Webscraping with RSelenium

Automate your browser actions

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Introduction

Scraping can be divided in two steps:

1. getting the HTML that contains the information
2. cleaning the HTML to extract the information we want

These 2 steps don't require the same tools, and *shouldn't be made at the same time*.

Here, we will focus on step 1: *how to get the HTML we need with dynamic webpages?*

Static vs dynamic

Static webpage: all the information is loaded with the page.

Example: Wikipedia.

Dynamic webpage: the website uses JavaScript to fetch data from their servers and *dynamically* update the page.

Example: see later.

(R)Selenium

Idea

Idea: control the browser from the command line.

I wish I could click on this button to open a modal

```
remote_driver$
  findElement(using = "css", value = ".my-button")$
  clickElement()
```

I wish I could fill these inputs to automatically connect

```
remote_driver$
  findElement(using = "id", value = "password")$
  sendKeysToElement(list("my_super_secret_password"))
```

Almost everything you can do "by hand" in a browser, you can reproduce with Selenium:

- open a browser
- click on something
- enter values
- go to previous/next page
- refresh the page
- get all the HTML that is currently displayed

- `open()` / `navigate()`
- `clickElement()`
- `sendKeysToElement()`
- `goBack()` / `goForward()`
- `refresh()`
- **`getPageSource()`**

...

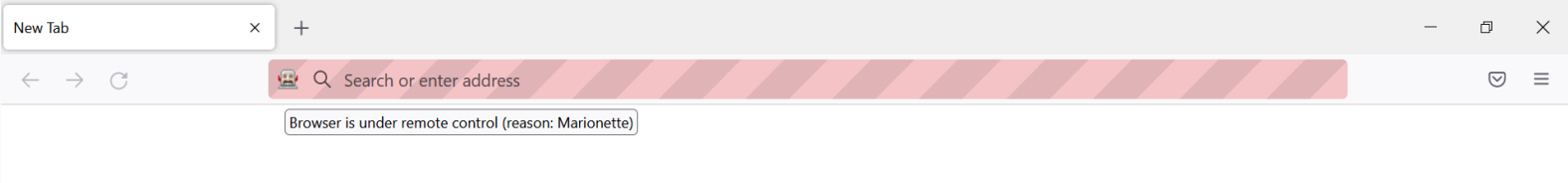
Get started

In the beginning there was ~~light~~ `rsDriver()`:

```
# if not already installed
# install.packages("RSelenium")
library(RSelenium)

driver <- rsDriver(browser = "firefox") # can also be chrome
remote_driver <- driver[["client"]]
```

This will print a bunch of messages and open a "marionette browser".



