



UNIVERSITÉ DU  
LUXEMBOURG



LUXEMBOURG  
INSTITUTE  
OF **HEALTH**  
RESEARCH DEDICATED TO LIFE

PhD Course  
**Advanced Biostatistics**

Lecture 1  
**Introduction to R**

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## Outline

- ◆ **Information package**
- ◆ **Installation**
- ◆ **R interface (L1.1)**
  - ◆ typing commands, calling functions, embedded help and demo
- ◆ **Variables and basic operations (L1.2)**
  - ◆ variables, types of data, scalar data, vectors, matrixes, data frames, lists.
- ◆ **Data import and export (L1.3)**
  - ◆ work folders, use scan, read/write tables, load/save data
- ◆ **Control workflow and custom functions (L1.4)**
  - ◆ if, while, repeat, next, break, custom functions, use external scripts
- ◆ **Data visualization (L1.5)**
  - ◆ variables, types of data, scalar data, vectors, matrixes, data frames, lists

**Main Web-page:**  
[cran.r-project.org](http://cran.r-project.org)

[cran.r-project.org/manuals.html](http://cran.r-project.org/manuals.html)  
[cran.r-project.org/web/packages/](http://cran.r-project.org/web/packages/)  
[cran.r-project.org/other-docs.html](http://cran.r-project.org/other-docs.html)

**R/Bioconductor**  
[www.bioconductor.org](http://www.bioconductor.org)

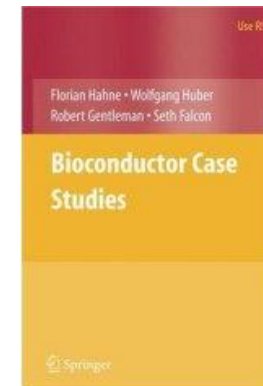
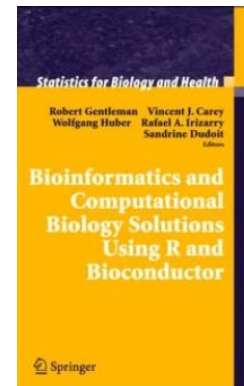
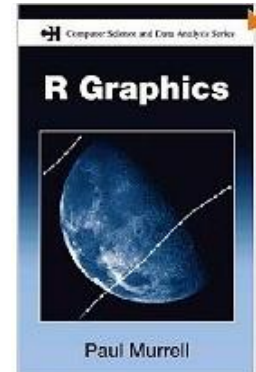
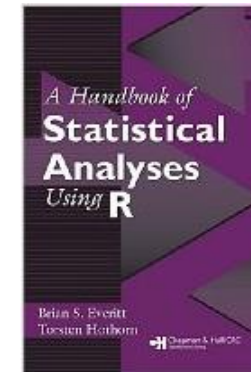
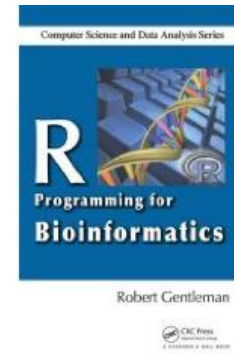
**R-Project Seek Engine:**  
[www.rseek.org](http://www.rseek.org)

**Advanced Biostatistics**  
[edu.sablab.net/abs2016](http://edu.sablab.net/abs2016)

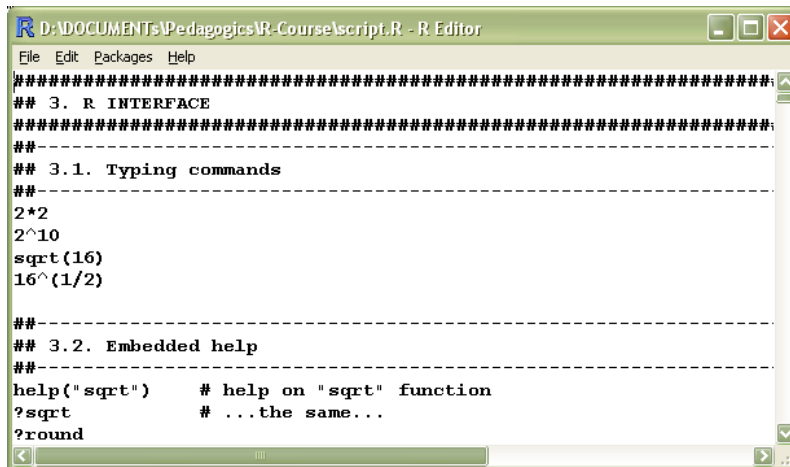
**Scripts**  
[edu.sablab.net/abs2016/scripts](http://edu.sablab.net/abs2016/scripts)

