Women and science

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Women and science

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Abstract. "Set Routes" is a Community Initiative project launched within the 6th Framework Programme and aimed at encouraging women to commit themselves professionally in the areas of science, engineering and technology. Three international institutes cooperate on this initiative: the European Molecular Biology Institute based in Heidelberg, the European Molecular Biology Organization (EMBO) and the CERN of Geneva. To encourage the female presence in careers and powerful positions, "school ambassadors" and "university ambassadors" are involved by participating in conferences to explain their activities and how they have succeeded in their own careers. Following her personal working experience, the author has been involved, since 2003, also in the DNA Barcode programme. This activity intends to supply any living organism with a barcode, a small DNA sequence. The most significant problem for the implementation of the genetic BARCODE is that the DNA barcode varies and therefore, it should be selected within this continuous variability. This programme deserves much attention given its several applications: the safeguard of earth biodiversity, the support to diagnostic sciences and agriculture, the safeguard of the food chain. Europe is participating also in the international project "International Barcode of Life" (iBOL) as "central hub".

Keywords. Programme – Education – Women – Professional services – DNA – Biodiversity – European Union.

Les femmes et la science

Résumé. *"Set Routes" est un projet d'initiative communautaire lancé à l'intérieur du 6ème Programme Cadre pour encourager les femmes à s'engager professionnellement dans les domaines de la science, de l'ingénierie et des technologies. Trois instituts internationaux collaborent à cette initiative : l'Institut Européen de Biologie Moléculaire d'Heidelberg, l'Organisation Européenne de Biologie Moléculaire (EMBO) et le CERN de Genève. Pour soutenir les femmes dans des carrières et des positions importantes, "des ambassadeurs des écoles" et "des ambassadeurs des universités" sont mobilisés à travers la participation à des conférences pour expliquer leurs activités et comment ils ont réussi leur carrière. Vu son expérience de travail personnelle, l'auteur a aussi participé, à partir de 2003, au programme du Code-barres de l'ADN. Cette activité vise à attribuer un code-barres, une petite séquence d'ADN, à tout organisme vivant. Concernant la réalisation du CODE-BARRES génétique, le problème principal est que le code-barres de l'ADN varie et devrait ainsi être sélectionné dans cette variabilité continue. Ce programme mérite une attention spéciale compte tenu de ces diverses applications : la préservation de la biodiversité terrestre, le soutien aux sciences diagnostiques et à l'agriculture, la protection de la chaîne alimentaire. L'Europe participe aussi au projet international "International Barcode of Life" (iBOL) comme "plate-forme centrale".*

Mots-clés. *Programme – Education – Femmes – Services professionnels – ADN – Biodiversité – Union Européenne.*

The program "Set Routes" might be defined as "highways into science" run by its manager Philip Gebhadrt and by a woman, Julia Willingale Theune**,** coordinator of the program.

This is an initiative of the European Community, launched within the 6th Framework Program and focused on the objective to encourage women (notably the new generation) to commit themselves professionally in the areas of science, engineering and technology ("Set" standing for science, engineering and technology). Actually, it is well known that it is not easy today to find women involved in these specific areas.

The program is the result of the collaboration between three international institutes: the European Molecular Biology Institute based in Heidelberg (Germany) and different "out stations" all over

Europe, the EMBO that is a European molecular biology organization and the CERN based in Geneve. (Website: www.set-routes.org).

Women's participation in the scientific and technological activities might be compared to a "*pipeline"*, which leaks all along its path (starting from the family to reach leading professional positions). Leaks start indeed from the family, continue in the school, and persist at university and at the beginnings of the career until you reach more important positions.

The program of "*ambassadors"* for women is intended to demonstrate that that are models and examples related to the career of women scientists and that these models can stimulate the interest for science and can favor women's participation encouraging them to commit themselves in this profession.

There is a program of "*school ambassadors*" and a program of "*university ambassadors*" that are obviously targeted to different phases of women's academic and professional life.

Next to these programs, our activity has involved the international conference "Women in science", organized in May, and the project "Inside Elector Series" scheduled for 2008.