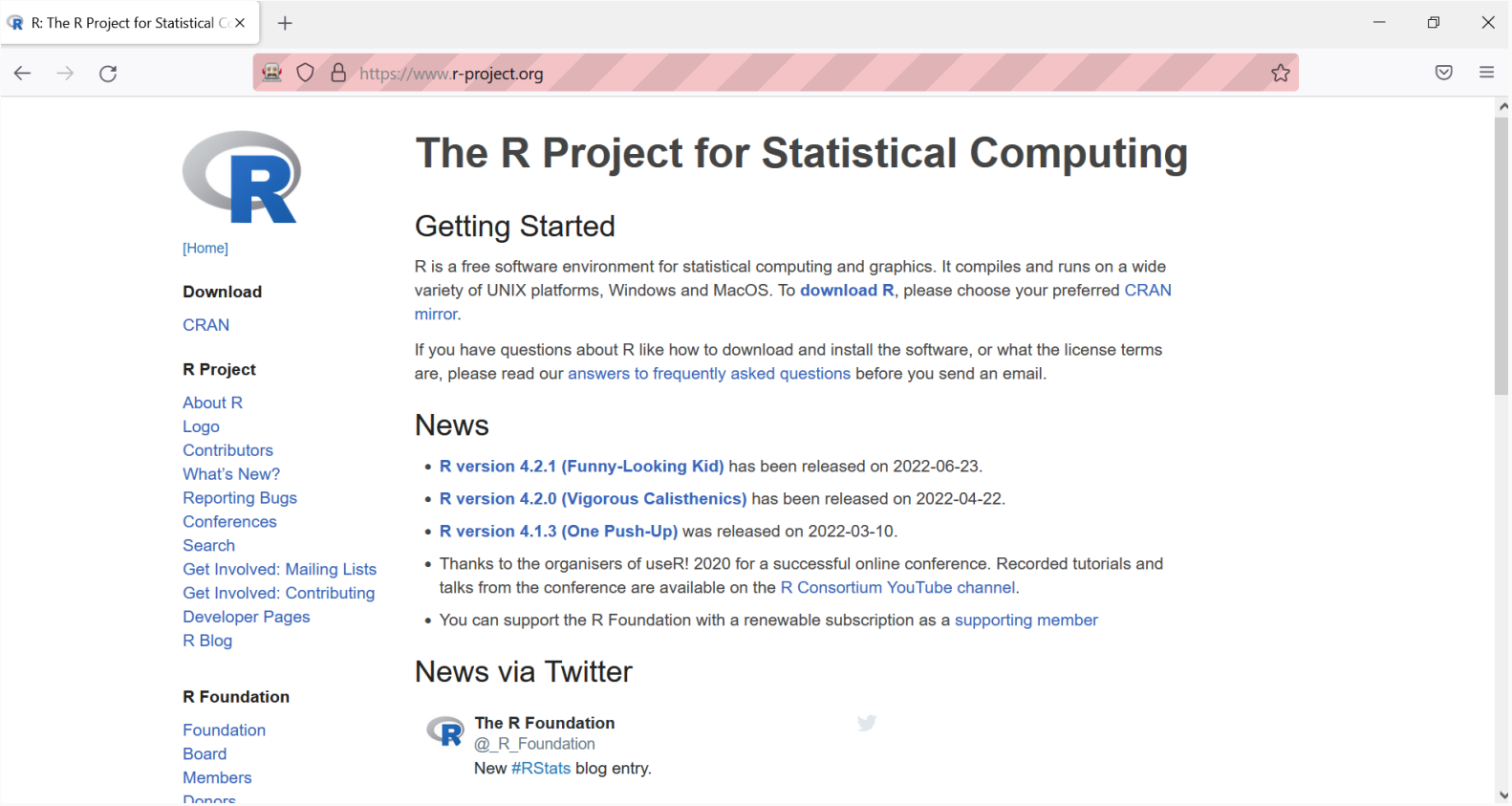
From now on, everything we do is calling `<function>()` starting with `remote_driver$`[1].

Objective: get the list of core contributors to R located here.

[1]: Or whatever you called it in the previous step

Navigate

```
remote_driver$navigate("https://r-project.org")
```



Click on "Contributors"

This requires two things:

1. find the element
2. click on it

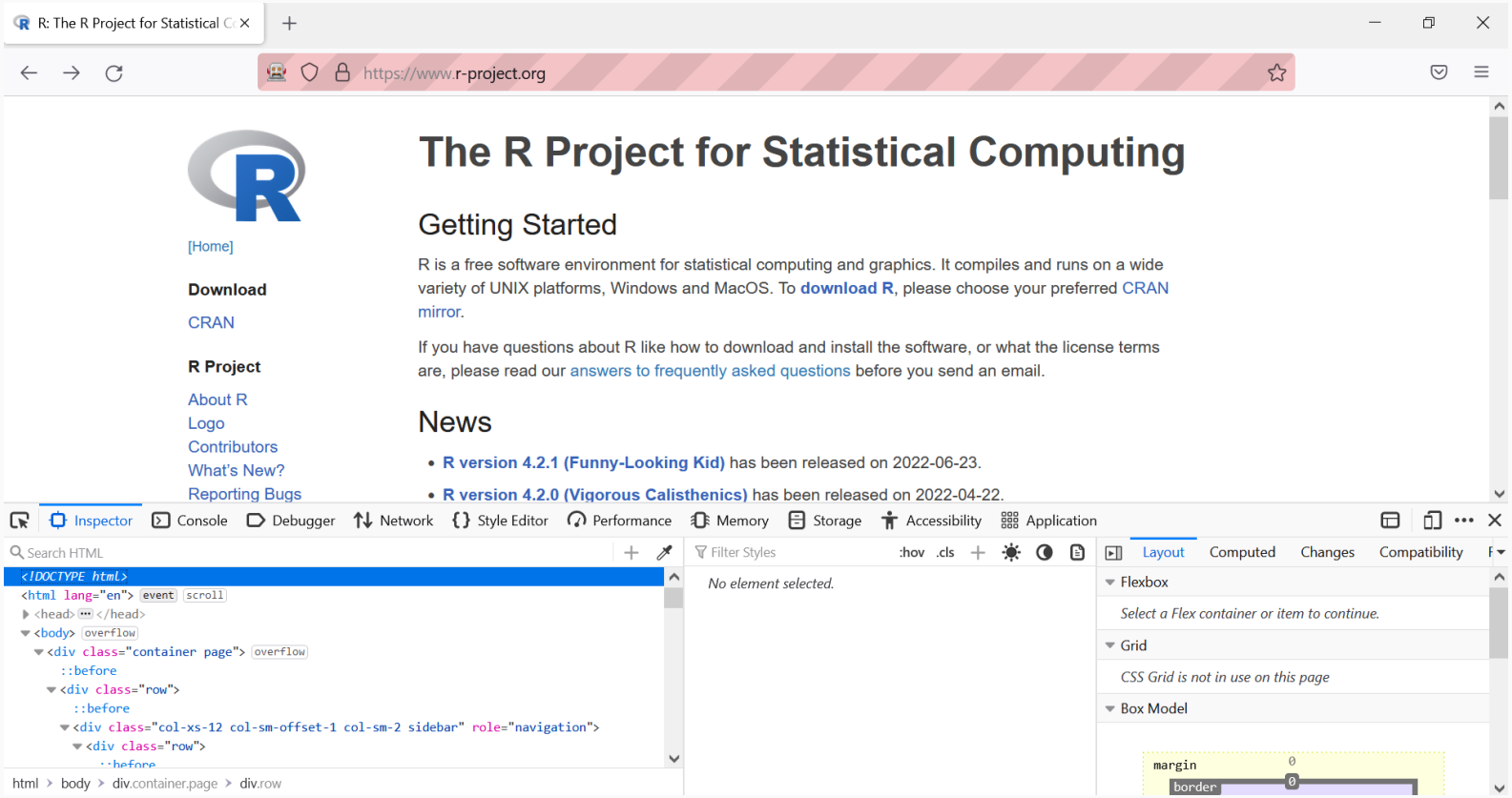
Humans -> eyes

Computers -> HTML/CSS

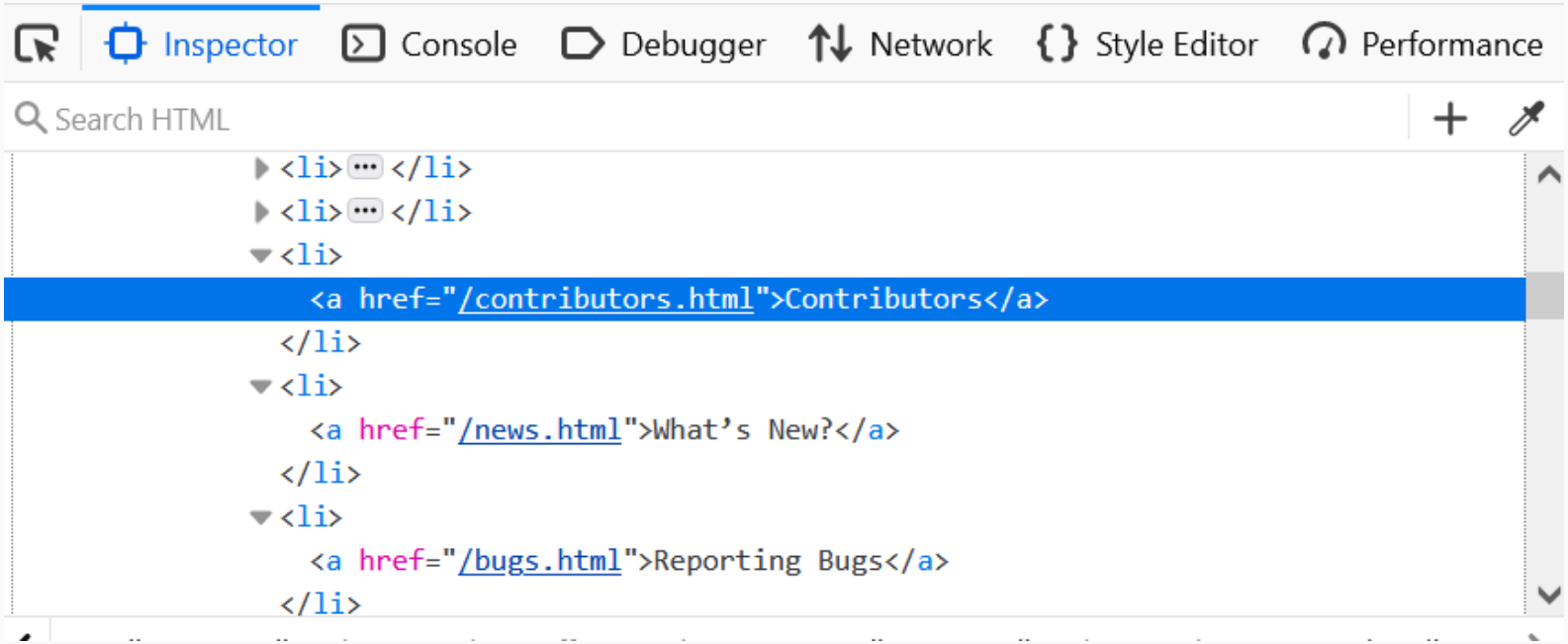
To find the element, we need to open the console to see the structure of the page.

