

# MUGA Example Data

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## 1 Introduction

The data in this package contains phenotype and genotype data from Diversity Outbred (DO) mice. The Mouse Universal Genotyping Array (MUGA) that was developed by the University of North Carolina at Chapel Hill [1]. The array contains 7,864 markers and was developed to genotype Collaborative Cross and Diversity Outbred mice. It may also be used to genotype other multi-founder mouse crosses.

The data in this package is from Svenson et.al, Genetics, 2012 [2]. Briefly, 150 mice (75 F and 75 M) were placed on either a chow or high fat diet at wean. They were phenotyped at early and late time points and sacrificed by 30 weeks of age. Tail tips were taken, DNA was extracted and the mice were genotyped on the MUGA.

## 2 Data Description

There are 10 data files available in this package. Any of them may be accessed using `data(<name>)`.

```
> library(MUGAExampleData)
```

**FinalReport1** Raw genotype file for the samples in this study.

**FinalReport2** Raw genotype file for the samples in this study.

**Samples1** Sample IDs for the samples in FinalReport1.

**Samples2** Sample IDs for the samples in FinalReport2.

**call.rate.batch** The allele call rates and batch IDs for each sample.

**x** The X allele intensities extracted from FinalReport1 and FinalReport2.

**y** The Y allele intensities extracted from FinalReport1 and FinalReport2.

**geno** The allele calls extracted from FinalReport1 and FinalReport2.

**model.probs** The DO founder haplotype probabilities for each sample at each marker.

**pheno** The phenotype data for this study.

## 2.1 FinalReport1 and 2

These are raw text files containing the MUGA genotyping output as it is received from GeneSeek. There are nine rows of header information. Each line is tab delimited and contains the following columns.

**SNP Name** MUGA SNP ID.

**Sample ID** Sample name. Will match the sample name in Samples1 or 2.

**Allele1 - Forward** Allele call for probe 1.

**Allele2 - Forward** Allele call for probe 2.

**X** Normalized X allele intensity

**Y** Normalized Y allele intensity

**GC Score** GC Score

**Theta** X and Y intensities converted to  $\theta$  coordinate.

**X Raw** Untransformed X allele intensity.

**Y Raw** Untransformed Y allele intensity.

**R** X and Y intensities converted to  $\rho$  coordinate.

## 2.2 Samples1 and 2

These are raw text files containing the sample names from the MUGA genotyping from GeneSeek. Each line is tab delimited and contains the following columns.

**Index** Sample index

**Name** Sample Name

**ID** Sample ID (may be the same as the name).

**Gender** Sample sex.

**Plate** Plate ID on which sample was run.

**Well** Well in which sample was run.

**Group** Sample group.

**Parent1** Parent1.

**Parent2** Parent2.

**Replicate** Replicate ID

**SentrixPosition** Sample position code.

## 2.3 call.rate.batch

Data.frame containing allele call rate and batch information for each sample.

**sample** Sample ID.

**call.rate** The proportion of successful allele calls.

**batch** A batch identifier to distinguish batch 1 and 2.

## 2.4 x and y

These are numeric matrices that contain the X and Y allele intensity data extracted from the FinalReport1 and FinalReport2 files. The dimensions are 141 samples by 7,854 markers. Although there were 150 samples in the study, only 141 were genotyped for technical reasons.

The rows are names by sample ID and the columns are named by the SNP ID.

## 2.5 geno

This is a character matrix that contains the allele calls extracted from the FinalReport1 and FinalReport2 files. The dimensions are 141 samples by 7,854 markers. Each cell contains either 'A', 'C', 'G', 'H', 'T' or '-'. Although there were 150 samples in the study, only 141 were genotyped for technical reasons.

The rows are names by sample ID and the columns are named by the SNP ID.

