

# The Biostatistical Scientist in a High-Profile Professional and Societal Environment

*Geert Molenberghs*

*I-BioStat, UHasselt & K.U.Leuven, Flanders*

*Barcelona, Catalunya, 18 October 2013*





Op 2 mei vieren we de Plechtige Communie van Jasper Molenberghs!

We zouden het fijn vinden mocht je erbij zijn!

De eucharistieviering heeft plaats

in de Sint-Lambertuskerk van Heverlee om 10 u 30.

Aansluitend, omstreeks 13 u, verzamelen we

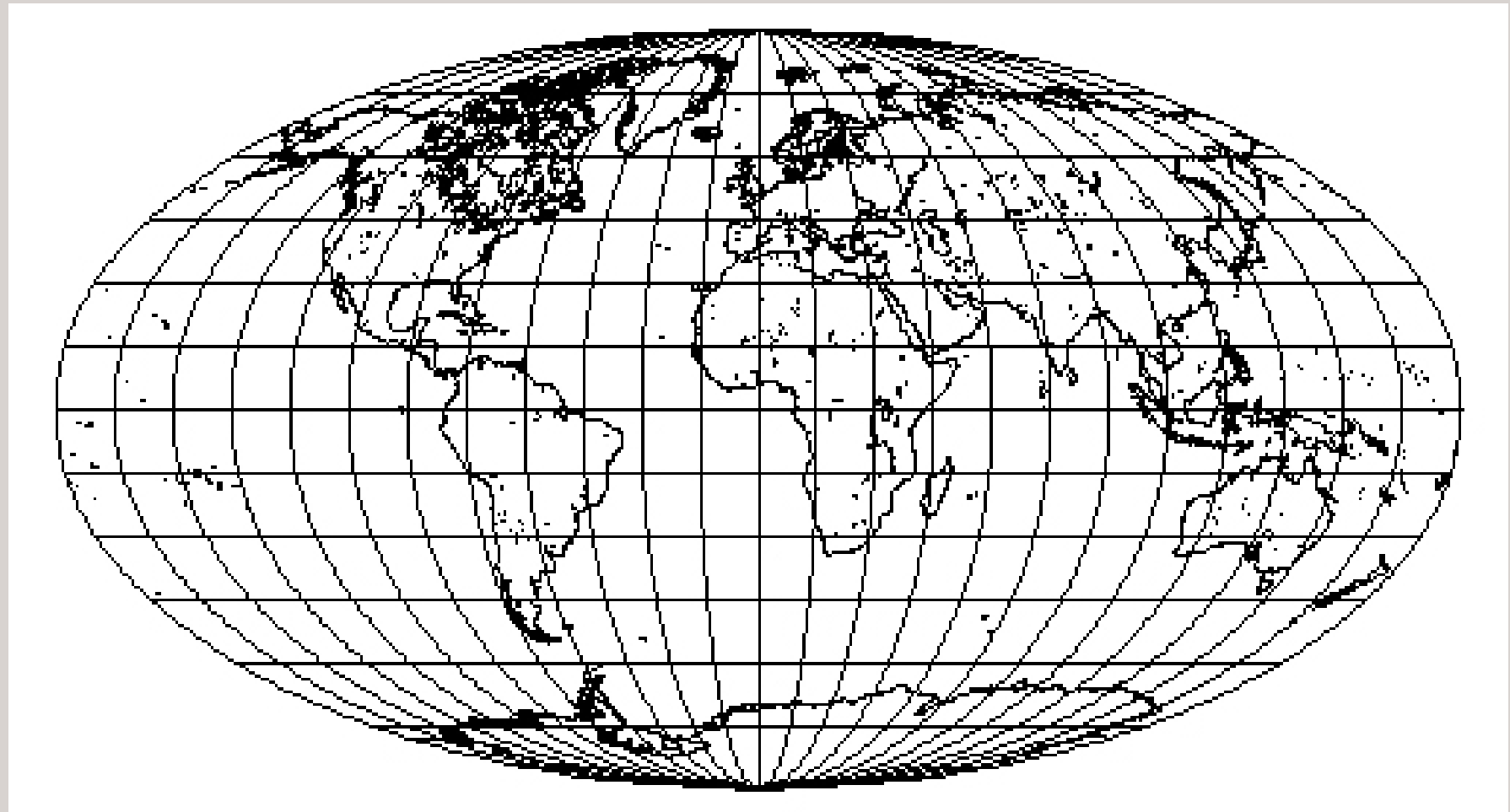
in de Salens Georges, Hogeschoolplein 15 te Leuven.