**Data**  
[edu.sablab.net/data/txt](http://edu.sablab.net/data/txt)

**Other related courses**  
[edu.sablab.net](http://edu.sablab.net)



## Built-in Script Editor



```
D:\DOCUMENTS\Pedagogics\R-Course\script.R - R Editor
File Edit Packages Help
#####
## 3. R INTERFACE
#####
##-----
## 3.1. Typing commands
##-----
2*2
2^10
sqrt(16)
16^(1/2)
##-----
## 3.2. Embedded help
##-----
help("sqrt") # help on "sqrt" function
?sqrt       # ...the same...
?round
```

## Console



```
R Console
File Edit Misc Packages Help

R version 2.9.2 (2009-08-24)
Copyright (C) 2009 The R Foundation for Statistical Computing
ISBN 3-900051-07-0

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

Natural language support but running in an English locale

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

Loading required package: tcltk
Loading Tcl/Tk interface ... done
Loading required package: Hmisc

Attaching package: 'Hmisc'

The following object(s) are masked from package:base :

format.pval,
round.POSIXt,
trunc.POSIXt,
units

Loading required package: R2HTML
Loading required package: svMisc
> |
```

## Alternative Editors

**RStudio** (Win, Linux, MacOS)  
<http://rstudio.com/>

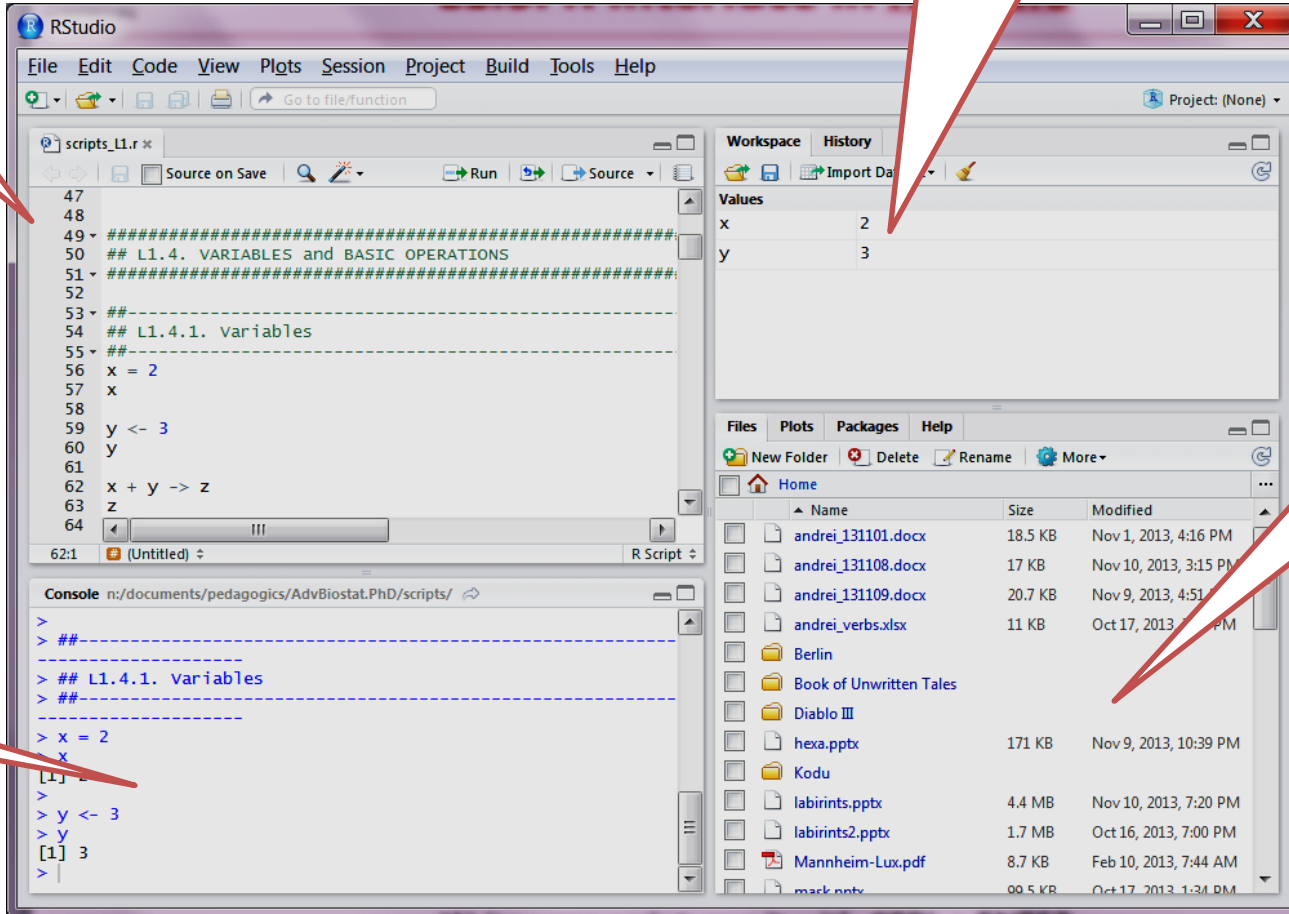
**Notepad++ & NpptoR** (Win)  
<http://notepad-plus-plus.org/>  
<http://sourceforge.net/projects/npptor>