## 2.6 model.probs

This is a numeric three dimensional array containing the founder haplotype contributions for each sample at each marker. The dimensions are 141 samples by 8 founders by 7,854 markers. Cell (i, j, k) contains the proportion of j at locus k for sample i. The founders are labeled A through H and are explained below.

|   |             |
|---|-------------|
| A | A/J         |
| B | C57BL/6J    |
| C | 129S1/SvImJ |
| D | NOD/ShiLtJ  |
| E | NZO/H1LtJ   |
| F | CAST/EiJ    |
| G | PWK/PhJ     |
| H | WSB/EiJ     |

```
> data(model.probs)
```

```
> model.probs[1, , 1:5]
```

```
UNC010515443 UNC010001943 UNC010515539 UNC010515556 UNC010002207
A 9.598007e-51 3.220165e-16 1.380275e-17 1.458903e-17 1.640058e-16
B 8.411587e-09 8.419524e-46 1.083905e-19 8.248867e-39 4.575537e-17
C 1.877777e-08 9.333647e-09 5.353990e-12 1.109631e-22 4.553043e-17
D 5.000000e-01 5.000000e-01 5.000000e-01 5.000000e-01 5.000000e-01
E 5.000000e-01 5.000000e-01 5.000000e-01 5.000000e-01 5.000000e-01
F 7.889177e-40 7.543572e-22 1.074099e-17 1.087953e-17 9.531830e-17
G 4.537672e-39 6.875965e-21 1.950897e-16 1.948297e-16 2.054865e-16
H 1.054247e-08 3.493217e-12 1.563549e-15 9.469679e-17 1.257905e-17
```

## 2.7 pheno

This is the phenotype data for the samples in this study. There are 149 samples in rows and 142 columns. The first six columns contain sample information and the remaining columns contain phenotype measurements.

```
> data(pheno)
> pheno[1:5,1:6]
```

|     | Sample | Sex | Gen  | Diet | Coat.Color | WBC1 |
|-----|--------|-----|------|------|------------|------|
| F01 | F01    | F   | G4L2 | hf   | agouti     | 4.95 |
| F02 | F02    | F   | G4L2 | hf   | black      | 5.59 |
| F03 | F03    | F   | G4L2 | hf   | white      | 6.54 |
| F04 | F04    | F   | G4L2 | hf   | agouti     | 6.02 |
| F05 | F05    | F   | G4L2 | hf   | agouti     | 5.64 |