Geef je ons een seintje?

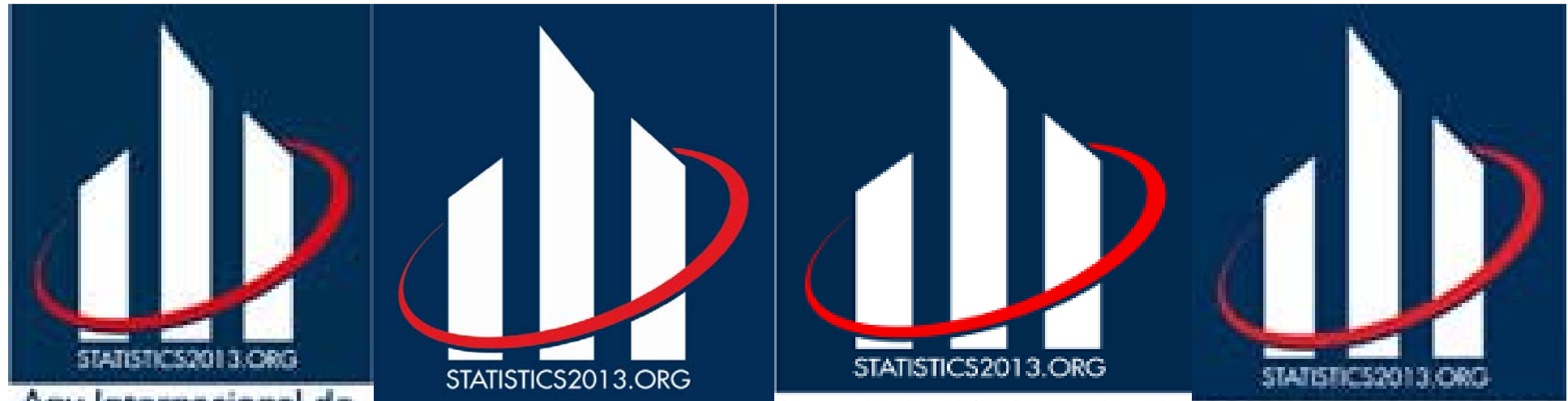
- Telefoon thuis: 016/355.605
- Jasper: 0488/60.86.34
- Geert: [Geert.molenberghs@uhasselt.be](mailto:Geert.molenberghs@uhasselt.be); 0476/35.45.12
- Conny: [Conny@ster.kuleuven.be](mailto:Conny@ster.kuleuven.be); 0478/28.96.30
- An: [annekem15@hotmail.com](mailto:annekem15@hotmail.com); 0497/60.78.38



# Statistics: A Global Profession



# International Year of Statistics 2013



Any Internacional de l'ESTADÍSTICA

INTERNATIONAAL JAAR VAN DE STATISTIEK

INTERNATIONAL YEAR OF **STATISTICS**

AÑO INTERNACIONAL DE LA ESTADÍSTICA

Organisme participant

DEELNEMENDE ORGANISATIE PARTICIPATING ORGANIZATION ORGANIZACIÓN PARTICIPANTE



# Who Needs Statistics?

- Government – Industry – Academia
- All around the world
- In various professional fields:
  - Agriculture, biology, medicine, public health
  - Social sciences, psychology
  - Economy
  - Engineering

# Is Statistics a Branch of Mathematics?

- Statistics is solidly rooted in mathematics
- So is physics!
- But it is a *science of its own*
- It lives from problems occurring in a variety of fields
- It does not provide “service”, but *partnership*