**JGR** (Win, Linux, MacOS)  
[rforge.net/JGR/](http://sourceforge.net/JGR/)

RStudio (Win, Linux, MacOS)  
<http://rstudio.com/>

Variables and History

Scripts



Files, Plots, Packages, Help

Console

Write your script, run it with CTRL + ENTER

# L1.1. Basic Operations

---

Please go through the code at:

<http://edu.sablab.net/abs2017/scripts1.html>

Section 1.1

## Atomic Data Types

**Numeric**

- Integer
- Double

```
1
3.141593
```

**Logical**

```
TRUE
FALSE
```

**Character**

```
"Hello, world!"
```

**Factor**

has a sense to use only in vectors or data frames

```
> answer=factor(c("yes", "no"))
> answer
[1] yes no
Levels: no yes
```

## Data Containers

faster than data frame and list other

**Vector**

```
> x
[1] 1 2 3 4 5
```

**Matrix**

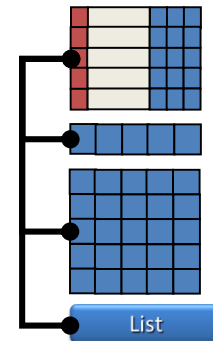
**Array**

```
> A
      [,1] [,2] [,3]
[1,]    1    3    5
[2,]    2    4    1
```

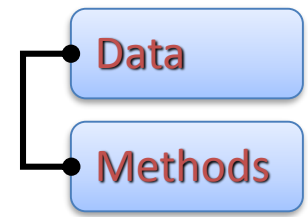
**Data frame**

	name	marks
1	Alex	10
2	Jean	8
3	David	7

**List**



**Object of a Class**



# L1.2. Variables and Operators

---

Please go through the code at:

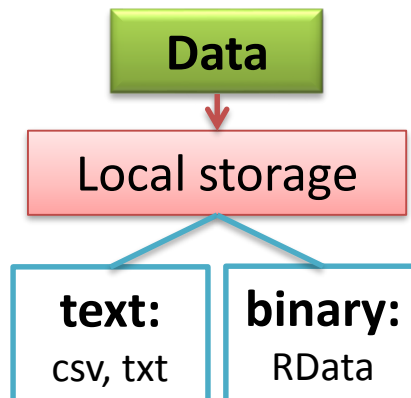
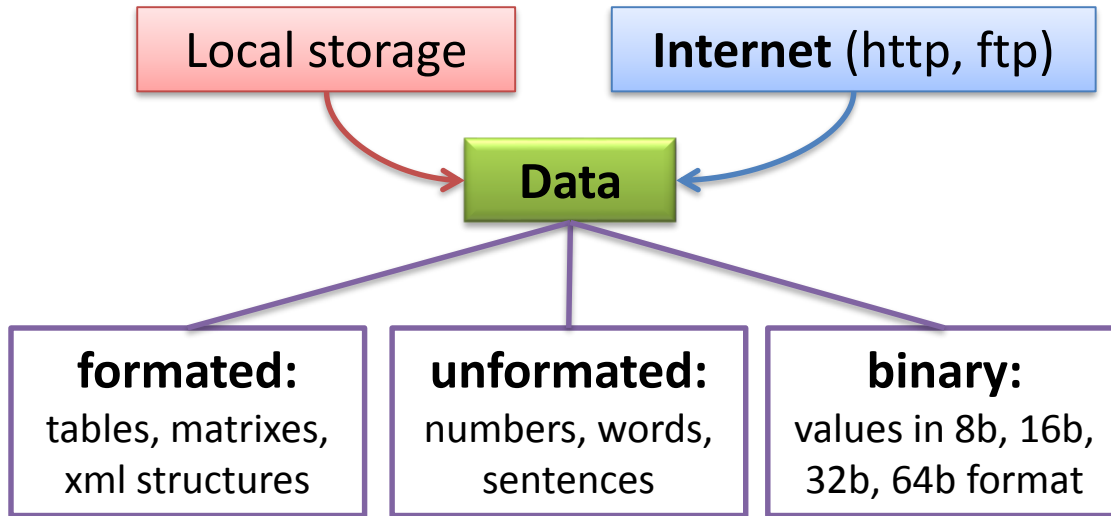
<http://edu.sablab.net/abs2017/scripts1.html>

Section 1.2

Do Exercises 1.2



## Way of Data Import and Export



**currency.txt**

	Date	EUR
1	1999-01-04	1.1789
2	1999-01-05	1.179
3	1999-01-06	1.1743
4	1999-01-07	1.1632
5	1999-01-08	1.1659
6	1999-01-11	1.1569
7	1999-01-12	1.152
8	1999-01-13	1.1744
9	1999-01-14	1.1653
10	1999-01-15	1.1626
11	1999-01-18	1.1612
12	1999-01-19	1.1616
13	1999-01-20	1.1575
14	1999-01-21	1.1572
15	1999-01-22	1.1567
16	1999-01-25	1.1584
17	1999-01-26	1.1582
18	1999-01-27	1.1529
19	1999-01-28	1.141
20	1999-01-29	1.1384

# L1.3. Data Import and Export

Please go through the code at:

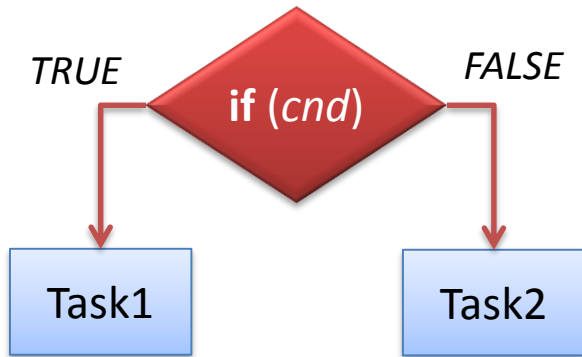
<http://edu.sablab.net/abs2017/scripts1.html>

