A Study in Dermatoglyphic Correlation in Related Individuals

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Dermatoglyphics

- Dermatoglyphics is a term that describes the study of dermal ridges specifically those on the fingers, hands, and feet.
- This is a study of dermatoglyphics,
  - It evaluates similarities based on heritability
  - It compares correlations in nuclear and extended families to unrelated individuals

Anthropology in Dermatoglyphics

- Fingerprints are less susceptible to genetic drift.
- Fingerprints are unalterable after birth.
- Dermatoglyphic studies are highly objective, reducing personal error.
- Because the ridges are polygenic traits.
- Due to the ridges being fixed once they are expressed.
- This is because the results are based on calculations, not opinion.

Pattern Types

Dermatoglyphics can be used to study worldwide populations.

- In terms of:
  - Heritability
  - Developmental selection
  - Geographic variation

Institutional Review Board

- To be approved by the IRB the study had to:
  - Adhere to the guidelines of the ethical treatment of human subjects
  - Go through an application process, to assure the safety of the participants
### Collection Process

- The participants were part of four groups:
  - Families 1-3
  - An unrelated control
- All ten fingers were printed using:
  - Archival ink
  - Acid free ID cards
  - A rolling technique
- All individuals received a serial number to assure confidentiality.

### Total Ridge Count

- A ridge count is the number of ridges along a straight line.
  - Starts at the delta
  - Stops at the center of the pattern
- A TRC is derived by adding the counts from all ten fingers

### Pattern Frequencies

- Family 2 most closely correspond with Harold Cummins' percentages
  - Loops 70%
  - Whorls 20%
- Family 3 was least like the expected percentages
  - Arches 5%
  - Unique 5%

- Male Pattern Percentages (Population 170)
  - Whorls: 66%
  - Arches: 5%
  - Loops: 14%

- Female Pattern Percentages (Population 297)
  - Whorls: 70%
  - Arches: 14%
  - Loops: 13%

- It is expected that males will have a higher percentage of whorls than females.

- The study found this to be untrue, possibly due to the difference in male and female populations.

### Correlations

- As a complete population the families were a good fit to theoretical values
- Family 1 was most like the theoretical values
- Family 3 was the least similar

<table>
<thead>
<tr>
<th>Degree of relationship</th>
<th>Number of Pairs used</th>
<th>Observed coefficient</th>
<th>Relative coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sibling-sibling</td>
<td>19</td>
<td>0.07954</td>
<td>0.50</td>
</tr>
<tr>
<td>Father-child</td>
<td>14</td>
<td>0.392316</td>
<td>0.50</td>
</tr>
<tr>
<td>Mother-child</td>
<td>7</td>
<td>0.431939</td>
<td>0.50</td>
</tr>
<tr>
<td>Midparent-child</td>
<td>7</td>
<td>0.75043</td>
<td>0.71</td>
</tr>
</tbody>
</table>

### Chi-square test: observed-observed

<table>
<thead>
<tr>
<th>Family comparison</th>
<th>X2 Value</th>
<th>Sample size</th>
<th>Significance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family 1 &amp; 2</td>
<td>14.3</td>
<td>359</td>
<td>0.01</td>
</tr>
<tr>
<td>Family 1 &amp; 3</td>
<td>9.44</td>
<td>262</td>
<td>0.05</td>
</tr>
<tr>
<td>Family 2 &amp; 3</td>
<td>22.8</td>
<td>217</td>
<td>0.01</td>
</tr>
</tbody>
</table>

- This test was used to find the goodness of association among the families
- Each family was tested against the others
- The frequencies were found to be statistically significant
Chi-square test: observed-expected

- This test was used to show goodness of fit
- It was done by testing the complete population against the expected frequencies
- Results showed that the study was significantly different from the expected values

\[ \chi^2 = 11.21 \]
Significant at \( p = 0.05 \)

Conclusions

- By comparing the data to proven correlations and pattern frequencies the study shows heritability and variation among the families through:
  - Correlations
  - Chi-square tests
- Supporting the hypothesis, that related individual’s fingerprint ridge counts are more similar than an unrelated individual’s

Thank You!

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