Several ways to do it:

- right-click -> "Inspect"
- `Ctrl` + `Shift` + `C`



Then, hover the element we're interested in: the link "Contributors".



How can we find this with `RSelenium`?

```
?RSelenium::remoteDriver
```

-> `findElement`

- class name ❌
- id ❌
- name ❌
- tag name ❌

- css selector ✔
- link text ✔
- partial link text ✔
- xpath ✔

All of these work:

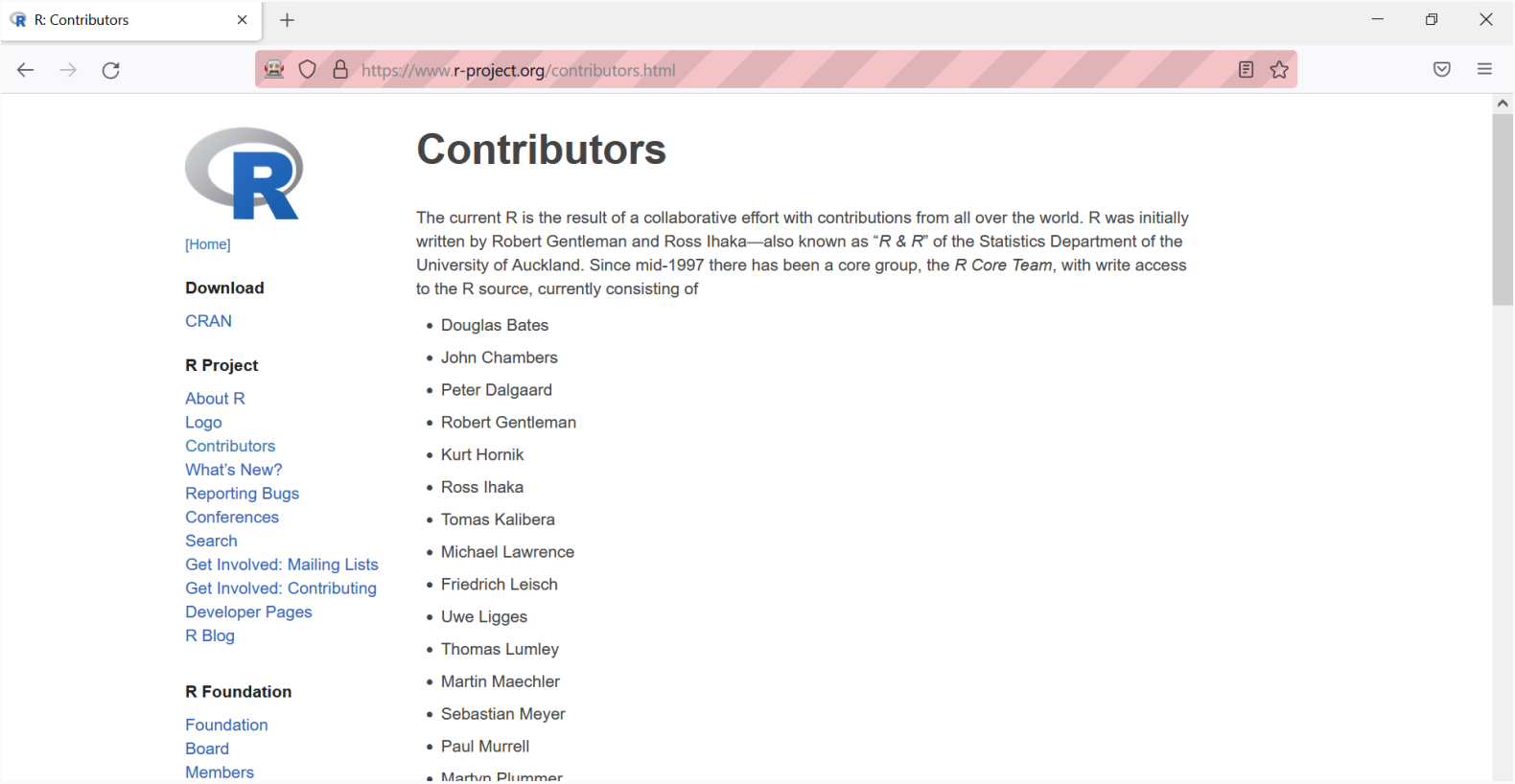
```
remote_driver$
  findElement("link text", "Contributors")$
  clickElement()

remote_driver$
  findElement("partial link text", "Contributors")$
  clickElement()

remote_driver$
  findElement("xpath", "/html/body/div/div[1]/div[1]/div/div[1]/ul/li[3]
  clickElement()

remote_driver$
  findElement("css selector", "div.col-xs-6:nth-child(1) > ul:nth-child(
  clickElement()
```

