COST

Domain Committee "BMBS"

COST Action (BM1102)

Start Date (16/12/2011)

Ciliates as model systems to study genome evolution, mechanisms of non-Mendelian inheritance, and their roles in environmental adaptation

MONITORING PROGRESS REPORT

Reporting Period: *from (April 2012-April 2013)*

This Report is presented to the relevant Domain Committee.
It contains three parts:

I. Management Report *prepared by the Grant Holder*
II. Scientific Report *prepared by the Chair of the Management Committee of the Action*
III. Previous versions of the Scientific Report*; i.e., part II of past reporting periods*

The report is a "cumulative" report, i.e. it is updated annually and covers the entire period of the Action.

Confidentiality: the documents will be made available to the public via the COST Action web page except for chapter *II.D. Self evaluation*.

Based on the monitoring results, the COST Office will decide on the following year's budget allocation.

Executive summary (max.250 words):

Darwinian selection of random mutations is considered the driving force for evolution. However, it is now clear that acquired characters can also be transmitted from one generation to the next through non-Mendelian inheritance, with influence on cell differentiation and occurrence of diseases. Important questions are whether environmental changes can induce such epigenetic variation and if these variations drive adaptation. Research on ciliates has greatly contributed to unravelling the molecular mechanisms of non-Mendelian heredity. These unicellular eukaryotes constitute excellent models to study basic biological processes. We are organising an innovating, highly interacting, dynamic European research network focusing on epigenetics, genome evolution and ecology of ciliates. The aim of this COST Action is to obtain solid evidence for the role of epigenetic phenomena in environmental adaptation. Participants at the moment are from 12 COST countries, with the addition of 3 non-COST countries for mutual benefits. A European network of ciliate molecular biologists will improve the quality of the research and training of young scientists on the continent, and will provide greater visibility for European research. The knowledge expected to be produced through the Action will likely be of use to other researchers in the fields of genetics, genome evolution, population genetics, environmental sciences, cell differentiation and health. Practically the action started in 2012 and for this first year we had 3 scientific conferences with doctoral students and podocs, one conference will be in next May, and 7 STSM. We have also planned a training school in September 2013.

I. Management Report prepared by the Grant Holder

I.A. COST Action Fact Sheet

- **COST Action** BM1102 - Ciliates as model systems to study genome evolution, mechanisms of non-Mendelian inheritance, and their roles in environmental adaptation
- **Domain** Biomedicine and Molecular Biosciences (BMBS)

- **Action details:**

CSO Approval: *(17/05/2011)* **End date:** *(15/12/2015)*
Entry into force: *(01/07/2011)* **Extension:** *(day/month/year)*

Objectives: The main objective of this Action is to establish a network of molecular biologists working on Ciliates in order to strengthen and consolidate European research in this area aiming at deciphering the molecular mechanisms underlying epigenetics and non-Mendelian inheritance and environmental adaptation.

Secondary objectives of the Action are:
1. To demonstrate that ciliates are optimal model organisms to study epigenetic phenomena and the mechanisms of environmental adaptation, among other important biological fields;
2. To provide a platform for technology transfer within the European ciliate community;
3. To unite experts of diverse disciplines. The multidisciplinary Action will create opportunities to interact with/incorporate researchers from the fields of bioinformatics, population genetics and phylogeny, with whom most ciliatologists currently do not even have a chance to interact. Novel cutting-edge research domains are expected to be created through these interactions;
4. To guide early-stage researchers. The creation of a highly interactive network of "ciliatologists" will improve the quality of scientific production and the training of young researchers, including PhD students. Regular meetings will circumvent the current lack of opportunities for young researchers to expose their research and to obtain valuable feedback from specialists. Moreover, the action will enable young researchers to visit other laboratories and learn techniques through hands-on training.

- **Parties:** *list of countries and date of acceptance*

Austria *(24/06/2011)*	Greece *(23/01/2012)*	Poland *(01/07/2011)*
Belgium *(date)*	Hungary *(date)*	Portugal *(19/12/2011)*
Bulgaria *(date)*	Iceland *(date)*	Romania *(date)*
Croatia *(date)*	Ireland *(date)*	Serbia *(date)*
Cyprus *(date)*	Israel *(date)*	Slovakia *(date)*
Czech Rep. *(date)*	Italy *(15/06/2011)*	Slovenia *(date)*
Denmark *(12/12/2011)*	Latvia *(date)*	Spain *(01/12/2011)*
Estonia *(8/11/2012)*	Lithuania *(date)*	Sweden *(date)*
Finland *(date)*	Luxembourg *(date)*	Switzerland *(05/07/2011)*
FYR of Macedonia *(date)*	Malta *(date)*	Turkey *(date)*
France *(12/08/2011)*	Netherlands *(date)*	United Kingdom*(16/06/2011)*
Germany *(27/06/2011)*	Norway *(date)*	

- **Intentions to accept:** Hungary, Israel, Turkey, Norway, Croatia (September 2013 with participation to the Training School)

- **Other participants:**

Alexey Potekhin and Sergei Fokin, from the University of St-Petersburg, Russia.