| Column Name | Description                                    | Timepoint (weeks) |
|-------------|--|-------------------|
| Sample      | Sample ID                                      | NA                |
| Sex         | Sample Sex                                     | NA                |
| Gen         | DO outbreeding generation and litter           | NA                |
| Diet        | Diet, either chow or hf                        | NA                |
| Coat.Color  | Coat color coded as agouti, black or white     | NA                |
| WBC1        | White Blood Cell counts (1000 cells / $\mu$ l) | 10                |
| RBC1        | Red Blood Cell counts (1000 cells / $\mu$ l)   | 10                |
| mHGB1       | Measured Hemoglobin                            | 10                |
| HCT1        | Hematocrit                                     | 10                |
| MCV1        | Mean Corpuscular Volume                        | 10                |
| MCH1        | Mean Corpuscular Hemoglobin                    | 10                |
| MCHC1       | Mean Corpuscular Hemoglobin Concentration      | 10                |
| CHCM1       | Corpuscular Hemoglobin Concentration Mean      | 10                |
| RDW1        | Red blood cell distribution width              | 10                |
| HDW1        | Hemoglobin distribution width                  | 10                |
| PLT1        | Platelet counts                                | 10                |
| MPV1        | Mean platelet volume                           | 10                |
| perc.NEUT1  | Percent neutrophils                            | 10                |
| perc.LYM1   | Percent lymphocytes                            | 10                |
| perc.MONO1  | Percent monocytes                              | 10                |
| perc.EOS1   | Percent Eosinophils                            | 10                |
| Retic1      | Reticulocyte counts                            | 10                |
| cHGB1       | Calculated hemoglobin                          | 10                |
| ct.NEUT1    | Neutrophil counts                              | 10                |
| ct.LYM1     | Lymphocyte counts                              | 10                |
| ct.MONO1    | Monocyte counts                                | 10                |
| ct.EOS1     | Eosinophil counts                              | 10                |
| WBC2        | White Blood Cell counts (1000 cells / $\mu$ l) | 22                |
| RBC2        | Red Blood Cell counts (1000 cells / $\mu$ l)   | 22                |
| mHGB2       | Measured Hemoglobin                            | 22                |
| HCT2        | Hematocrit                                     | 22                |
| MCV2        | Mean Corpuscular Volume                        | 22                |
| MCH2        | Mean Corpuscular Hemoglobin                    | 22                |
| MCHC2       | Mean Corpuscular Hemoglobin Concentration      | 22                |
| CHCM2       | Corpuscular Hemoglobin Concentration Mean      | 22                |
| RDW2        | Red blood cell distribution width              | 22                |
| HDW2        | Hemoglobin distribution width                  | 22                |
| PLT2        | Platelet counts                                | 22                |
| MPV2        | Mean platelet volume                           | 22                |
| perc.NEUT2  | Percent neutrophils                            | 22                |
| perc.LYM2   | Percent lymphocytes                            | 22                |
| perc.MONO2  | Percent monocytes                              | 22                |
| perc.EOS2   | Percent Eosinophils                            | 22                |
| Retic2      | Reticulocyte counts                            | 22                |
| cHGB2       | Calculated hemoglobin                          | 22                |
| ct.NEUT2    | Neutrophil counts                              | 22                |
| ct.LYM2     | Lymphocyte counts                              | 22                |
| ct.MONO2    | Monocyte counts                                | 22                |
| ct.EOS2     | Eosinophil counts                              | 22                |
| HR          | Heart rate (beats/min)                         | 13                |
| HRV         | Heart rate variability                         | 13                |
| PQ          | P to Q wave time                               | 13                |
| PR          | P to R wave time                               | 13                |
| QRS         | Q, R S wave time                               | 13                |
| QTC         | Q to T wave time, corrected                    | 13                |
| RR          | RR wave  | 13                |
| ST          | S to T wave time                               | 13                |

