COST Action
Progress Report at 24 months
(19/09/2017 to 19/09/2019)

CA16217: European network of multidisciplinary research to improve the urinary stents

The Action was approved by the Committee of Senior Officials (CSO) on 23-6-2017 and has the MoU reference COST 028/17.

This report was submitted on 17-10-2019 by the Action Chair on behalf of the Management Committee in fulfilment of the requirements of the rules for COST Action Management, Monitoring and Final Assessment.

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Action leadership and participants

Leadership positions

Position	Name	Contact details	Country*
Chair	Dr Federico Soria	fsoria@ccmijesususon.com +0034927181032	Spain

Position	Name	Contact details	Country*
Vice Chair	Prof Evangelos Liatsikos	liatsikos@yahoo.com +302610994479	Greece

Working groups

#	WG Title	# of participants	WG Leader	Country*
1	State of art of Urinary stents.	25	Dr Duje Rako duje.rako@gmail.com	Croatia
2	Computational simulation, Biomedical fluid dynamics, Biomechanical characterization.	25	Prof Sarah Waters waters@maths.ox.ac.uk	United Kingdom
3	Methodology for the development and validation of new stent designs.	25	Dr Sotir Stavridis stavridis.sotir@gmail.com	North Macedonia
4	Biomaterials and stent coatings.	25	Dr Alexandre Barros alexandrebarros27@gmail.com	Portugal
5	Drug Eluting Stents (DESs).	25	Prof Gianluca Ciardelli gianluca.ciardelli@polito.it	Italy
6	Future research lines (Bioactive-Antibody, Biocovered stents, Biodegradable, Nanotechnology, Bioprinting).	25	Dr Niels-Peter Buchholz noor.buchholz@gmail.com	United Kingdom

Other key leadership positions

Position	Name	Contact details	Country*
STSM Coordinator	Dr Dario Carugo	d.carugo@soton.ac.uk	United Kingdom
Science Communication Manager	Dr Nuno Azevedo	nuno@pereira-azevedo.com	Portugal
GH Scientific Representative	Dr Federico Soria	fsoria@ccmijesususon.com	Spain

* The country displayed is:

- for the Action Chair, the country that nominated that person to the Management Committee before they were elected Action Chair;
- for the Vice Chair the country that nominated the person as a Management Committee Member,
- for all other leadership positions, if the person is a MC Member the country displayed is the country

of nomination, otherwise it is the country of the person's primary work affiliation.

Participants

COST members having accepted the MoU

AT	31/07/2017	**BE**	14/09/2017	**BA**	22/02/2018	**BG**	19/12/2017	**HR**	15/07/2017
DK	03/08/2017	**EE**	21/07/2017	**FI**	12/09/2017	**FR**	27/07/2017	**DE**	19/07/2017
EL	13/07/2017	**HU**	09/10/2017	**IS**	01/09/2017	**IE**	13/09/2017	**IL**	20/07/2017
IT	06/09/2017	**MT**	11/07/2017	**NL**	09/04/2018	**MK**	19/07/2017	**NO**	11/09/2017
PL	26/07/2017	**PT**	28/07/2017	**RS**	07/06/2018	**SK**	15/06/2018	**SI**	19/12/2018
ES	22/08/2017	**SE**	05/09/2017	**CH**	11/07/2017	**TR**	06/03/2018	**UK**	14/08/2017

Other participants

Institution Name	Country
University of British Columbia	Canada
Institute of Taewoong Medical	South Korea
University of Minnesota	United States
Global Hospital	India
3D Bioprinting Solutions	Russian Federation
University of British Columbia	Canada

Summary

The main aim and objective of the Action is to

To create a multidisciplinary group to identify the inherent problems in urinary stents related to: design, composition, biomaterials, coatings, encrustation, urinary tract-stent interaction, fluid dynamics and physiologic effects on the urinary tract. The second objective is to improve urinary stents, creating synergies from multidisciplinary network: bioengineers, urologist, translational researcher, etc.