Wei Miao, Institute of Hydrobiology, Chinese Academy of Sciences, Wuhan, Hubei Province, China.

Jack C. Ng and **Ting Yu** from the University of Queensland Faculty of Health Sciences National Research Centre for Environmental Toxicology (Entox) 39 Kessels Road, Coopers Plains, QLD 4108, Australia.

Chair: *Cristina Miceli, University of Camerino, Via Gentile III da Varano, 62032 Camerino, Italy, +390737403255, cristina.miceli@unicam.it*

DC Rapporteur: *Anu Jalanko, NATIONAL INSTITUTE FOR HEALTH AND WELFARE, Biomedicum, 00290 Helsinki, Finland, +358206108392, anu.jalanko@thl.fi*

Science Officer: *Magdalena Radwanska, magdalena.radwanska@cost.eu*

Administrative Officer: *Gabriela Cristea, gabriela.cristea@cost.eu*

- **Action Web site:** *http://cost.cgm.cnrs-gif.fr*
- **Grant Holder Representative** *(Cristina Miceli, cristina.miceli@unicam.it)*

Working Groups

WG 1: Developmentally regulated, alternative genome rearrangements showing non-Mendelian inheritance.
WG 2: Genetic variation of adaptive significance.
WG 3 : Linkage of non-Mendelian inheritance to environmental adaptation. The more relevant scientific innovation of this Action will be to try to link non-Mendelian inheritance to environmental adaptation.

List of participants:

WG 1: Developmentally regulated, alternative genome rearrangements showing non-Mendelian inheritance.

1-Hans Joachim Lipps, Institut für Zellbiologie Universität Witten/Herdecke Witten, DE

2- Kazufumi Mochizuki, IMBA (Institute of Molecular Biotechnology of the Austrian Academy of Sciences) Vienna, AT

3- Eric Meyer, Institut de Biologie de l'Ecole Normale Supérieure Paris, FR

4- Sandra Duharcourt, Institut Jacques Monod Paris, FR

5- Mariusz Nowacki, Institut für Zellbiologie Universität Bern , CH

6- Linda Sperling, Centre de Génétique Moléculaire CNRS Gif sur Yvette , FR

7- Mireille Betermier, Centre de Genetique Moleculaire, CNRS, Gif sur Yvette , FR

8- Jan Postberg, Centre for Biomedical Education and Research, Institute of Cell Biology, Witten, Germany.

9- Malgorzata Prajer, Department of Experimental Zoology, Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland.
10- Daniela Rhodes, MRC Laboratory of Molecular Biology Cambridge , UK
11- Eduardo Villalobo, Department of Microbiology, Faculty of Biology, University of Sevilla, Spain.

WG 2: Genetic variation of adaptive significance.

1- Laurent Duret, Biométrie et Biologie Evolutive Lyon, FR
2- Jacek K. Nowak, Institute of Biochemistry and Biophysics, Polish Academy of Sciences, Pawinskiego Street 5a, Warsaw, Poland
3- Eric Meyer, Institut de Biologie de l'Ecole Normale Supérieure Paris, FR
4- Malgorzata Prajer, Department of Experimental Zoology, Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland.
5- Sandra Duharcourt, Institut Jacques Monod Paris, FR
6- Linda Sperling, Centre de Génétique Moléculaire CNRS Gif sur Yvette , FR
7- Alexey Potekhin, Biological Institute of St. Petersburg State, University of St-Petersburg, Russia
8- Cristina Miceli, School of Biosciences and Biotechnology, University of Camerin , IT
9- Sandra Pucciarelli, School of Biosciences and Biotechnology, University of Camerino , IT
10- **Anne Kahru**, National Institute of Chemical Physics and Biophysics Akadeemia,Tallinn, Estonia
11- **Monika Mortimer**, National Institute of Chemical Physics and Biophysics Akadeemia,Tallinn, Estonia
12- **Katre Juganson**, National Institute of Chemical Physics and BiophysicsAkadeemia, Tallinn, Estonia.
13- **Thomas Berendonk**, Institute of Hydrobiology, Dresden Univeristy of Technology, Dresden, Germany
14- **Martina Schrallhammer**, Institute of Hydrobiology, Dresden Univeristy of Technology, Dresden, Germany
15- **Maria Jerka-Dziadosz**, Department of Cell Biology, M. Nencki Institute of Experimental Biology, Polish Academy of Sciences, Warsaw, Poland

WG 3 : Linkage of non-Mendelian inheritance to environmental adaptation.

1- Mariusz Nowacki, Institut für Zellbiologie Universität Bern , CH
2- Cristina Miceli, School of Biosciences and Biotechnology, University of Camerino , IT

3- Henrik Nielsen, Department of Molecular Biology, Odense University, Odense M, Denmark

4- Dia Galanopoulou, Laboratory of Biochemistry, Department of Chemistry, University of Athens, Zografou, Athens, Greece.