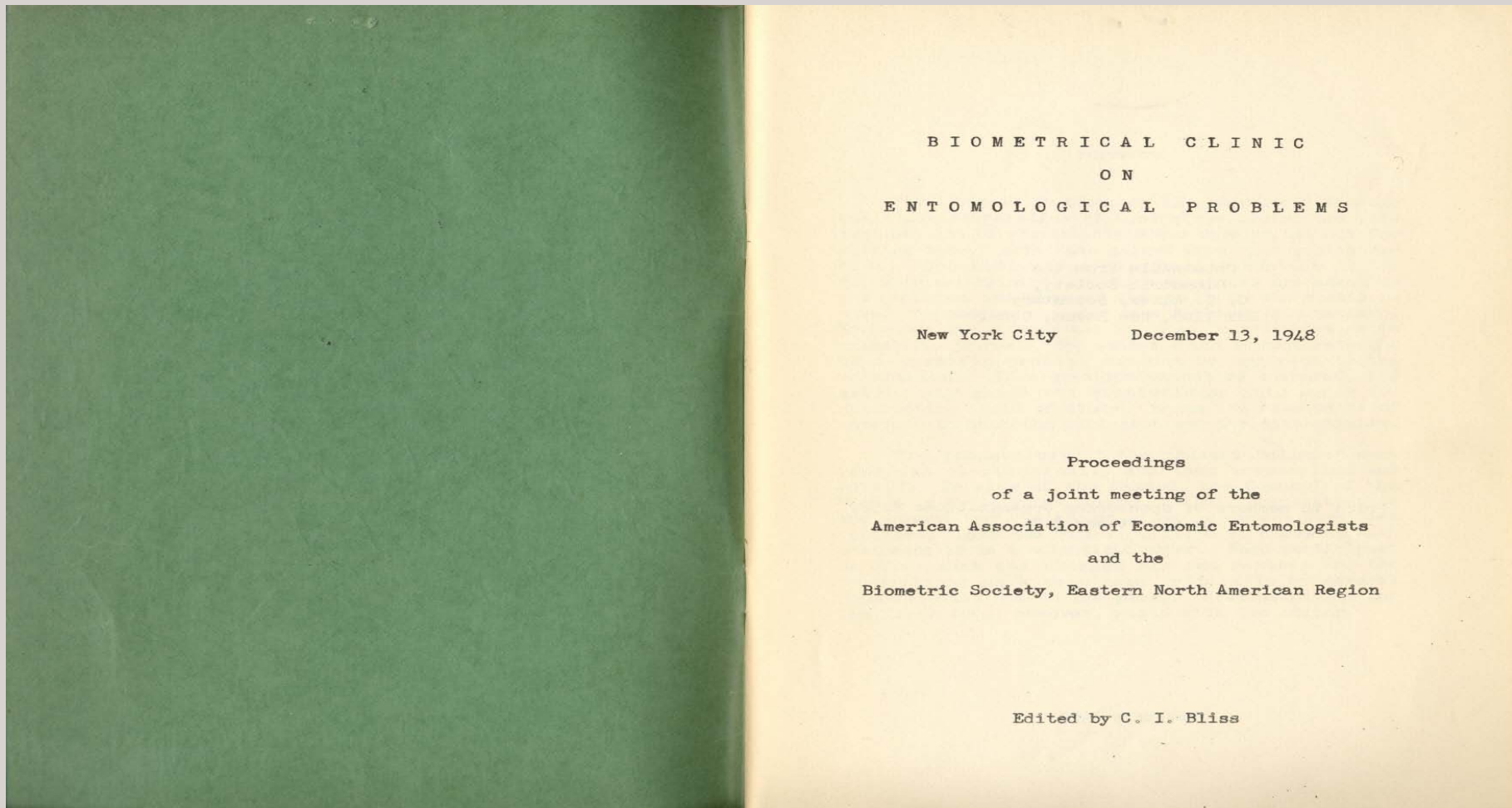
# Interdisciplinary Science

- Where is statistics positioned in the linear ranking of the mathematician?
- Is statistics an easy version of mathematics?
- Is applied statistics an easy version of mathematical statistics?

*History says:*  
*“No”*



# A Forgotten Publication...



# A Forgotten Publication...

- Part of inheritance of ***Lewis R. Grosenbaugh***, graduate of Yale School of Forestry and Environmental Studies
- Spent career with the US Forest Service
- Died in April 2003
- Inherited by Timothy G. Gregoire (ENAR)
- Lewis's copy at Yale

Foreword

The advances in biometry have developed through the close cooperation of biologists confronted with problems and of statisticians who develop methods for solving them. Both have gained from this collaboration. One medium for maintaining contact is the "biometrical clinic", in which questions are asked by the biologist and answered informally by the statistician. The meeting recorded here followed this pattern. Even when the answers can be found in textbooks or in scientific journals, the method which is most relevant to a specific problem may not be apparent to the uninitiated. If a question cannot be answered, its asking may guide the statistician into a new and interesting field of study. Hence the session is of interest to both the biologist and the statistician.

The proceedings of the present "clinic" were recorded electronically and then transcribed and edited. In view of the demand, the Council of the Biometric Society has agreed to their publication in the present form. Although a few references have been inserted, there has been no attempt to document each statement as in a scientific paper. Each participant on the panel has checked his own remarks and the proceedings have been read critically by several biometricians not on the panel. Responsibility for the final form, however, rests with the editor.