During its first two years the Action progressed the achievement of this as described below

The main objective of the network which is to create a multidisciplinary group has been achieved. The number of members of the network is 239, when the number of proposers was 75. The activities that have been carried out to date have been attended by 135 members, and 17 STSMs have been carried out. The main evidence that we are a multidisciplinary group is that among the members of the network are: urologists, industrial partners, engineers (biomedicine, materials, industrial, computing, chemistry), chemists, pharmacists, mathematicians, physicists, microbiologists, biologists, biochemists, veterinarians. So we have managed to bring together a large group of experts and ECIs interested in researching and improving urinary stents.

The second objective, which is the improvement of urinary stents, is a process we are working on. Today, thanks to the multidisciplinary work we can evidence a number of certainties to improve urinary stents. The main efforts being made focus on stent coatings, especially to reduce biofilm formation, providing stents with anti-adhesive coatings, by electrostatic means, peptides, drugs, contact killing biomaterials, etc. Another of the important evidences detected by the members of this COST Action is the importance of fluid dynamics in stent design (Computational modelling of fluid-structure interaction). As well as the use of new biodegradable biomaterials that is leading to a breakthrough of this network.

As evidence of the research work and its dissemination, network members (mainly ECIs) have presented and defended 77 oral communications in the ENIUS activities carried out in these first 24 months.

Action website

https://www.enius.org/

Achievement of MoU objectives, deliverables and additional outputs/ achievements

MoU objectives

The Action reported the following progress in achieving its specific objectives.

MoU objective	Level of progress	Further information (hyperlink or other)
To determine the causes of failure and adverse effects of urinary stents from the medical point of view and industrial design, by systematic review and meta-analysis.	51 - 75%	This first objective is being carried out directly by WG1. They have been distributed in three blocks to speed up the Systematic reviews. Dr. D. Rako (WG1 leader) is in charge of the SR on "metallic ureteral stents". Dr. P. DeGraaf is in charge of the SR on "urethral stents". Finally, Dr. F. Soria (Chairman) is in charge of the SR on "polymeric ureteral stents". The phases of bibliographic review and selection of the scientific papers have been completed, as well as the finalization of the criteria for inclusion and exclusion of these SRs. 16 ENIUS members who are working on these SRs have been selected. Funds have been budgeted in the Work Budget plan to advertise these SRs in open access during this GP3.
Develop multidisciplinary guidelines for the evaluation and validation new stent designs at computational, experimental and preclinical level.	0 - 25%	The measures and a detailed contingency plan have been put in place to redirect the tasks related to this objective.
Assess opportunities for improved stents related to the evaluation of new biomaterials, Nano-Technology applications, new coatings, eluting drugs stents and biodegradable stent materials.	26 - 50%	In the last TS held in Lublin (Poland) and previously in the WG meeting in Sofia (Bulgaria) definite progress was made in the tasks of this objective. It is a joint work of WG4 and WG5 (Dr. A. Barros-WG4 leader and Prof. G. Ciardelli- WG5). The database of biomaterials is being completed in the established period. A mini-review has been designed to publish in a scientific journal the update of biomaterials and drug-eluting stents in urinary stents.
To develop a realistic computational environment to assess the Computational simulation and modelling and computational fluid dynamics to evaluate new urinary stents designs	0 - 25%	The main final product of this WG2 is a set of guidelines for the development of computational frameworks to develop and validate the characteristics of the new stents. Several scientific papers will be produced. The first will be a review of what is currently known about the biomechanics of the urinary tract, both with and without stents. This will provide a database for researchers aiming to develop computational frameworks of the urinary tract. A second paper will review the current state of the art of computational simulation of urinary tracts with and without stents, together with in vitro validation. Finally, a whitepaper, entitled “Computational simulation in urinary stents’’, will be written, which sets out future challenges and research questions in the field of computational models for urinary stents. In this GP3, it has been confirmed that the first scientific paper related to the described objective will be sent.
Stimulate innovative scientific ideas and propose new lines of	26 - 50%	This objective is one of the greatest advances in this network. The different groups have been able to contact each other and Research groups that were initially very far from the area of work of urinary stents have been finding links that allow foresee great advances in stent research.