5- Juan C. Gutierrez, Departamento de Microbiología-III, Facultad de Biología, Universidad Complutense (UCM), Spain.

6- Martin Simon, Biologische Fakultät Universität Kaiserslautern, DE

7- Helena Soares, Inst. Ciênc. Bioméd. Abel Salazar, Porto, Portugal

8- Giulio Petroni, Dipartimento di Biologia, University of Pisa, PISA, IT

9- Dorota Wloga, Nencki Institute of Experimental Biology, Polish Academy of Science, Warsaw, Poland

10- Eduardo Villalobo, Department of Microbiology, Faculty of Biology, University of Sevilla, Spain.

11- Ewa Joachimiak, Department of Animal Physiology, Faculty of Biology, University of Warsaw, Warsaw, Poland

12- Sandra Pucciarelli, School of Biosciences and Biotechnology, University of Camerino , IT

13- Hanna Fabczak, Department of Cell Biology, Nencki Institute of Experimental Biology, Warsaw, Poland.

The working groups will develop the following studies:

A- DNA rearrangement and macronuclear development, WG1.

B- Genome evolution and gene annotation: WG2, however, a contribution from all the participants is expected for the annotation of the ciliate genomes.

C- response to stress from environment and effects on genome, WG3

D- chromatin organization WG1

E- small RNA control (gene expression, genome rearrangement, nucleotide modification) WG1 & 3

F-mating type determination WG1, 2 & 3

G-cell polarity determination, role of structural inheritance, cilia as sensor WG2 & 3

H-bacterial symbiosis of ciliates WG2 & 3

I.B. Management Committee member list

Name (MC member)	*Country*	*E-mail*
Dr Kazufumi MOCHIZUKI	Austria	***kazufumi.mochizuki@imba.oeaw.ac.at***

Prof. Henrik NIELSEN	Denmark	hamra@sund.ku.dk
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Name (MC substitute)	*Country*	*E-mail*
Ms Katre JUGANSON	Estonia	katre.juganson@kbfi.ee
Dr Sandra DUHARCOURT	France	duharcourt@ijm.univ-paris-diderot.fr
Dr Jacek NOWAK	Poland	jknowak@ibb.waw.pl

I.C. Overview activities and expenditure

(2012) Budget

Total Action Budget: 89,700.00
Remaining Action Commitment: 14,145.91

Meetings

Meeting Type	Date	Place							Cost	Total
All working groups	April 16th-18th 2012	Sevilla							19,228.54	
All working groups	November 8th-10th 2012	Paris							16,739.21	
										35,967.75

STSM

Beneficiary	Date	Place							Cost	Total
Pr Helena Soares	From 09/09/2012 to 13/09/2012	The Nencki Institute of Experimental Biology, PAS, PL							584.00	
Mr Adeel Manaf	From 15/09/2012 to 01/10/2012	Institute of Cell Biology Institut fur Zellbiologie, CH							1,200.00	
Mr Michael Ignarski	From 17/09/2012 to 11/10/2012	Institute of Cell Biology, University Witten/Herdecke, DE							2,500.00	

Ms Natalia Sawka	From 01/10/2012 to 01/12/2012	Institut de Biologie de l`Ecole Normale Superieure, FR							2,500.00	
Mr Konstantinos Tsaramirsis	From 01/10/2012 to 31/12/2012	Biomedical Research Foundation , Academy of Athens, EL							2,250.00	
Mr Michele Castelli	From 18/11/2012 to 16/12/2012	Institute of Hydrobiology , DE							2,500.00	
Ms Chiara Bella	From 18/11/2012 to 16/12/2012	Institute of Hydrobiology, DE							2,500.00	
										14,034.00

Workshops

Title	Date		Place						Cost	Total
	From	To	From	To						
										0

General Support Grants

Beneficiary	Date								Cost	Total
										0

Schools

Title	Date	Place							Cost	Total
										0

Dissemination

Title	Date	Place							Cost	Total
website set-up	18-10-2012	Centre de Génétique Moléculaire CNRS Gif sur Yvette , FR							2,508.36	**2,508.36**

Others

Bank charges	500.00	
Parking expenses Dr Martin Simon (DE)	75.00	
Taxi expenses Ms Katre Juganson (EE)	11.81	
		586.81

Action Total : 53,096.92

II. Scientific Report *prepared by the Chair of the Management Committee of the Action, describing results achieved during the Action operation in this period, in no more than 3 pages (the report is "cumulative"). All items listed in Sections A, B, and C, below, must be addressed.*