Obtainable from the  
Biometric Society,  
C. I. Bliss, Secretary  
Box 1106, New Haven, Conn.

Price to members of sponsoring organizations \$.50,  
to all others \$.75.



The advances in biometry have developed through the close cooperation of biologists confronted with problems and of statisticians who develop methods for solving them. Both have gained from this collaboration. One medium for maintaining contact is the "biometrical clinic", in which questions are asked by the biologist and answered informally by the statistician. The meeting recorded here followed this pattern. Even when the answers can be found in textbooks or in scientific journals, the method which is most relevant to a specific problem may not be apparent to the uninitiated. If a question cannot be answered, its asking may guide the statistician into a new and interesting field of study. Hence the session is of interest to both the biologist and the statistician.

Acknowledgements

The Biometric Society is indebted to Professor C. E. Palm and other members of the program committee of the American Association of Economic Entomologists for their cooperation in scheduling this joint meeting, to the SoundScriber Corporation for the loan of microphones and other equipment for recording the proceedings of the meeting, and to the Connecticut Agricultural Experiment Station for its cooperation, especially through two members of its staff, Miss Nancy Woodruff, who operated the SoundScriber during the session, and Mrs. Anna Branchini, who transcribed the original records and prepared the copy.

QUESTIONS

	Page
1. What is the value of replication and randomization if later the data are not analyzed statistically?	7
2. Why should entomologists <u>not</u> use systematic designs?	12
3. How best to set up large airplane plots for statistical interpretation?	17
4. How many replicates are there in a randomized block experiment with six blocks?	21
5. Discussion of short-cut methods of statistical calculation and their relation to experimental design.	22
6. The calculation and limitation of least significant differences from the statistics obtained in the analysis of variance.	33
7. In applying the analysis of variance to the results of experiments on insect control, what is the importance of the observed distribution of insects?	39
8. What units should be used in analyzing data on the number of rat ectoparasites on individual rats?	49
9. What is the value of pretreatment estimates of an insect population in relation to the analysis of covariance and Abbott's formula?	51
10. What is a suitable design and analysis for experiments on off-flavor in potatoes and other vegetables resulting from insecticidal treatment?	57



## QUESTIONS

Page

1. What is the value of replication and randomi- 7  
zation if later the data are not analyzed  
statistically?

Members of the Panel

Frank Wilcoxon, Chairman, American Cyanamid Company,  
Stamford, Connecticut  
C. I. Bliss, Connecticut Agricultural Experiment Sta-  
tion, New Haven, Connecticut  
A. E. Brandt, U. S. Atomic Energy Commission, New York  
Operations Office, New York City  
Walter C. Jacob, Long Island Vegetable Research Farm,  
Riverhead, New York  
John W. Tukey, Princeton University, Princeton, New  
Jersey

Questioners and Participants in the Discussion

J. W. Apple, University of Wisconsin, Madison  
L. A. Carruth, New York Agricultural Experiment Station,  
Geneva  
C. R. Cutright, Ohio Experiment Station, Wooster  
M. M. Darley, General Chemical Co., Long Island City  
M. W. Farrar, University of New Hampshire, Durham  
H. C. Fryer, Kansas Agricultural Experiment Station,  
Manhattan  
Philip Garman, Connecticut Agricultural Experiment  
Station, New Haven  
J. L. Horsfall, American Cyanamid Company, New York  
L. B. Reed, Bureau of Entomology and Plant Quarantine,  
Washington, D. C.  
Neely Turner, Connecticut Agricultural Experiment  
Station, New Haven  
W. M. Upholt, C. D. C., Savannah, Georgia  
F. M. Wadley, 3125 N. Albermarle Street, Arlington  
R. H. Wellman, Boyce Thompson Institute, Yonkers

BIOMETRICAL CLINIC ON ENTOMOLOGICAL PROBLEMS

Wilcoxon: This meeting is a joint session of the American Association of Economic Entomologists and the Biometric Society, Eastern North American Region. When the question of this meeting first came up there was a good deal of discussion as to the form which it should take. We finally decided to send out a circular letter to a number of entomologists, asking them to submit questions regarding the statistical treatment of certain types of experimental data, and in response to this questionnaire a number of replies were received. These questions were then forwarded to the members of our statistical panel, to select the particular ones which they wanted to consider. The program was made up from the questions selected.