| Column Name          | Description   | Timepoint (weeks) |
|----------------------|---|-------------------|
| QTc.dispersion       | Q to T, corrected dispersion                        | 13                |
| pNN50...6ms.         | Mean number of time that teh NN signal exceeds 6 ms | 13                |
| rMSSD                | root mean squared standard deviation                | 13                |
| CHOL1                | Total serum cholesterol                             | 8                 |
| TG1                  | Serum triglycerides                                 | 8                 |
| HDL1                 | Serum high density lipoprotein                      | 8                 |
| NEFA1                | Serum non-esterified fatty acids                    | 8                 |
| Lipase1              | Serum lipase  | 8                 |
| Glucose1             | Serum glucose                                       | 8                 |
| Phosphorus1          | Serum phosphorus                                    | 8                 |
| Calcium1             | Serum calcium                                       | 8                 |
| GLDH1                | Serum glutamate dehydrogenase                       | 8                 |
| BUN1                 | Blood urea nitrogen                                 | 8                 |
| FRUC1                | Serum fructose                                      | 8                 |
| CHOL2                | Total serum cholesterol                             | 19                |
| TG2                  | Serum triglycerides                                 | 19                |
| HDL2                 | Serum high density lipoprotein                      | 19                |
| NEFA2                | Serum non-esterified fatty acids                    | 19                |
| Lipase2              | Serum lipase  | 19                |
| Glucose2             | Serum glucose                                       | 19                |
| Phosphorus2          | Serum phosphorus                                    | 19                |
| Calcium2             | Serum calcium                                       | 19                |
| GLDH2                | Serum glutamate dehydrogenase                       | 19                |
| BUN2                 | Blood urea nitrogen                                 | 19                |
| FRUC2                | Serum fructose                                      | 19                |
| non.fast.Phosphorous | Non-fasted serum phosphorus                         |                   |
| non.fast.Calcium     | Non-fasted serum calcium                            |                   |
| non.fast.ALB2        | Non-fasted serum albumin                            |                   |
| non.fast.CREX        | Non-fasted serum creatinine                         |                   |
| Subject.Length1      | Length (cm)   | 12                |
| Weight1              | Weight (g)  | 12                |
| BMD1                 | Bone Mineral Density                                | 12                |
| BMC1                 | Bone Minearal Content                               | 12                |
| B.Area1              | Bone Area   | 12                |
| T.Area1              | Total Area  | 12                |
| X..Fat1              | Percent fat   | 12                |
| TTM1                 | Total tissue mass (g)                               | 12                |
| LTM1                 | Lean tissue mass (g)                                | 12                |
| Subject.Length2      | Length (cm)   | 21                |
| Weight2              | Weight (g)  | 21                |
| BMD2                 | Bone Mineral Density                                | 21                |
| BMC2                 | Bone Minearal Content                               | 21                |
| B.Area2              | Bone Area   | 21                |
| T.Area2              | Total Area  | 21                |
| X..Fat2              | Percent fat   | 21                |
| TTM2                 | Total tissue mass (g)                               | 21                |
| LTM2                 | Lean tissue mass (g)                                | 21                |
| urine.microalbumin1  | Urine microalbumin                                  |                   |
| urine.Glucose1       | Urine glucose                                       |                   |
| urine.creatinine1    | Urine creatinine                                    |                   |
| urine.microalbumin2  | Urine microalbumin                                  |                   |
| urine.Glucose2       | Urine glucose                                       |                   |
| urine.creatinine2    | Urine creatinine                                    |                   |

| Column Name | Description             | Timepoint (weeks) |
|-------------|-------------------------|-------------------|
| heart.wt    | Heart weight (g)        | 24 - 30           |
| spleen.wt   | Spleen weight (g)       | 24 - 30           |
| kidney.wt.L | Left kidney weight (g)  | 24 - 30           |
| kidney.wt.R | Right kidney weight (g) | 24 - 30           |
| BW.3        | Body weight (g)         | 3                 |
| BW.4        | Body weight (g)         | 4                 |
| BW.5        | Body weight (g)         | 5                 |
| BW.6        | Body weight (g)         | 6                 |
| BW.7        | Body weight (g)         | 7                 |
| BW.8        | Body weight (g)         | 8                 |
| BW.9        | Body weight (g)         | 9                 |
| BW.10       | Body weight (g)         | 10                |
| BW.11       | Body weight (g)         | 11                |
| BW.12       | Body weight (g)         | 12                |
| BW.13       | Body weight (g)         | 13                |
| BW.14       | Body weight (g)         | 14                |
| BW.15       | Body weight (g)         | 15                |
| BW.16       | Body weight (g)         | 16                |
| BW.17       | Body weight (g)         | 17                |
| BW.18       | Body weight (g)         | 18                |
| BW.19       | Body weight (g)         | 19                |
| BW.20       | Body weight (g)         | 20                |
| BW.21       | Body weight (g)         | 21                |
| BW.22       | Body weight (g)         | 22                |
| BW.23       | Body weight (g)         | 23                |
| BW.24       | Body weight (g)         | 24                |
| BW.25       | Body weight (g)         | 25                |
| BW.26       | Body weight (g)         | 26                |
| BW.27       | Body weight (g)         | 27                |
| BW.28       | Body weight (g)         | 28                |
| BW.29       | Body weight (g)         | 29                |
| BW.30       | Body weight (g)         | 30                |
| INSULIN     | Body weight (g)         | 17                |
| LEPTIN      | Body weight (g)         | 17                |

## References

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