Who are indeed these ambassadors of the Set Routes program?

They include the whole staff of the European Molecular Biology Laboratory, of EMBO and CERN, pre-doctorate and post-doctorate students, senior scientists, group leaders and also institute directors for the "*university program"*.

The international conference "Women in science" that has been previously mentioned has led to a specific conclusion: women are still poorly represented today.

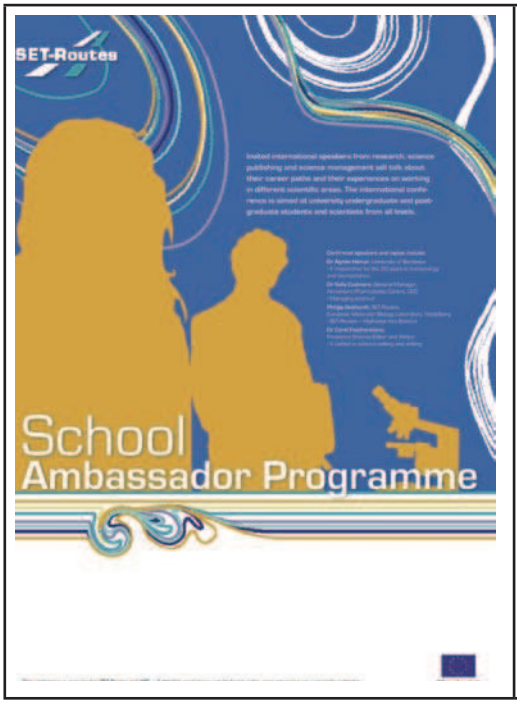

Figure 1. School Ambassador Programme

Figure 2. University Ambassador Programme

Source: http://www.set-routes.org

How to invert this trend? Starting first of all from the choice of study fields. The *Royal Society* has proved that 52% of scientists have been influenced in the choice of their profession by the knowledge and acquaintance of a scientist: there is a very important point of contact with those who have devoted their life to this activity. The “school ambassadors” are thus very numerous, whereas the “university ambassadors” are involved through specific conferences in which they explain what is their activity and how they have succeeded in their careers.

In my quality of ambassador I should shortly describe my career. It started in Naples, where I took the position of extraordinary assistant at the University and where I qualified for university teaching in Biochemistry. Then I moved to Bari, I became full professor and I had the opportunity to work in many European and American laboratories (the experience at the European molecular biology laboratory has been one of the most significant).

My scientific involvement stemmed from a specific interest in membrane biochemistry and bioenergetics and grew after the discovery of mitochondria. These “organites” act in our cells for their respiration, but what is important is that they have their own genome. I started to work in that area when the mitochondrial genome was not known yet, I have contributed to that very important discovery, and I have sequenced many mitochondrial and then nuclear genomes as well. The nuclear genome is much more important for our cell and it is noteworthy that it is passed down to the progeny, the children, from that of the father and of the mother; the mitochondrial genome, instead, drifts and is transmitted only through the mother. Hence, it could be stated that children belong more to the mother than to the father. However, the most recent interest that I have developed and that is close to the theme of the symposium is molecular biodiversity.

What is **molecular biodiversity**? It is the range of all living forms existing on the earth and the entire network they create around them and between them. The biodiversity we observe today is obviously the result of million years of evolution; there is a genetic diversity, species diversity and an ecosystem diversity that is one of the problems for environment-related research and its monitoring, and for the study of its changes. Life is biodiversity and life cannot exist without biodiversity. In other words, change means evolution. Biodiversity means indeed that we are all different, although we belong to a single species, *Homo sapiens sapiens*. So there is a biodiversity that we should respect: we are all different but all belonging to the same species whose limits should not be exceeded.

Since 2003 a world program called “***DNA BARCODE***”, has been initiated. What does this program mean? It intends to supply any living organism with a barcode, that is a small DNA sequence with a given location of the genome: for example, instead of describing plants through their morphology or their embryo development, it will be sufficient to extract from these plants a small part of a sequenced gene selected as standard, and to detect by this procedure the exact species it belongs to. The implementation of the genetic BARCODE has obviously many problems; things are not so simple as they seem to be, because unlike the barcodes we find in supermarkets that never change, the DNA BARCODE varies and should thus be selected within this continuous variability. Once the DNA BARCODE is established , we get a key that may be used for all possible applications of the species concept.