I might take a minute to introduce the members of the statistical panel. On my extreme left is Dr. C. I. Bliss of the Connecticut Agricultural Experiment Station; next to him is Dr. A. E. Brandt of the U. S. Atomic Energy Commission; immediately on my right is Professor W. C. Jacob of the Long Island Vegetable Research Farm, while on my extreme right is Professor John Tukey of the Princeton mathematics faculty. I will read each question aloud and if the man who offered the question is in the room and wishes to amplify it, he will have a chance to do so. Then members of the panel will attempt to answer the question. Following that there may be comments, criticisms or suggestions from any one in the audience and whatever discussion seems necessary.

Question 1.

Wilcoxon: The first question on our list goes like this: For what it might be worth in improving experimental technique among entomologists who do not now and probably never will employ statistical analyses

Members of the Panel

Frank Wilcoxon, Chairman, American Cyanamid Company,  
Stamford, Connecticut

C. I. Bliss, Connecticut Agricultural Experiment Sta-  
tion, New Haven, Connecticut

A. E. Brandt, U. S. Atomic Energy Commission, New York  
Operations Office, New York City

Walter C. Jacob, Long Island Vegetable Research Farm,  
Riverhead, New York

John W. Tukey, Princeton University, Princeton, New  
Jersey

*These were the  
Early Days of the  
International Biometric Society*

# Some IBS History

Science, Vol. 106, No. 2757, October 31,  
1947:

*“International Biometric Society Formed  
at Woods Hole Conference”*



# *THE BIOMETRIC SOCIETY*

*An International Society  
Devoted to the Mathematical  
and Statistical Aspects of  
Biology*

*The Biometric Society is an international society for the advancement of quantitative biological science through the development of quantitative theories and the application, development and dissemination of effective mathematical and statistical techniques. To this end the society welcomes to membership biologists, mathematicians, statisticians and others interested in applying similar techniques.*

# Officers for 1948

- *President:* **R.A. Fisher** (Cambridge)
- *Vice-Presidents:* **C.P. Winsor** (JHU), **J.W. Trevan** (Wellcome) **P.C. Mahalanobis** (Presidency College, Calcutta)
- *Treasurer:* **J.W. Hopkins** (NRC, Canada)
- *Secretary:* **C.I. Bliss** (CT Agr Exp Station)

*Famous Statisticians...*  
*Famous to Whom?*

# Blue Plaques

## Commemorating Famous Londoners

- 1867: Royal Society of Arts (36)
- 1901: London City Council (249)
- 1965: Greater London Council (262)
- 1985: English Heritage
- Close to 800



# Two Blue Plaques in London...

- **PEARSON, Karl**  
(1857-1936),  
Pioneer  
Statistician, lived  
here.  
7 Well Road,  
Hampstead, NW3  
Camden 1983

- **FISHER, Sir  
Ronald Aylmer**  
(1890-1962)  
Statistician and  
Geneticist, lived  
here, 1896-1904  
Inverforth House,  
North End Way,  
NW3  
(Camden 2002)



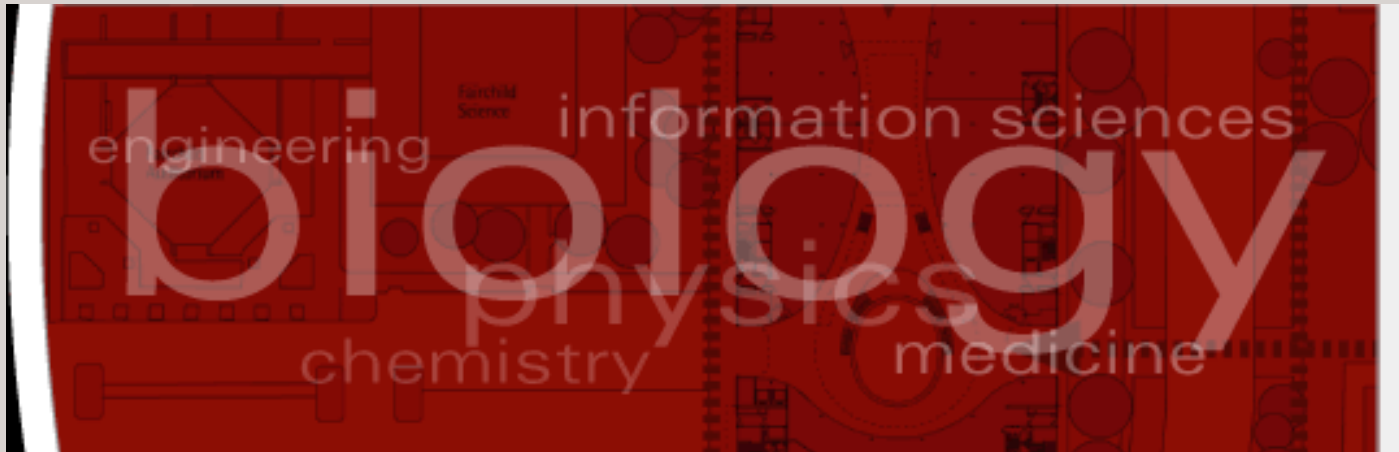
# From Biometrical Clinic of 1950 to ...