Section 1.3

Do Exercises 1.3

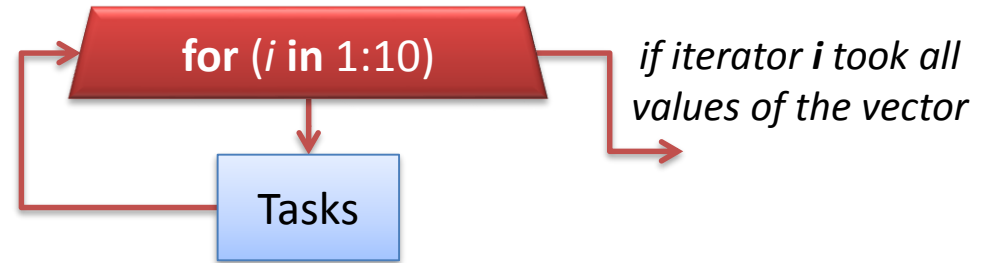
# L1.4. Control Workflow

## Main Workflow Control Methods

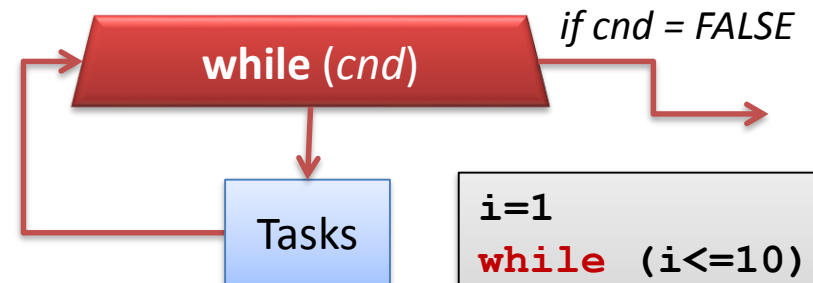


```
if (r > 1) {
  fc = r      ## task 1
} else {
  fc = -r     ## task 2
}
```

**Functional version:**  
`fc = ifelse(r>1, r, -r)`



```
for (i in 1:10) {
  print(2^i)
}
```



```
i=1
while (i<=10) {
  print(2^i)
  i=i+1
}
```

Command **next** finishes current iteration and starts a new one.

Command **break** allows going out from a loop immediately.

## L1.4. Control Workflow

Please go through the code at:

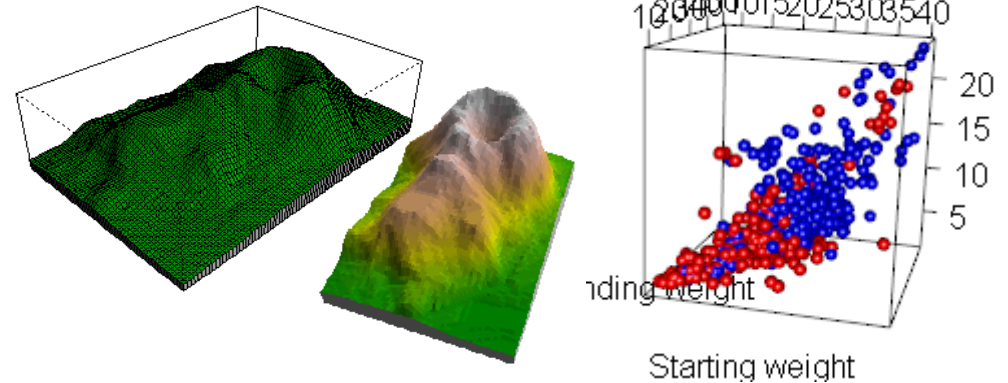
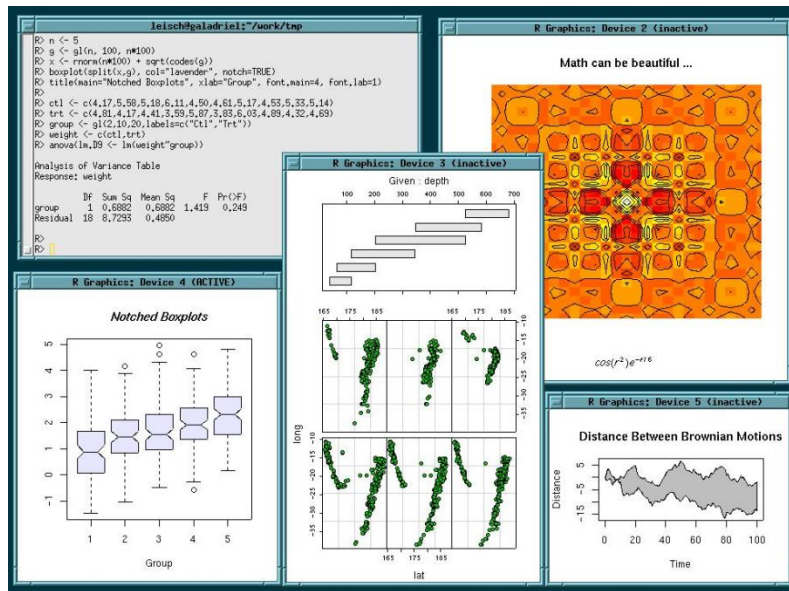
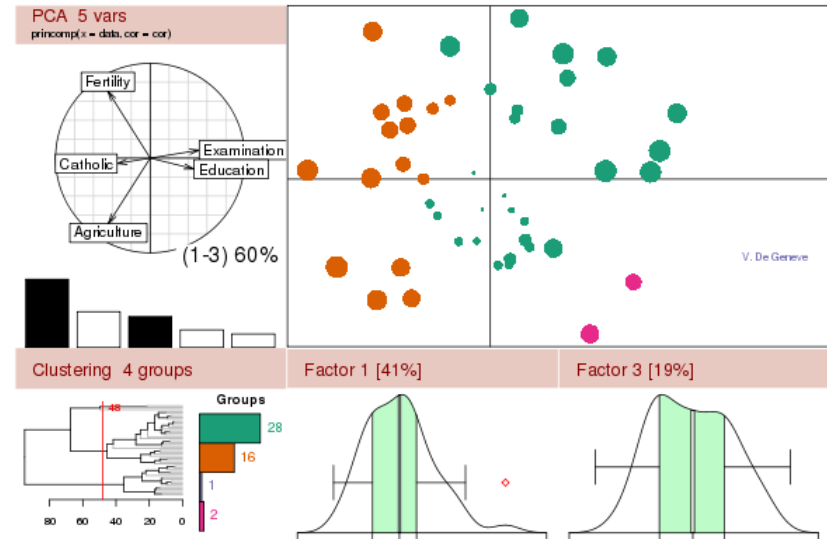
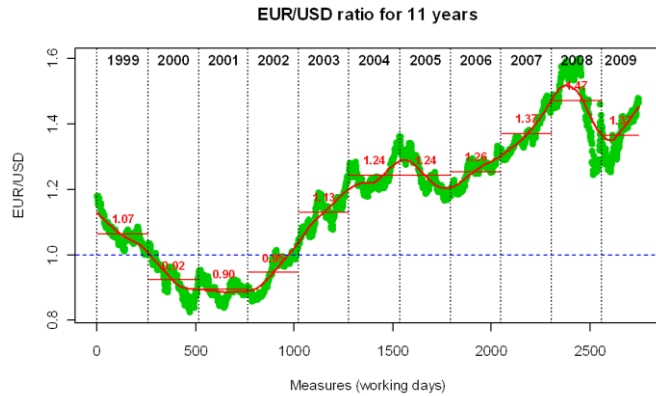
<http://edu.sablab.net/abs2017/scripts1.html>

