Genetics of extreme body size evolution in mice from Gough Island

Karl Broman

Biostatistics & Medical Informatics, UW–Madison

kbroman.org
github.com/kbroman
@kwbroman

bit.ly/APStats2017
Gough Island
Gough Island
Big rodents
Big rodents
Big rodents
Gough mice
WSB and Gough mice
Leptin knockout
WSB and Gough mice
The Island Rule
Gough and WSB mice
Body weight
Body weight

Males

Females

Body weight (g)

Week
Growth rate

Males

Females
Partially-inbred Gough lines
Partially-inbred Gough lines
Gough × WSB crosses
Gough × WSB crosses
Gough × WSB crosses
Gough × WSB crosses
Gough × WSB crosses
Growth curves

**Males**

**Females**
Growth curves

Males

Week
Body weight (g)
1 5 10 15
0
5
10
15
20
25
30
35

F
Gough
WSB

Females

Week
Body weight (g)
1 5 10 15
0
5
10
15
20
25
30
35

F 2
Gough
WSB
Growth rate

**Males**

<table>
<thead>
<tr>
<th>Week</th>
<th>Growth rate (g/week)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

**Females**

<table>
<thead>
<tr>
<th>Week</th>
<th>Growth rate (g/week)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>
Growth rate

Males

Females

Week

Growth rate (g/week)

Week

Growth rate (g/week)
Growth rate

Males

Growth rate (g/week)

Females

Growth rate (g/week)
Genotypes

Chromosomes

Markers

Mice

50

100

150

200
Weight at 5 weeks vs genotype
Genome scan
Permutation test

- genotype data
- markers
- mice

phenotypes → test statistics → maximum test statistic
Permutation test
Histogram of permutation results
Genome scan for body weight

![Graphs showing genome scan results for body weight.](image)
Genome scan for growth rate
Summary

- Multiple genetic loci contribute to body size in Gough × WSB.
- Gough alleles result in increased size.
- The major effects are on growth rate in first five weeks.
Acknowledgments

Bret Payseur
Melissa Gray
Michelle Parmenter
Caley Hogan
Irene Ford

Richard Cuthbert

Peter Ryan

NIGMS/NIH

University of Wisconsin–Madison
Royal Society for the Protection of Birds
Percy FitzPatrick Institute of African Ornithology, University of Cape Town