- Interdisciplinary field
- Statistics is at best an acquired taste
- *"The secretary who can count"* ↔ scientists
- *"Service of biostatistics"* ↔ *"Department of biostatistical sciences"*

# Interdisciplinary is “In”

- Two decades ago: *“pure is better”*
- The future is inter- and multidisciplinary:
  - Research groups: Bio-X in Stanford
  - Interdisciplinary studies are successful
- *Biometrika* 110 years old, *Biometrics* 60
- *Will professional societies follow this trend?*

# Bio-X in Stanford



- Where is statistics?



# Interdisciplinary is “In”

- Two decades ago: *“pure is better”*
- The future is inter- and multidisciplinary:
  - Research groups: Bio-X in Stanford
  - Interdisciplinary studies are successful
- *Big Data – Data Science - Analytics*

# Quadrature of the Circle

- “Let us be one with our scientific partners!”
- “Let us be one across all branches of statistics!”
- How do we solve this?



# How do we Solve This?

- The same name for different things:
  - *conditional, mixed,...*
- Different names for the same thing:
  - *repeated measures, longitudinal data, hierarchical model, multilevel model, growth curves,...*
  - *Biometry, biometrics, biostatistics, medical statistics,...*     **AND THEN...**

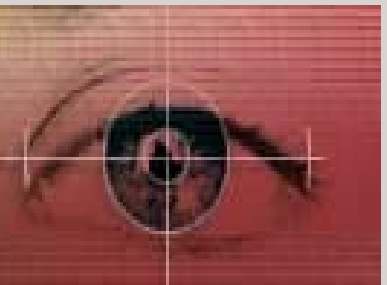
# Biometrics or Biometrics?

Biometrics - great hope for world security  
or triumph for Big Brother?

*The Guardian,*  
*Friday, June 18, 2004*



International Behavioral  
& Medical Biometrics Society



# Bioinformatics

- We have a competitive advantage!  
*Yeah right!*
- Small survey (among colleagues in my dept)
  - $n=30$
  - What is bioinformatics?: **29 def's** (one person ill)
  - Who talks about it?: **29/29**  
Who does it?: **[1.03%;98.97%]**

# Education

- Level of educational facilities variable
- We need a ***radical investment*** in the future
  - Short courses
  - Summer schools
  - Graduate programs
    - On site
    - Distance
- For statisticians ***and our partners***

# Academic Models: North America

- First generation:
  - Buffalo, NY
- Second generation:
  - Harvard U., Boston, MA
  - U. Washington, Seattle, WA
  - U. Waterloo, Ontario
- Third generation?



# Academic Models: North America

- Third generation?
  - U. Michigan
  - Johns Hopkins, Baltimore, MD
  - North Caroline State U., Raleigh, NC
  - ...

# Europe

- U.K.
- And then Europe...
  - Spain (*Catalunya, Barcelona, BIOSTAT-RED, ...*)
  - Belgium (*Flanders, ...*)
  - Netherlands
  - Denmark
  - Emerging trends in Eastern part of EU

# Their Recipe: Focus on All Aspects

- Education
- Research
- Scientific collaboration (consultancy)
- *Education & research*
- *Education & collaboration*
- *Research & collaboration*

# A Spirit of Collaboration

- Otherwise the paradox of data:
  - Theoretical people develop methods but hardly find good data to *illustrate* them
  - Applied people have a wealth of data but do not know how to approach them
  - Join both and the sky is the limit

# Biometry: A Spirit of Collaboration

- Catalunya, Spain, Flanders, Belgium, Europe, and the globe
- In agriculture, environment, (bio)medicine
- For better food, a better environment, and safe and active drugs
- This is our contribution to peace in the world!
- It will keep us on the

# MAP!