We are now on the right page!



Last step: obtain the HTML of the page.

```
remote_driver$getPageSource()
```

To read it with `rvest`:

```
x <- remote_driver$getPageSource()[[1]]
rvest::read_html(x)
```

Do we read the HTML and extract the information in the same script?

No!

Rather, we save the HTML in an external file, and we will be able to access it in another script (and offline) to manipulate it as we want[1].

```
write(x, file = "contributors.html")
# Later and in another script
rvest::read_html("contributors.html")
```

Click here to see the results.

[1]: Although, in this case, it wouldn't cost too much to treat it directly in the same script.

A harder & real-life example

The previous example was not a *dynamic* page: we could have used the link to the page and apply webscraping methods for static webpages.

Let's now dive into a more complex example, where RSelenium is the only way to scrape.

How to know when Selenium is needed?

Using RSelenium is slower than using "classic" scraping methods, so it's important to check all possibilities before using it.

Use Selenium if:

- the HTML you want is not directly accessible, i.e need some interactions (clicking on a button, connect to a website...)
- the URL doesn't change with the inputs
- you can't access the data directly in the "network" tab of the console

Example: Sao Paulo immigration museum

ASK MARTIN FIRST

Appendix

For reference, here's the code to extract the list of contributors:

```r
library(rvest)

html <- read_html("contributors.html")

bullet_points <- html %>%
  html_elements(css = "div.col-xs-12 > ul > li") %>%
  html_text()

blockquote <- html %>%
  html_elements(css = "div.col-xs-12.col-sm-7 > blockquote") %>%
  html_text() %>%
  strsplit(., split = ", ")

blockquote <- blockquote[[1]] %>%
  gsub("\\r|\\n|\\.|and", "", .)

others <- html %>%
  html_elements(xpath = "/html/body/div/div[1]/div[2]/p[5]") %>%
  html_text() %>%
  strsplit(., split = ", ")

others <- others[[1]] %>%
  gsub("\\r|\\n|\\.|and", "", .)

all_contributors <- c(bullet_points, blockquote, others)
```