research and technological innovation in the field of urinary stents. To prepare for subsequent research Projects to design ureteral and urethral stents to reduce the complications and morbidity.		The application of nanotechnology to urinary stents, as well as tissue engineering are new lines that have been implemented in this network. There is already a research group within the network that is promoting an H2020 project. Within this third great period, the first WG6 Workshop will be held, which is directly related to this challenging objective.
To consolidate a multidisciplinary network (urologist, translational researcher, bioengineer, etc.) actively involved in urinary stents research to facilitate scientific knowledge exchange through, workshops, training schools, scientific papers, and guidelines.	51 - 75%	The following have been completed to date: 3 Worshops; 4 Training schools; 2 scientific papers related to the research of this network have been published and the results of WG1 and 2 will be published soon. In most of these activities, at the end of the activity a Proceedings Book is published with the trainers' conferences and the trainees' oral communications (77).
To create a cohort of skilled bioengineer/researchers with experience in stents by providing training courses and supporting Exchange visits between Research Centres or Hospitals.	51 - 75%	A total of 17 STSMs have been carried out to the date of this report. This has allowed 17 young researchers to be trained in techniques they do not have in their laboratories or University Hospitals. As well as contacting groups that strengthen their lines of research.
This COST Action will play a seminal role in facilitating links within researchers and industrial communities. A transfer of technological knowledge to the industry will foster industrial competitiveness of Europe.	26 - 50%	During these first two years, 10 industrial partners have been included among the members of the network. They regularly attend activities such as Workshops or Training Schools, which has made it possible to connect many projects or initiatives with the industry. In our second most recent TS held in Bern (Switzerland), emphasis was placed on this idea "Ureteral stents: from modelling to commercialisation".

Deliverables

The Action reported the following progress with achieving its deliverables

Deliverable	Month deliverable due	Delivery status	Further information (hyperlink or other)
Report on the state of the art in the field of urethral & ureteral stents, including scientific publications related to the WG1 of the Action.	12	Not delivered, but expected before end of Action	
Report of the state of art of “In silico and urinary stents, biomechanical specifications in urinary tract, and computational simulation in urinary stents and future”, including scientific publications related to the WG2 and yearly Training schools, meetings, workshops and STSM.	44	Not delivered, but expected before end of Action	
Report on Comprehensive Methodology and Validation protocol on new stent designs, including scientific publications related to the WG3 of the Action (M24), with training school and STSM related to the WG3 of the Action.	24	Not delivered, but expected before end of Action	
Report on the State of art on new Biomaterials and Coatings suggest to Urinary environment, including scientific publications related with WG4 of the Action to the urinary environment (M36). During the third year, a Training School focused on the issues addressed by this WG4.	36	Not delivered, but expected before end of Action	
Report on Drugs assessed for DESs to reduce the urinary stents´s morbidity, including scientific papers and training school, meetings, workshops and STSM related to the WG5 of the Action.	44	Not delivered, but expected before end of Action	
Report on New technological opportunities in urinary stents manufacturing. Future in urinary stents, including scientific papers and training school, meetings, workshops and STSM related to the WG6 of the Action.	48	Not delivered, but expected before end of Action	
Midterm reports of the Action, including the main scientific achievements and monitored activities of the Management Committee.	24	Not delivered, but expected before end of Action	
Final reports of the Action, including the main scientific achievements and monitored activities of the Management Committee.	48	Not delivered, but expected before end of Action	
Report after first Management Committee meeting, including activities performed during the relevant period of the action meetings, an account of scientific advances in technical WGs, including publications and a report monitoring activities of management committee and (STSM, ECI, gender balance, and dissemination activities).	12	Delivered	https://intranet.enius.org/mod/forum/discuss.php?d=28
Report after second Management Committee meeting, including activities performed during the relevant period of the action meetings, an account of scientific advances in technical	24	Delivered	https://intranet.enius.org/mod/forum/discuss.php?d=29

WGs, including publications and a report monitoring activities of management committee and (STSM, ECI, gender balance, and dissemination activities).			
Report after third Management Committee meeting, including activities performed during the relevant period of the action meetings, an account of scientific advances in technical WGs, including publications and a report monitoring activities of management committee and (STSM, ECI, gender balance, and dissemination activities).	36	Not delivered, but expected before end of Action	
Report after fourth Management Committee meeting, including activities performed during the relevant period of the action meetings, an account of scientific advances in technical WGs, including publications and a report monitoring activities of management committee and (STSM, ECI, gender balance, and dissemination activities).	48	Not delivered, but expected before end of Action	

Additional outputs/ achievements

The Action reported 2 publications on the topic of the Action, co-authored by at least two Action participants from two countries participating in the Action, and for which the Action networking was necessary.