First of all in its safeguard; life on earth would not be possible without biodiversity, we should protect it in any respect. Then there are many important applications for health, for diagnostics in medicine, bacteriology, parasitology, veterinary science etc. Its application in agriculture is also very important for the detection of pathogens, for invasive species and above all to safeguard the food chain. Through the DNA BARCODE we could protect the consumer and, at the same time, we can contribute to the enactment of very important laws (for example, at the level of customs etc.). We can even monitor an environment. How to monitor an environment based on the description of the single species that inhabit it? This effort is practically impossible; so far the description involved the traditional classification of the genus, not of the species. By the species

monitoring we can easily create a specific environment to study the climatic effects (the famous "*climate changes"* recalled so often) for sustainable development and for agriculture.

Europe is operating to participate in the international project "International Barcode of Life" (iBOL) as "central hub". The central hubs of this 150-million-dollar project are, besides Europe, America and Canada. The regional nodes will include Australia, Brazil, Argentine, China etc, the national ones will be the developing countries that possess the highest biodiversity to preserve and to use in different applications. This requires a fast, reliable and cost-effective leading technology making possible the sequencing of specific genome regions.

We have already developed a DNA Barcode that costs one dollar and a half, but all procedures should be miniaturized, necessitating both nano-technologies and informatics (notably bioinformatics). Based on the previous remarks it is obvious that the DNA Barcode is an inter-disciplinary, or even multi-disciplinary approach. Europe is currently implementing a "European Consortium of the DNA barcode" for which raisefunding has already been started up.

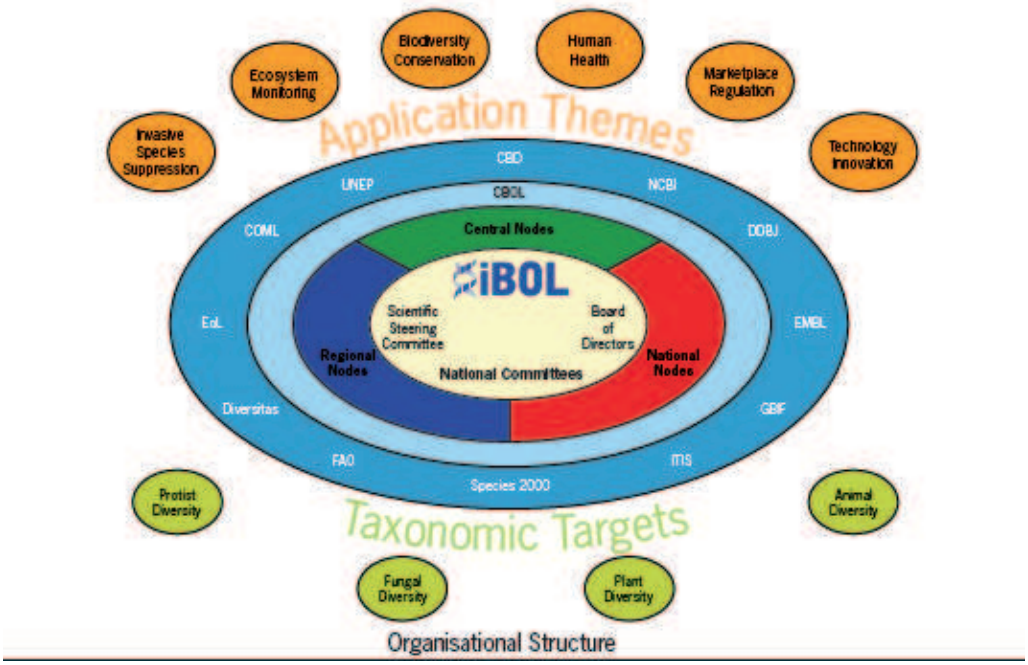

Figure 3. iBOL Organization Structure
Source: http://www.dnabarcoding.org/alliance.html