During the year referred in this report, a scientific meeting was held in Seville (April16-17), with the participation of research groups from all involved countries, not only those immediately motivated in this research field, but also others possibly able to contribute in the future. In fact, most of them are now part of the project. The Sevilla meeting had also the objective to realise how many were the resources at international and national level in the different groups to carry out research, with the aim of using this networking for future applications to EU projects. Details on this issue are reported below. At the meeting, research presentations of 16 research groups allowed the determination of the tasks of the working groups for the near future. One of the topics that needs improvement at the moment is the gene annotation with extended competences in bioinformatics, as comparative genomics is essential for the objectives of this action. For this reason we opened a contact with the COST action BM1006 on Next generation sequencing and we also asked for the participation of members of our action to the training school they are organising. A second scientific meeting was held in Paris (November 8 to 10) and the work in progress was discussed. The coordinator of WG2, Sandra Pucciarelli participated to the TRANS-COST Meeting in Amsterdam 29-30 November organised by Erik Bongcam-Rudloff to discuss synergies on new technologies in DNA sequencing and on the bioinformatics approach to genomics. In that meeting our action was presented and a collaboration in organising a joint training school in bioinformatics and genomics was opened. The possibility of joint applications to EC calls was also considered.

- *Significant scientific breakthroughs as part of the COST Action. (Specific examples).*

The following scientific breakthroughs resulted from this year of COST networking:

a- new insights in the evolution of ciliate genomes by the sequencing of the Paramecium tetraurelia germline DNA. This study provided direct evidence that domesticated transposases are required for excision of all internal eliminated sequences (IESs) during macronuclear formation (Arnaiz et al, 2013). In this context, members of the action also contributed to a relevant publication on the sequencing of the macronuclear genome of the ciliate Oxytricha trifallax, that provides additional insight in the topic of "DNA rearrangement and macronuclear development" (Swart et al., 2013);

b- additional knowledge was obtained about the epigenetic control of the macronuclear genome by small RNAs in Tetrahymena and other ciliates. Small nuclear RNAs derived from the parental nucleus work to control specific DNA elimination (Schoeberl et al., 2012) and in other ciliates small non coding RNAs function in reordering of gene segments and regulating specific gene amplification (Fuhrmann et al., 2013).

c- in the topic "Symbiosis of ciliates", different members of the WG2 and 3 studied bacterial sequences associated to ciliate genomes, such as the genome of the Antarctic ciliate *Euplotes focardii*. The analysis of these bacterial sequences is bringing insights in the role of symbiosis in environmental adaptation. Joint publications are in preparation in this subject.

- *Tangible medium term socio-economic impacts achieved or expected. (Specific examples)*

1- In the study of mechanisms of molecular adaptation under extreme environmental conditions (topic of WG 2), hydrolytic enzymes, as lipases and alpha-amylases, were characterized in the genome of *E. focardii*, the Antarctic psychrophilic ciliate. These molecules display the peculiar

characteristics of cold-adapted enzymes as highest catalytic efficiency at low temperature, and low thermostability. Therefore, these enzymes are of interest for industrial applications performed at low temperature. This discovery may help the manufacturing of a new generation of ordinary facilities, as cleaning agents, biofuels, with a significant impact on the everyday life of European population.

2- Members of the University of Camerino, Italy, were awarded (20,000 euro) in a national business plan competition (e-capital). Thanks to this award, a small company named SYNTHLIFE, that will exploit *E. focardii* cold-adapted molecules for industrial application, has been established as spin off of the University of Camerino.

- *Spin off of new EC RTD Framework Programme proposals/projects. (List)*
    1- The European Research Council (ERC) Starting Grant (204986) is supporting the project entitled "RNA directed DNA elimination in Tetrahymena", to Kazufumi Mochizuki.
    2- Cristina Miceli applied for a Marie Curie Industry-Academia Partnerships and Pathways (IAPP) call with a project entitled “Discovery of new enzymes from extremophiles and development of bioinformatics tools for genome analysis”. The proposal has been evaluated as “good” but the score is just below the threshold. A “redress” procedure is under consideration.

- *Spin off of new National Programme proposals/projects. (List)*

    1- The Austrian Science Fund (FWF), SFB F43, is supporting the project "Developmentally-regulated non-coding RNA transcription by RNA polymerase II (F4307-B09), " to Kazufumi Mochizuki, up to 28.02.2015:
    2- Austrian Science Fund (FWF), supported the International doctoral program (Doktoratskolleg) in RNA Biology (W1207-B09) to Kazufumi Mochizuki, for the period 01.10.2012-30.09.2013:
    3- Cristina Miceli applied for two National Programme proposals: one to the MIUR (Italian Ministry of Education, University and Research) with a project entitled: "Targeting of ciliary cargoes and intraflagellar transport in ciliogenesis". In this project the use of ciliates as model organisms to study ciliogenesis is proposed. The second entitled “Genome scanning and characterization of novel antifreeze proteins for industrial applications” has been proposed to the PNRA (Programma Nazionale di Ricerche in Antartide). In this project the use of ciliates as model organisms to characterize new antifreeze proteins is proposed. These projects are under review.
    4- Sandra Pucciarelli applied for one National Programme proposal to the MIUR (Italian Ministry of Education, University and Research) with a project entitled: “From genomics to biotechnology: Molecular mechanisms of cold adaptation and implementation of antifreeze proteins for industrial”. In this project the use of ciliates as model organisms to characterize the molecular mechanisms responsible for cold-adaptation and the role of antifreeze proteins for this process is proposed. The project is still under review.
    5- The Spanish National Plan financed to prof Eduardo Villalobo a project entitled “Nonsense-Mediated Decay in Ciliates” (BFU2009-10393).
    6- The Swiss National Science Foundation financed a project entitled "A role of non-Mendelian inheritance in environmental adaptation." to Mariusz Nowaski (this application was open only to researchers involved in COST actions), Apr. 2010 Mar. 2013

