent K Gyande, Mr. Evans O Ansah

• Found that all tested phones were highly contaminated with multiple types of bacteria

• Suggest a periodic cleaning of ones phone
TWO CLASSES OF BACTERIA

- **Gram Positive (Staph)**
  - Most pathogenic bacteria in humans are gram-positive organisms.
  - Simple cell wall.
  - Antibiotics such as penicillin work against the formation of the cell wall.

- **Gram Negative (E. Coli)**
  - Cell wall is thin extra layer of lipopolysaccharide which adds extra level of protection.
  - If the toxin enters the circulatory system it causes a toxic reaction.
  - This outer membrane protects the bacteria from several antibiotics.
ESCHERICHIA COLI

- A rod-shaped, gram negative bacteria found on the blood and intestinal tract of warm-blooded animals
- Most widely studied prokaryotic organism
- Some strains can cause illness
- Easily manipulated in lab
STAPHYLOCOCCUS

- A round-shaped, gram positive bacteria, found on the skin or mucous membranes of animals.
- Most strains are not harmful.
- Pathogenic strains can be life threatening.
- Common bacteria model.
The purpose of this experiment was to determine if E.coli and Staph could grow and survive on the surface of a cell phone over the course of time.
HYPOTHESES

- **Null Hypothesis**: Exposure time will have **no significant effect** on the survivorship and growth of E.coli and Staph on the surface of a cell phone.

- **Alternative Hypothesis**: Exposure time will have a **significant effect** of the survivorship and growth of E.coli and Staph on the surface of a cell phone.
MATERIALS AND EQUIPMENT

- LB agar plates
- LB Media (0.5% yeast extract, 1% tryptone, 1% sodium chloride)
- Escherichia Coli
- Staphylococcus Epidermidis
- 4 cell phones
- Ethanol and gauze pads
- Bunsen burner and matches
- SDF (Sterile Dilution Fluid) 100mM KH2PO4, 100mM K2HPO4, 10mM MgSO4, 1mM NaCl
- Spreader bar
- Micro pipet with sterile tips
- Sterile test tubes
- Sterile microtubes
- Klett Spectrometer
- Sidearm flask
- Incubator (set at 37°C)
PROCEDURE

• The bacteria were grown overnight in sterile LB media.
• A sample of the overnight culture was added to fresh media in a sterile sidearm flask.
• The culture was placed in an incubator until a density of 50 Klett spectrophotometer units was reached. This represents a cell density of approximately $10^7$ cells/mL.
• The culture was diluted in sterile dilution fluid to a concentration of approximately $10^5$ cells/mL.
• The surface of the phones were sterilized by ethanol and a gauze pad
• The tube of bacteria was then vortexed
• 0.1 mL of the bacteria was pipetted onto the surface of each phone
• The bacteria was left to sit on the surface for exposure times (0, 5, 10, 20 minutes)
• After the appropriate exposure time, 0.9 mL of SDF was pipetted on to the surface of the phone
PROCEDURE (CONT.)

- The liquid was then re-suspended by a pipette slowly to reabsorb the bacteria on the phone.
- The liquid was transferred to a microtube.
- The microtube was then vortexed and 0.1 mL of E.coli from the microtube was pipetted onto 5 petri dishes.
- After 5 petri dishes had been plated, 0.5 mL of SDF was added to the microtube.
- The microtube was vortexed and 0.1 mL of E.coli was pipetted on to 5 more petri dishes.
- The plates were then incubated for 24 hours.
- Colonies were then counted and assumed to have risen from one cell.
E. COLI SURVIVORSHIP ON CELL PHONES

**Number of colonies**

- **Before dilution**
- **After dilution**

**Time elapsed**

- 0
- 5
- 10
- 20

**P-value**

- Before dilution: 1.9E-12
- After dilution: 0.000617
STAPH SURVIVORSHIP ON CELL PHONES

Number of colonies

Elapsed Time

Before Dilution

After Dilution

P-value

1.01E-10

1.3E-12
## PERCENT CHANGE

### Before Dilution

<table>
<thead>
<tr>
<th>Time</th>
<th>E.coli</th>
<th>Staph</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 min</td>
<td>-10.05%</td>
<td>-9.55%</td>
</tr>
<tr>
<td>10 min</td>
<td>-34.68%</td>
<td>-12.18%</td>
</tr>
<tr>
<td>20 min</td>
<td>-40.30%</td>
<td>-34.41%</td>
</tr>
</tbody>
</table>

### After Dilution

<table>
<thead>
<tr>
<th>Time</th>
<th>E.coli</th>
<th>Staph</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 min</td>
<td>-6.47%</td>
<td>-23.38%</td>
</tr>
<tr>
<td>10 min</td>
<td>-15.86%</td>
<td>-40.21%</td>
</tr>
<tr>
<td>20 min</td>
<td>-20.20%</td>
<td>-56.31%</td>
</tr>
</tbody>
</table>
## DUNNETT’S TEST

(If t-value > than t-crit, then significant)

### E.coli

<table>
<thead>
<tr>
<th>Variable</th>
<th>T-value</th>
<th>T-crit</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 minutes</td>
<td>4.870</td>
<td>3.29</td>
<td>Significant</td>
</tr>
<tr>
<td>10 minutes</td>
<td>16.805</td>
<td>3.29</td>
<td>Significant</td>
</tr>
<tr>
<td>20 minutes</td>
<td>19.529</td>
<td>3.29</td>
<td>Significant</td>
</tr>
</tbody>
</table>

### Staph

<table>
<thead>
<tr>
<th>Variable</th>
<th>T-value</th>
<th>T-crit</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 minutes</td>
<td>4.737</td>
<td>3.29</td>
<td>Significant</td>
</tr>
<tr>
<td>10 minutes</td>
<td>6.044</td>
<td>3.29</td>
<td>Significant</td>
</tr>
<tr>
<td>20 minutes</td>
<td>17.082</td>
<td>3.29</td>
<td>Significant</td>
</tr>
</tbody>
</table>
CONCLUSIONS

• The null hypothesis can be rejected for both E.coli and Staph because the statistical analysis showed that exposure time had and affect on the survivorship and growth of E.coli and Staph.

• The alternative hypothesis can be accepted because the statistical analysis showed that exposure time had an effect on the survivorship and growth of E.coli and Staph.

• Statistical analysis suggests that time exposure had a negative effect on the survivorship of E.coli and staph on cell phones.
LIMITATIONS AND EXTENSIONS

• Slight delay time in stop watch going off and plating. This could be avoided if a team of 2 or 3 students were present.

• Resuspension errors

• Cell phone surface differences

• If I was to do this experiment again I would test different surfaces such as doorknobs, toilet handles, etc. Also I would change the model.

• Direct pressing of cell phone onto agar plates.

• Test effects of cleaners on surface of phone.
REFERENCES

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- http://textbookofbacteriology.net/staph.html