## Work and life of Guido Pontecorvo



Anna M Rossi Dip di Biologia - Univ di Pisa 13 October 2015 Aula Pontecorvo Brothers University of Pisa Born in 1907 at Pisa, Guido was the first of eight children of a Jewish family.

He graduated in Agricultural Science at the University of Pisa in 1928 and spent nine years in Florence, working to a program of improving livestock at the Inspectorate for Agriculture of Tuscany.



In 1938, he had to leave the country because of the racial laws promulgated by the Fascist Government.

#### Leni e Lisa, two ladies behind the man



The wedding of Leonore Freyenmuth (Leni) in 1939



His daughter Lisa (1944-2008)

### From cows to humans through fungi, fruit flies ... and even lice

Refugee in Edinburgh, he became a pupil of Hermann J. Muller, with whom he carried out in 1941 his doctorate discussing a thesis on the induction of chromosomal rearrangements by means of ionizing radiation in *Drosophila*.

After a period of internment the Isle of Man, he moved to Glasgow where he devoted himself to the development of microbial genetics, in particular to genetics of fungi, and in 1950 he discovered that in the fungus *Aspergillus nidulans* the recombination of genes can take place **without sexual reproduction**.



## From cows to humans through fungi, fruit flies ... and even lice

Pontecorvo got the first chair of genetics established at the University of Glasgow in 1955 where he stayed until 1968, when he moved to London at the Imperial Cancer Research Fund.

He retired in 1975 but continued to work until his death in 1999, aged 92, due to a minor accident in the mountains, near Zermatt, Switzerland.



#### Academic career

-PhD, Institute of Animal Genetics, University of Edinburgh, 1938-1940 and 1944-1945

- -Post-Doc, Department of Zoology, University of Glasgow, 1941-1944 -Lecturer, Department of Genetics, University of Glasgow, 1945-1955
- Professor, Department of Genetics, University of Glasgow, 1956-1968
- Honorary Director MRC Cellular Genetics Unit, 1966-1968
- Member of the Imperial Cancer Research Fund, 1968-1975
- Honorary Consulent ICRF, 1975-1980 ... and beyond

In 1955 he was elected Fellow of the Royal Society.

## From cows to humans through fungi, fruit flies ... and even lice

Pontecorvo was an absolute pioneer of the studies on genetics and biochemistry of many fungi.

In particular, Aspergillus nidulans became a powerful tool of experimental genetics.



1938-41

But human geneticists remember him for having proposed a very innovative experimental approach to the study of human genetics through the use of somatic cells *in vitro*. The state of art in human genetics Genetics of the first half of the twentieth century had made great steps but human genetics was left far behind.

The study of genetics was based primarily on experimental crosses between individuals with different characters, but this approach could not be applied to human genetics.



1938-41

Pontecorvo's contribution to solving this problem was at least as important as that given to the development of microbial genetics.

#### Parasexual cycles

In 1950 Pontecorvo discovered that in fungi somatic cells can fuse and put in common their genetic material.

He called **parasexual cycle** this phenomenon similar to those typical of sexual reproduction.



The parasexual cycle that was patented in 1954 represents the first patent obtained for a natural biological process.

#### Parasexual cycles also in man?

Given that the parasexual cycles had proved so useful for genetic analysis of fungi, in 1956 Pontecorvo suggested that something similar could be achieved for genetic analysis in man using somatic cells cultured *in vitro*.

It took a few years before this brilliant idea could be put at work.



Is genetic analysis via mitotic segregation possible in man? Symp. R. Phys. Soc. 25 : 16-20, 1956



Pontecorvo is universally considered the founder of somatic cell genetics, however many today's scientists ignore the origins and history of these studies that have laid the foundations of modern molecular medicine. In 1984 Pontecorvo could say with satisfaction: Human genetics, which was the Cinderella of genetics, has become his advanced frontier.



Inauguration of the Pontecorvo Building the new Institute of Genetics in Glasgow, 1995

Anderson College	Withous Cuit of Melester Permitelogy
Entrance Robertson Institute Main Tatrance control of them	Common Facilities Department of Decountings Robertons facilitate of Biotechanlogs 10115, Division of Molecular and Cettalar Biology
Pontecorvo Building Main Latrance via Anderson College	Genetics Laboratory IBLS, Division of Malocelar and Cellular Biology
Institute of Virology	Entrance off Church Storet
Deliveries	To Lase off Chanch Stored

Starting from these discoveries, in the recent decades a number of biotechnological applications have been developed, ranging from in vitro fertilization to stem cell production, transgenic organisms to the cloning of higher organisms.

#### in vitro fertilization and embryo development





Cloning of a newborn organism from a somatic cell nucleus and an enucleated egg

#### Cytoplasmic hybrids

A human somatic cell nucleus is transferred into a cow egg cell without the nucleus... and a hybrid embryo develops up to 14 days.



#### Science fiction scenarios, but for how long...







#### Some references

Siddiqi, O. (2002). "Guido Pontecorvo. 29 November 1907 - 25 September 1999". Biographical Memoirs of Fellows of the Royal Society 48: 375. doi:10.1098/rsbm.2002.0022.

Cohen, B. L. (2007). "Guido Pontecorvo ("Ponte"): A centenary memoir". Genetics 177 (3): 1439–1444.

Cohen, B. L. (2000). "Guido Pontecorvo ("Ponte"), 1907-1999". Genetics 154 (2): 497–501.

Siddiqi, O. (1999). "Guido Pontecorvo (1907-99)". Nature 402 (6759): 250. doi:10.1038/46201.

Roper, J. A.; Hopwood, D. A. (1988). "Guido Pontecorvo and his contribution to genetics". Cancer surveys 7 (2): 229–237.

[No authors listed] Somatic cell genetics and cancer. Dedicated to Guido Pontecorvo on his 80th birthday. Cancer Surv. 1988;7(2):223-375.

# Thank you for your attention