REPORT ON EUTOPIA-1, WG 4, FEBRUARY 2019

Davide Michieletto & Dorothy Buck

The EUTOPIA-1 meeting in Trento (5-8 February 2019) was a perfect opportunity to make a general survey on the topics of interest within WG4. From our point of view, the meeting was a success not only because of the proactive participation of the members, but also because discussion among WG4 members often involved other WGs, thus creating potential network-wide connections.

We showcased the research done in WG4 through few selected talks described below:

PRESENTED WORK

Cristian Micheletti - Computer simulations DNA translocation and knotted DNA

Noam Kaplan - 3D DNA/chromatin organisation in the cell nucleus through HiC methods

Andrzej Stasiak - Are Topologically Associated Domains Supercoiled?

Dusan Racko - DNA/Chromatin unknotting through Topoisomerase and SMC proteins

Giada Forte - DNA Braids and Plectonomes Dynamics

Agnese Barbensi - Mathematical Models for the action of Topoisomerase

Slobodan Zdravkovic - Solitons and Non-Linear Dynamics of DNA and Microtubules

Eoin Hurley - Re-wiring genes in bacteria

Bojana Lucic - HIV integration in the human genome and 3D organisation

The meeting was also an occasion to make practical plans for the future of the WG.

In particular, we highlight the following projects & activities:

NEW/ONGOING SCIENTIFIC PROJECTS

1.**Luca Tubiana**, **Davide Michieletto** and **Noam Kaplan** started a practical discussion on how to study the topology of the kinetoplast DNA using HiC methods and computer simulations. This feat has never been attempted before and it would lead to a better understanding of the interplay between topology and genome regulation in eukaryotes, one of the main scientific goals of the WG.

2.**Enzo Orlandini**, **Davide Michieletto** and **Cristian Micheletti** discussed an ongoing collaboration on understanding the behaviour of knots under confinement and under non-equilibrium conditions. This work will potentially result in a publication within the year.

3.Following the success of the first joint project recently published in Nature Communications (in which EUTOPIA is acknowledged), **Bojana Lucic** and **Davide Michieletto** discussed new projects on understanding HIV integration in the human genome and planned a series of experiments, bioinformatics analysis and computer simulations which will likely result in STSMs applications in the 2nd grant period.

4. **Enzo Orlandini** and **Cristian Micheletti** discussed an ongoing project on “multi-chain entanglement of DNA filaments”. Here, they expand on the notion of physical links to study entanglement in highly confined genomic DNAs (both linear and circular).

5. **Enzo Orlandini** and **Giada Forte** have current ongoing work on braids (presented by **Forte** in Trento). Future work will broaden this research by characterising the buckling transition of braids formed by three or more strands.

6. **Peter Virnau** in collaboration with Tim Stevens and Yakov Kantor is working on quantifying knotting, looping and 3D structure of chromatin from HiC contact maps (discussed by **Kaplan** in Trento).

7. **Andrzej Stasiak** with **Agnese Barbensi** and **Dorothy Buck** have discussed their joint work leading to a publication.

8. **Agnese Barbensi** and **Gkountaroulis** discussed ways in which to make Agnese’s model more computationally efficient.

STSM 1st GRANT PERIOD:

As far as we know, the following STSMs have been planned for the 1st GP:

1. **Jan Smrek** and **Davide Michieletto** will apply for a STSM for Jan to visit Davide in Edinburgh for 5 days in April (8-13). The aim is to bridge different models and algorithms to detect threadings in systems of rings and tadpoles.

STSM in 2nd GRANT PERIOD:

These are the potential STSMs which could be proposed in the 2nd GP:

1. Slobodan Zdradkovic - Enrico Carlon

2. Noam Kaplan - Davide Michieletto

3. Bojana Lucic - Davide Michieletto

4. Giada Forte - Enzo Orlandini

5. Cristian Micheletti - Davide Michieletto

6. Dusan Racko - Andrzej Stasiak

7. Peter Virnau - M Kardar

ENGAGEMENT AND EXPLOITATION:

In Trento **Ivan Coluzza** and **Davide Michieletto** started to gather information and devise a standard procedure to involve additional researchers (EU), observers (i.e. not EU) and companies into the Network. For example, **Cristian Micheletti** explicitly mentioned links with Oxford Nanopores, David Leigh and Joaquim Roca. These existing connections will be exploited to involve international companies and world-leading scientists into EUTOPIA. In the next weeks, we will send the procedures to the network chairs to be vetted. David Leigh was recently contacted and he enthusiastically accepted to become part of the network under WG2.