7- The German National Science Foundation (DFG), financed a project entitled "Molecular regulation of Antigenic Variation in protists" (SI 1397/2-1) to Prof Martin Simon.
8- the National Centre of Science (Poland), granted a project entitled: "*Paramecium jenningsi* - structure of species and syngens characteristics based on genetic crosses, cytological studies and analysis of chosen genome fragments" to Ewa Przyboś and Sebastian Tarcz, from 2013 (January) to 2015 (July)
9- The Agence National de la Recherche (ANR, France) granted three projects, coordinated respectively by Eric Meyer, by Sandra Duharcourt, and by Mireille Bétermier, in 2013 (the three coordinators belong to different groups and the project are organised with joint efforts).

II.B. Inter-disciplinary networking

- *Additional knowledge obtained from working with other disciplines within the COST framework. (Specific examples)*

Particularly for the objectives of WG1 and 2 interdisciplinarity is essential as it is evident from joint publications. These include bioinformatics (competences in the French groups) together with microscopy and ecology (Polish and Russian groups) and molecular biology that is a competence of most of the participants. For what concerns the study on effects of environmental changes on gene regulation, a new interdisciplinary approach was provided by the entrance of a new research group from Estonia with main background in toxicology. An STSM of a young researcher from the Estonian group to the group of Camerino University has been already programmed for next September.

- *Evaluation of whether the level of inter-disciplinarity is sufficient to potentially provide scientific impacts. (Specific examples)*

We consider to have a good level of interdisciplinarity in the action. However, the level of publications is still unequal among different groups and members of different countries. As opinion of the Chair of the action, we should increase the collaborations and this could improve the total scientific impact of our research. Furthermore, we need to collaborate with other actions or projects related to other biological systems, not only ciliates. The involvement of our action in the conference on Epigenetics with the joint organisation by COST and EC (last February) was of great help to establish new contacts that need to be better explored.

- *Evaluation of whether the level of inter-disciplinarity is sufficient to potentially provide socio-economic impacts. (Specific examples)*

Our research is mainly addressed to discover new biological mechanisms and to diffuse the knowledge by good scientific publications. However, there are some lateral research aspects that can provide socio-economic impact, such as the discovery of molecules functioning in extreme environment with high potential industrial application. We should insist more in address research of other groups toward this interest. The new many transposases that we are studying in ciliates may have applications in industrial biotechnologies.

II.C. New networking

- *Additional new members joining the Action during its life.*

During this year we had the entrance of 5 new research groups and an additional country plus the approval of participation of a group from Australia.

- *Total number of individual participants involved in the Action work. (Number of participants. Give % of female and of Early Stage Researcher participants).*

Total number of researchers is 81, with 51 % of females and 45% of early stage researchers. Names of early stage researchers are not reported in the list of participants. However, they participate to conferences and STSMs.

- *Involvement of Early Stage Researchers in the Action, in particular with respect to STSMs, networking activities, and Training Schools. In addition, justification should be provided if less than 4 STSMs were carried out during the year.*

In the 7 STSMs carried out during this year, only one involved an experienced researcher. All the others involved early stage researchers. The training school has been postponed to this coming September 2013 with a large involvement of early stage researchers. In addition we are in the organisation of a Scientific conference open to early stage researchers that will be in Tallinn next May 13-16. We have already collected abstracts for 35 oral presentations and about 20 posters.

- *Involvement of researchers from outside of COST Countries. (Number of participants from non-COST Countries approved by the CSO. Give % of such participants from countries with reciprocal agreements. Specify their contribution*

We obtained the approval of one participant group from Australia. At the moment it involves only two people, but it is promising in growing. The contribution is on toxicology (effects of environmental pollutants on the genome) and this can improve the socio-economic impact of our action.

- *Advancement and promotion of scientific knowledge through publications and other outreach activities. (Number of publications and other outreach activities that resulted from COST networking through the Action).*

List of most relevant publications (joint publications are underlined)

1: Fuhrmann G, Swart E, Nowacki M, Lipps HJ. RNA-dependent genome processing during nuclear differentiation: the model systems of stichotrichous ciliates. Epigenomics. 2013 Apr;5(2):229-36. doi: 10.2217/epi.13.15. PubMed PMID: 23566098.