The Action has also produced the outputs/ achievements described below.

Co-authored Action publications - peer-reviewed

1. doi:10.1007/s12551-019-00590-7

Title	Mechanobiology of cells and cell systems, such as organoids
Authors	Ece Bayir; Aylin Sendemir; Yannis F. Missirlis
DOI	doi:10.1007/s12551-019-00590-7
Type	Journal article
Published in	Biophysical Reviews
Published by	Springer Science and Business Media LLC
ISSNs	1867-2450; 1867-2469
Subjects	Biophysics; Molecular Biology; Structural Biology
Links	http://link.springer.com/content/pdf/10.1007/s12551-019-00590-7.pdf; http://link.springer.com/article/10.1007/s12551-019-00590-7/fulltext.html

2. doi:10.3390/coatings8110376

Porous ZnO/2–Hydroxyethyl Methacrylate Eluting Coatings for Ureteral Stent Applications. Laurenti M, Grochowicz M, Cauda V. *Coatings* 2018, *8*(11), 376; https://doi.org/10.3390/coatings8110376.

Proposals/ projects

The Action reported 1 project(s) and 0 proposal(s) resulting from the Action networking.

Key details of the projects are shown below:

1. Development and validation of a biologically inspired in vitro platform for long-term assessment of commercial and innovative ureteral stents”
(National)

Other outputs / achievements

N/A

Impacts

The Action reported the following impact(s):

Description of the impact, i.e. what will change, and for whom, as a result of what the Action achieved	Type of impact	Timing of impact
One of the direct impacts on this network is related to the inclusion of new disciplines in the area of urinary stents. We consider the inclusion of computational simulation and fluid dynamics in studies related to adverse effects and new designs of urinary stents to be of great importance and this has been identified in the ENIUS meetings. This new vision can improve many aspects related to urinary stents, which are currently poorly researched.	• Scientific / Technological	Foreseen within two years of the end of the Action
Thanks to the network, research groups have been able to overcome their weaknesses thanks to the strengths of other ENIUS groups. This has been done thanks to the meetings as well as the STSMs. This is a great impact as it allows the advancement of stent research and reduces the limitations of the research groups.	• Scientific / Technological	Foreseen two-to-five years after the end of the Action
An important socioeconomic, but also scientific, impact of this network related to the new stent coatings has been detected. A large number of research groups involved in ENIUS network are working on new coatings mainly to reduce stents bacterial adhesion and thus prevent urinary tract infections that affect patients today. Thanks to the joint work of the network, several groups have started to work and/or improve their coatings with the help of other ENIUS groups. This will allow a more direct and quicker progress in obtaining new coatings, which will improve the life of the patients.	• Scientific / Technological • Economic	Foreseen five-to-ten years after the end of the Action
Another impact that will foreseeably be achieved with this network is the inclusion of different disciplines that were not part of urinary stents. We can mainly mention the inclusion in the network and therefore the knowledge of disciplines such as vascular stents, drug-eluting stents, three-dimensional printing, and the application of cell biology for the development of biorecovered stents. The important and beneficial impact that the inclusion in the network of specialist groups in these disciplines is primordial to advance in new designs more efficient and with less adverse effects of urinary stents.	• Scientific / Technological • Economic • Societal	Foreseen five-to-ten years after the end of the Action
The first direct impact of this network is to identify the causes of failure of current urinary stents from a multi-disciplinary point of view. This will allow the scientific community and stent companies to have the keys to improve urinary stents.	• Scientific / Technological • Economic • Societal	Foreseen by the end of the Action

Dissemination and exploitation of Action results

Dissemination and exploitation approach of the Action

The Action's dissemination and exploitation approach as well as all activities undertaken to ensure dissemination and exploitation of Action results and the outcomes of these activities are described below.