Appendix

```
##   [1] "Douglas Bates"          "John Chambers"          "Peter Dalgaard"
##   [4] "Robert Gentleman"       "Kurt Hornik"            "Ross Ihaka"
##   [7] "Tomas Kalibera"         "Michael Lawrence"       "Friedrich Leisch"
##  [10] "Uwe Ligges"             "Thomas Lumley"          "Martin Maechler"
##  [13] "Sebastian Meyer"        "Paul Murrell"           "Martyn Plummer"
##  [16] "Brian Ripley"           "Deepayan Sarkar"        "Duncan Temple Lang"
##  [19] "Luke Tierney"           "Simon Urbanek"          "Valerio Aimale"
##  [22] "Suharto Anggono"        "Thomas Baier"           "Gabe Becker"
##  [25] "Henrik Bengtsson"       "Roger Biv"              "Ben Bolker"
##  [28] "David Brahm"            "Göran Broström"         "Patrick Burns"
##  [31] "Vince Carey"            "Saikat DebRoy"          "Matt Dowle"
##  [34] "Brian D'Urso"           "Lyndon Drake"           "Dirk Eddelbuettel"
##  [37] "Claus Ekstrom"          "Sebastian Fischmeister" "John Fox"
##  [40] "Paul Gilbert"           "Yu Gong"                "Gabor Grothendieck"
##  [43] "Frank E Harrell Jr"     "Peter M Haverty"        "Torsten Hothorn"
##  [46] "Robert King"            "Kjetil Kjernsmo"        "Roger Koenker"
##  [49] "Philippe Lambert"       "Jan de Leeuw"           "Jim Lindsey"
##  [52] "Patrick Lindsey"        "Catherine Loader"       "Gordon Maclean"
##  [55] "Arni Magnusson"         "John Maindonald"        "David Meyer"
##  [58] "Ei-ji Nakama"           "Jens Oehlschägel"       "Steve Oncley"
##  [61] "Richard O'Keefe"        "Hubert Palme"           "Roger D Peng"
##  [64] "José C Pinheiro"        "Tony Plate"             "Anthony Rossini"
##  [67] "Jonathan Rougier"       "Petr Savicky"           "Günther Sawitzki"
##  [70] "Marc Schwartz"          "Arun Srinivasan"        "Detlef Steuer"
##  [73] "Bill Simpson"           "Gordon Smyth"           "Adrian Trapletti"
##  [76] "Terry Therneau"         "Rolf Turner"            "Bill Venables"
##  [79] "Gregory R Warnes"       "Andreas Weingessel"     "Morten Welinder"
##  [82] "James Wettenhall"       "Simon Wood"             " Achim Zeileis"
##  [85] "J D Beasley"            "David J Best"           "Richard Brent"
##  [88] "Kevin Buhr"             "Michael A Covington"    "Bill Clevel"
##  [91] "Robert Clevel,"         "G W Cran"               "C G Ding"
##  [94] "Ulrich Drepper"         "Paul Eggert"            "J O Evans"
##  [97] "David M Gay"            "H Frick"                "G W Hill"
## [100] "Richard H Jones"        "Eric Grosse"            "Shelby Haberman"
## [103] "Bruno Haible"           "John Hartigan"          "Andrew Harvey"
## [106] "Trevor Hastie"          "Min Long Lam"           "George Marsaglia"
## [109] "K J Martin"             "Gordon Matzigkeit"      "C R Mckenzie"
## [112] "Jean McRae"             "Cyrus Mehta"            "Fionn Murtagh"
## [115] "John C Nash"            "Finbarr O'Sullivan"     "R E Odeh"
## [118] "William Patefield"      "Nitin Patel"            "Alan Richardson"
## [121] "D E Roberts"            "Patrick Royston"        "Russell Lenth"
## [124] "Ming-Jen Shyu"          "Richard C Singleton"    "S G Springer"
## [127] "Supoj Sutanthavibul"    "Irma Terpenning"        "G E Thomas"
## [130] "Rob Tibshirani"         "Wai Wan Tsang"          "Berwin Turlach"
## [133] "Gary V Vaughan"         "Michael Wichura"        "Jingbo Wang"
## [136] "M A Wong"
```

Back