2: Swart EC, Bracht JR, Magrini V, Minx P, Chen X, Zhou Y, Khurana JS, Goldman AD, Nowacki M, Schotanus K, Jung S, Fulton RS, Ly A, McGrath S, Haub K, Wiggins JL, Storton D, Matese JC, Parsons L, Chang WJ, Bowen MS, Stover NA, Jones TA, Eddy SR, Herrick GA, Doak TG, Wilson RK, Mardis ER, Landweber LF. The Oxytricha trifallax macronuclear genome: a complex eukaryotic genome with 16,000 tiny chromosomes. PLoS Biol. 2013 Jan;11(1):e1001473. doi: 10.1371/journal.pbio.1001473. Epub 2013 Jan 29. PubMed PMID: 23382650; PubMed Central PMCID: PMC3558436.

3: Arnaiz O, Mathy N, Baudry C, Malinsky S, Aury JM, Wilkes CD, Garnier O, Labadie K, Lauderdale BE, Le Mouël A, Marmignon A, Nowacki M, Poulain J, Prajer M, Wincker P, Meyer E, Duharcourt S, Duret L, Bétermier M, Sperling L. The Paramecium germline genome provides a niche for intragenic parasitic DNA: evolutionary dynamics of internal eliminated sequences. PLoS Genet.2012;8(10):e1002984. doi: 10.1371/journal.pgen.1002984. Epub 2012 Oct 4. PubMed PMID: 23071448; PubMed Central PMCID: PMC3464196.

4: Swart EC, Nowacki M, Shum J, Stiles H, Higgins BP, Doak TG, Schotanus K, Magrini VJ, Minx P, Mardis ER, Landweber LF. The Oxytricha trifallax mitochondrial genome. Genome Biol Evol. 2012;4(2):136-54. doi: 10.1093/gbe/evr136. Epub 2011 Dec 16. PubMed PMID: 22179582; PubMed Central PMCID: PMC3318907.

5: Montagna M, Sassera D, Epis S, Bazzocchi C, Vannini C, Lo N, Sacchi L, Fukatsu T, Petroni G, Bandi C. "Candidatus Midichloriaceae" fam. nov. (Rickettsiales), an ecologically widespread clade of intracellular alpha-proteobacteria. Appl Environ Microbiol. 2013 Mar 15. [Epub ahead of print] PubMed PMID: 23503305.

6: Modeo L, Fokin SI, Boscaro V, Andreoli I, Ferrantini F, Rosati G, Verni F, Petroni G. Morphology, ultrastructure, and molecular phylogeny of the ciliate Sonderia vorax with insights into the systematics of order Plagiopylida. BMC Microbiol. 2013 Feb 18;13:40. doi: 10.1186/1471-2180-13-40. PubMed PMID: 23418998; PubMed Central PMCID: PMC3626617.

7: Boscaro V, Petroni G, Ristori A, Verni F, Vannini C. "Candidatus Defluviella procrastinata" and "Candidatus Cyrtobacter zanobii", two novel ciliate endosymbionts belonging to the "Midichloria clade". Microb Ecol. 2013 Feb;65(2):302-10. doi: 10.1007/s00248-012-0170-3. Epub 2013 Jan 8. PubMed PMID: 23296446.

8: Modeo L, Petroni G, Lobban CS, Verni F, Vannini C. Morphological, ultrastructural, and molecular characterization of Euplotidium rosati n. sp. (ciliophora, euplotida) from Guam. J Eukaryot Microbiol. 2013 Jan-Feb;60(1):25-36. doi: 10.1111/jeu.12003. Epub 2012 Nov 29. PubMed PMID: 23194274.

9: Chiellini C, Iannelli R, Petroni G. Temporal characterization of bacterial communities in a phytoremediation pilot plant aimed at decontaminating polluted sediments dredged from Leghorn harbor, Italy. N Biotechnol. 2012 Nov 9. doi:pii: S1871-6784(12)00857-6. 10.1016/j.nbt.2012.10.002. [Epub ahead of print] PubMed PMID: 23142765.

10: Boscaro V, Fokin SI, Verni F, Petroni G. Survey of Paramecium duboscqui using three markers and assessment of the molecular variability in the genus Paramecium. Mol Phylogenet Evol. 2012 Dec;65(3):1004-13. doi: 10.1016/j.ympev.2012.09.001. Epub 2012 Sep 13. PubMed PMID: 22982632.

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- *Activities and projects with COST network colleagues.*

Some of the grants described in chapter *IIA* are obtained by joint groups. For the next future, we are planning to apply in joint groups to Horizon 2020 in Marie Curie Actions similar to the IAPP and ITN of the FP7.

- *The capacity of the Action members to raise research funds.*

This capacity is evident from the list of grants reported in chapter *IIA.*

II.D. Self evaluation

Indicate in no more than 1 page what, in the opinion of the MC, were the main successes, drawbacks (if any) and the key difficulties encountered (if any).