Dissemination strategies include the following: -A dedicated website. (www.enius.org), which provides information on the objectives of the network, as well as the activities carried out (STSMs, TS, Workshops) and how to register in CA16217. -Twitter, (@enius_org). A very active account that disseminates daily the activities of the network, as well as the achievements of ENIUS members. -Links to the scientific papers resulting from the work of the WGs, STSMs or dissemination meetings in our website. Open access. -Dissemination Meetings for MC members. -ENIUS members have received different invitations to spread our network in different national Meetings, mainly of Urology. -Workshops help for both knowledge development and dissemination within ENIUS partners. -We are developed four Training Schools right now. -STSMs serve us to spread the objectives of the network, as well as to attract new members interested in participating in our network. To date, the strategies presented have shown their effectiveness. The network is composed of 239 members (75 in the proposal).

Dissemination

Dissemination meetings funded by the Action

The Action funded Dissemination Meetings as shown below:

Title	4th international symposium on Nanoengineering for Mechanobiology		
Date	24-03-2019 to 27-03-2019	**Country**	Italy
Event	4th international symposium on Nanoengineering for Mechanobiology (N4M)		

Other dissemination activities

The Action also undertook the following dissemination activities:

Activity	XXVIII National Meeting of the Lithiasis and Endourology, Laparoscopy and Robotics Groups (Spanish Urological Association). 25-26 January 2018 (Cordoba-Spain). Dr. F. Soria (Action Chairman). ENIUS. COSTs actions.
Target	300 spanish endourologist. The specialists of urinary stents and stent specialists and experts in their clinical problems.
Outcome	The conference allowed us to spread the network and get more clinical members for this multidisciplinary network.
Link	https://posters.aeu.es/capitulo.aspx?id=82

Activity	LII Regional Valencia Urology Congress. Elda (Alicante-Spain), 23-24 february, 2018. Dr. F. Soria (Action Chair). ENIUS (European network of multidisciplinary research to improve the urinary stents).
Target	120 young and seniors urologist from the Valencia Community (Spain)
Outcome	The conference allowed us to spread the network and get more clinical members for this multidisciplinary network.
Link	https://www.webaucv.org/congreso-de-la-aucv-2018/

Activity	LXXXIII Urology Spanish National Congress. Gijón (Spain) 2018; 13-16 june. Dr. F. Soria (Action Chair). Lecture: ENIUS (European network of multidisciplinary research to improve the urinary stents).
Target	More than 1200 Spanish urologist. Members of the Spanish Urology Association.
Outcome	This conference in plenary session allowed the dissemination of the ENIUS network among all Spanish urologists, being the largest national dissemination forum for specialists in Urology. At the end of the conference many young urologists were interested in ENIUS to participate in this network.
Link	https://www.aeu.es/aeu_webs/librosabstracts/aeu2018/

Activity	IV Hands-On Training skills programme on Laparoscopy and Endourology. Caceres (Spain), 12-14 February, 2019. Endorsed by European Association of Urology. Dr. F. Soria. Lecture. ENIUS. COSTS Actions.
Target	20 young urologist from more than 10 different european countries.
Outcome	This conference in this Hands on allowed the dissemination of the ENIUS network among young european urologist.
Link	https://uroweb.org/education/live-events/meetings/

Exploitation activities

The Action undertook the following activities to ensure exploitation (use, in particular in a commercial context) of the Action's achievements:

No input provided by the Action

Action Expenditure

The table below shows the budget allocated to the Action for each Grant Period (funds allocated for the first meeting of the Action and any Final Action Dissemination are not included):

#	Grant Period	Start Date	End Date	Budget allocated to Action (EUR)
1	AGA-CA16217-1	1-11-2017	30-4-2018	64,469.00 (EUR)
2	AGA-CA16217-2	1-5-2018	30-4-2019	163,623.75 (EUR)
3	AGA-CA16217-3	1-5-2019	30-4-2020	148,999.75 (EUR)
4	AGA-CA16217-4	1-5-2020	30-4-2021	122,866.00 (EUR)