Section 1.4

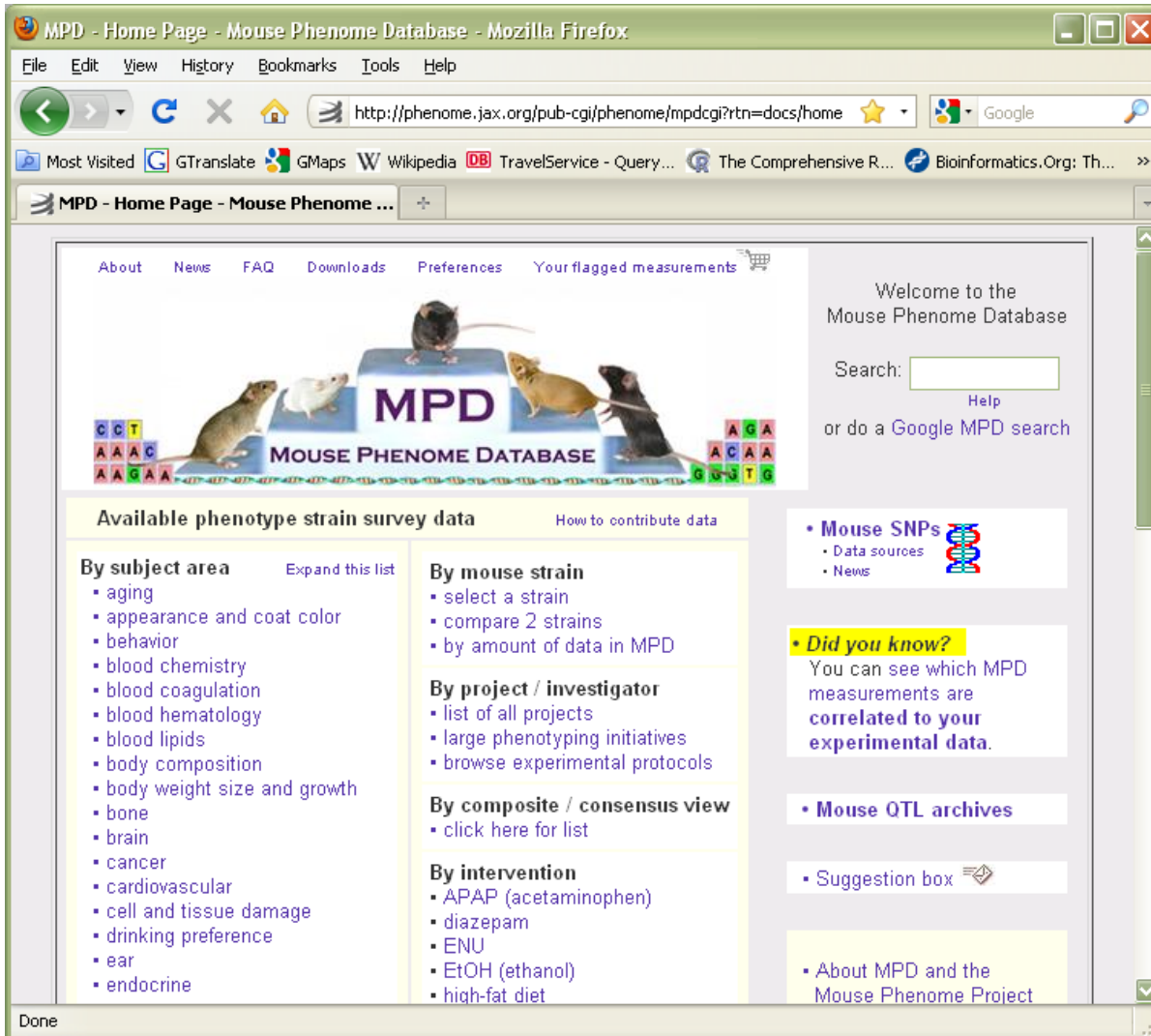
Do Exercises 1.4

*this section is optional*

## Various Figures Generated in R



## Mouse Phenome Data



**mice.txt**

Tordoff MG, Bachmanov AA  
Survey of calcium & sodium intake and  
metabolism with bone and body  
composition data  
Project symbol: **Tordoff3**  
Accession number: MPD:103

790 mice from  
40 different strains

<http://phenome.jax.org>

### parameter

Starting age  
Ending age  
Starting weight  
Ending weight  
Weight change  
Bleeding time  
Ionized Ca in blood  
Blood pH  
Bone mineral density  
Lean tissues weight  
Fat weight

# L1.5. Data Visualization

Please go through the code at:

<http://edu.sablab.net/abs2017/scripts1.html>

Section 1.5

Do Exercises 1.5

*this section is optional*

# Thank you for your attention



to be continued...



# [edu.sablab.net/abs2017](http://edu.sablab.net/abs2017)

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