We consider successes:

-the increase of contacts among different research groups that from this first year generated a good transfer of knowledge and technologies. Particularly positive in this sense were the STSMs.
- the continuous joining of other members in the network, in particular the groups that are not directly involved in epigenetics and open new perspectives of research vision.
- the organisation of good scientific conferences in the field with many European participants. In the past, most of the meetings of this scientific community were in USA with a reduced participation of Europeans.
-starting of good research collaboration with prospective publications of high impact
- the possibility to interact with people working on other biological systems by the Annual COST Conference and the EU-COST joint conference on Epigenetics

The main drawbacks were:

- Research is still too fragmented and the level of publications is still very different among groups and countries. We need to interact better to generate more joint publications.
- We have not worked enough on the visibility of our biological system (ciliates) as suitable system for genomic studies, comparable and with advantages with respect to other unicellular eukaryotes such as yeasts.

The main difficulties encountered:

- Many difficulties in managing the grant. The main limit is the fact that payment must occur only as reimbursement. It is difficult for laboratories to anticipate money and this limits the STSMs of young researchers that must use their own money, when actually the money is already deposited in the university of the grant holder but it cannot be anticipated. Sometimes the fact that we cannot anticipate the accommodation expenses limits the participation of people to meetings.

III. Previous scientific report(s)

Part II of past periods' reports are to be found here.

Scientific report (April 2012)

Although the first Management Committee meeting of this action was held in Brussels on September 16th 2011, the real activity of the action started in February 2012 after the confirmation by the COST of the budget available for the year (allocation of the budget at the grant holder institution was in April 10th).
The main innovative and final scientific objective of this action is the study of the correlation between the epigenetic mechanisms happening in the ciliate genome and the effect of environmental changes on the genome. We believe that the demonstration of this correlation can open an important research field, bring to scientific breakthroughs and also have a socio-economic impact. In order to reach this objective, an increase in research networking is necessary. As first activity of the year, members who promoted the proposal had a first meeting in Paris (February 3-4) to outline a plan to facilitate the involvement of many groups, now isolated in Europe, in the achievement of the objective.

A larger meeting is going to be in Seville (April16-17), with the participation of research groups from all involved countries, not only those immediately motivated in this research field, but also others possibly able to contribute in the future. This meeting had also the objective to realise how many are at the moment the resources at international and national level in the different groups to carry out research, with the aim of using this networking for future applications to EU projects. Details on this issue are reported below. At the meeting, research presentations of 16 research groups allowed the determination of the tasks of the working groups for the near future. One of the topics that needs improvement at the moment is the gene annotation with extended competences in bioinformatics, as comparative genomics is essential for the objectives of this action.

New networking

- ***Additional new members joining the Action were:***

1- Ewa Joachimiak, Department of Animal Physiology, Faculty of Biology, University of Warsaw, Warsaw, Poland

2- Sandra Pucciarelli, School of Biosciences and Biotechnology, University of Camerino , IT

3- Hanna Fabczak, Department of Cell Biology, Nencki Institute of Experimental Biology, 3 Pasteur Street, 02-093, Warsaw, Poland.

3- Natalija Bojanic,Institute of Oceanography and Fisheries Šetalište I. Meštrovića 63, 21000 Split, Croatia (not present at the meeting but willing to participate).

- ***Total number of individual participants involved in the Action work.***

At present 24 research groups are involved in the Action work with a total number of 65 individual participants. 45% are represented by females. 37% are represented by Early Stage Researchers.

- ***Involvement of Early Stage Researchers in the Action, in particular with respect to STSMs, networking activities, and Training Schools***.

At least 7 Early Stage Researchers (ESRs) are involved in 7 STSMs (see details below). Furthermore, we expect to have at least 20 ESRs eligible of reimbursement involved in the Summer Training school that will be held in September 2012 in Camerino (Italy). We expect the participation of at least other 20 ESRs from research groups not yet involved in the action.

Involvement of researchers from outside of COST Countries.

One non-COST Country researcher is clearly involved in the Action from the beginning:
Alexey Potekhin, from the University of St-Petersburg, Russia. He is a component of the WG2 and he will give a contribution on the task: Bacterial symbiosis of ciliates.
Furthermore, we are in contact with the following groups:
1- I.V.Dovgal Schmalhausen, Institute of Zoologie B. Khmelnitsky str. 15 KIEV-30
01601 UKRAINE
2- Inacio Domingos da Silva Neto Universidade Federal do Rio de Janeiro - UFRJ
21941-590 Ilha do Fundão, Rio de Janeiro - RJ, Brasil
4- Wei Miao, Institute of Hydrobiology, Chinese Academy of Sciences, Wuhan, Hubei Province, China.
If possible, two member from USA, excellent in research in this field will be invited as trainers at the training school in September 2012

Advancement and promotion of scientific knowledge through publications and other outreach activities. - List of publication of 2012:

1-Swart EC, **Nowacki M**, Shum J, Stiles H, Higgins BP, Doak TG, Schotanus K, Magrini VJ, Minx P, Mardis ER, Landweber LF. The Oxytricha trifallax mitochondrial genome. Genome Biol Evol. 2012;4(2):136-54.
2- Chiappori F, **Pucciarelli S**, Merelli I, Ballarini P, **Miceli C**, Milanesi L.Structural thermal adaptation of β-tubulins from the Antarctic psychrophilic protozoan Euplotes focardii. Proteins. 2012 Apr;80(4):1154-66.
3- Yu T, Barchetta S, **Pucciarelli S**, La Terza A, **Miceli C**. A novel robust heat-inducible promoter for heterologous gene expression in Tetrahymena thermophila. Protist. 2012 Mar;163(2):284-95.
4- **Postberg J**, Tsytlonok M, **Sparvoli D, Rhodes D**, **Lipps HJ.** A telomerase-associated RecQ protein-like helicase resolves telomeric G-quadruplex structures during replication. Gene. 2012 Apr 15;497(2):147-54.

5- Coyne RS, Lhuillier-Akakpo M, **Duharcourt S**. RNA-guided DNA rearrangements in ciliates: Is the best genome defence a good offence? Biol Cell. 2012 Feb 21.
6- Vannini C, Ferrantini F, Ristori A, Verni F, **Petroni G**. Betaproteobacterial symbionts of the ciliate Euplotes: origin and tangled evolutionary path of an obligate microbial association. Environ Microbiol. 2012 Apr 26.
7- **Wloga D**, Frankel J. From Molecules to Morphology: Cellular Organization of Tetrahymena thermophila. Methods Cell Biol. 2012;109:83-140.
8- **Andersen KL, Nielsen H**. Experimental identification and analysis of macronuclear non-coding RNAs from the ciliate Tetrahymena thermophila. Nucleic Acids Res. 2012 Feb;40(3):1267-81. Epub 2011 Oct 3.
9- Tarcz S, **Potekhin A**, Rautian M, **Przyboś E**. Variation in ribosomal and mitochondrial DNA sequences demonstrates the existence of intraspecific groups in Paramecium multimicronucleatum (Ciliophora, Oligohymenophorea). Mol Phylogenet Evol. 2012 May;63(2):500-9. Epub 2012 Feb 8.
10- **Przyboś E**, Tarcz S, **Potekhin A**, Rautian M, **Prajer M**. A two-locus molecular characterization of Paramecium calkinsi. Protist. 2012 Mar;163(2):263-73.

Activities and projects with COST network colleagues.

Beside the consolidation of existing interactions between partners of COST Action (Meyer-Prajer-Nowacki-Duharcourt-Sperling-Nowak-Simon-Bétermier working on small RNA control, genome rearrangements, mating type, genome evolution), the following activities and projects with COST network colleagues have been planned as STSMs:
1- Analysis of the role of tubulin post-transcriptional modifications on microtubules functions. To carry out this project an ESR from Miceli's group (Italy) will spend 3 months in the Wloga's lab (Poland).
2- Analysis of the role of environmental changes on genome evolution. To carry out this project an ESR from Miceli's group (Italy) will spend 3 months in the Nowacki's lab (Swiss), and two early stage researchers from Nowacki' lab will spend two weeks into Postberg's lab (Germany)
3- One ESR from Lipps's lab (Germany) will spend 1-2 months in Meyer's lab (France) for the tasks of WG1 on chromatin organization and modification and one ESR from Lipps's lab (Germany) will spend 2 months in England (Rhodes's lab)
5- One ESR from Miceli's group (Italy) will spend 2 weeks in the Sperling's lab (France) to help in the annotation of Paramecium genome, and the construction of the web site.

The capacity of the Action members to raise research funds.

Members of the Action applied for research funds at national level on topics related to the COST action:

1- Mariusz Nowaski applied for a grant in Switzerland open only to researchers involved in COST actions (State Secretariat for Education and Research) proposing a project entitled "A role of non-Mendelian inheritance in environmental adaptation."

2- Cristina Miceli applied for a grant to the MIUR (Italian Ministry of Education, University and Research) with a project entitled: "Innovative methodologies to estimate ecological risks under the effects of pollutants and climate changes". In this project the use of ciliates as biosensors of pollutants, and to analyse the effects of environmental changes on the genome is proposed. This project is under review and priority is given to proposals connected with European networks.

3- Malgorzata Prajer applied for a national grant in Poland on a subject strictly related to the COST action, WG1.This application was open only to researchers involved in other European grants, such as this COST action.

Self evaluation

It is difficult to provide a self evaluation at this early stage of the COST Action.

We believe that preliminary successes are:

1-the creation of contacts among the different research groups that will increase the transfer of knowledge and technologies, and the improvement of the research basis established in the different groups of the European network.

2- the joining of other members in the network, in particular the groups that are not directly involved in epigenetics and open new perspectives of interactions.

3- the organization of the training school to attract early stage researchers on this topic, and to improve the transfer of knowledge.

The main drawbacks were:

1- the lack of interaction with groups that work with other model organisms.

The main difficulties encountered:

1-present isolation of some research groups and fragmentation of the research interests in this field