



Extracellular vesicles from a natural source for tailor-made nanomaterials

VES4US

[D6.2] Training Plan

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1. INTRODUCTION

VES4US aims at developing a radically new platform for the efficient production and functionalisation of Extracellular Vesicles (EVs) obtained from a renewable source, which will enable their exploitation as tailor-made products in the fields of nanomedicine, cosmetics and nutraceuticals.

The main aim of Work Package 6 (WP-1) as part of VES4US is to consider core management and good research practice aspects to deliver high quality outcomes, to ensure their adequate dissemination and to guarantee cross-fertilisation of ideas and skills via integrated training actions at all levels of the consortium structure. Detailed actions as part of an ambitious training and exchange programme will be undertaken to encourage and improve the interdisciplinary of the methodologies employed in VES4US and enhance cooperation and synergy between the consortium members. This will be realised by visits to host institutions, online interactions and also when feasible the organisation of 'hands-on' workshops on specific thematic during the yearly meetings.

Deliverable 6.2 constitutes the training plan for VES4US and its date for submission was purposely set early in the timeframe of the planned scientific activities to encourage joint reflexion and to stimulate the exchange of ideas in the view to identify the necessary skills needed to make them fructify. This training plan details as best feasible at the time of its submission (month 03) the projected training activities which will be sought during the duration of VES4US and it comprises specific needs which were identified for all partners within the consortium.

The training plan of VES4US acknowledges the dynamic nature of FET Open projects and indeed the varying needs which may arise at particular stages of the work programme, possibly requiring adjustments as new results are generated. Future additions which may ensue will hence be documented in the yearly reports submitted as other deliverables in other work packages. This deliverable might also be updated should it be considered a better option.

Training was considered for this deliverable at all levels of the consortium structure (eg. administrative and/or technical support, PhD students, contracted researchers, post-docs, principal investigators, task leaders or work package leaders) and is viewed henceforth both in terms of typical practical hands-on activities as well as any such action which could contribute toward the transdisciplinary development of the personnel involved in the project and the better functioning of research teams.

The tables presented in this document list a variety of training activities as envisaged for each of the work packages within VES4US. The numerous actions listed are varied in nature and encompass for example theoretical knowledge acquisition, sound experimental design, technical skill development in terms of methods and instrumentation, self-improvement initiatives via online courses or other electronic resources, presentation and writing skill improvement for more efficient communication of science, good laboratory practices for data collection, storage and analysis, exposure to new knowledge and idea exchange, exposure to administrative practices in other institutions (contracts, procurement, recruitment, dissemination approaches, teaching, academia, partner search strategies) or personal enrichment and cultural appreciation of the diversity of approaches to commonly shared academic, administrative, technical or professional issues. The plan contains a significant proportion of activities which are internally controlled (consortium members training other members) but also training which is provided by external parties (eg. online courses from universities or workshops organised via other fora such as FETFX and FET2RIN).



Table 1. VES4US training activities relative to the tasks of Work Package 1.

WP-1							
Relevant Tasks	Training beneficent / role	Institution of trainee	Training activities	Host + location	Training provider	Training period	Frequency
1.1 / 1.2	Elena Barone (PhD)	ITS	Microalgal cultivation / antioxidant and antimicrobial assays / FAME analysis / pigment analysis	ITS / Sligo	N TOUZET	Months 01-06	continuous
	Anita Aranyos (PhD)	ITS	Microalgal cultivation / antioxidant and antimicrobial assays / FAME analysis / pigment analysis	ITS / Sligo	N TOUZET	Months 01-06	continuous
	David Fierli (PhD)	ITS	Microalgal cultivation / antioxidant and antimicrobial assays / FAME analysis / pigment analysis	ITS / Sligo	N TOUZET	Months 01-06	continuous
	Carolina Paganini (PhD)	ETHZ	Microalgal cultivation	ITS / Sligo	N TOUZET	Months 01-06	1 week
	Darja Božič (PhD)	UL	Microalgal cultivation	ITS / Sligo	N TOUZET	Months 01-06	1 week
	Antonella Bongiovanni (PI)	CNR IBIM	Microalgal cultivation	ITS / Sligo	N TOUZET	Months 01-06	1 week

Table 2. VES4US training activities relative to the tasks of Work Package 2.

WP-2							
Relevant Tasks	Training beneficent / role	Institution of trainee	Training activities	Host + location	Training provider	Training period	Frequency
2.1	PostDoc TBD	IBIM	EV characterisation and handling	IBIM-CNR	A BONGIOVANNI D ROMANCINO	Months 04-12	continuous
	PhD TBD	IBIM	EV characterisation and handling	IBIM-CNR	D. ROMANCINO PostDoc TBD	Months 13-18	continuous
	Immacolata Fiume (PhD)	IBBR	Advanced and novel EV isolation methods	IBBR-CNR	V KRALJ IGLIC A IGLIC	Months 04-07	
	ER oncontract	IBBR	Acquisition of new knowledge and basic skills relative to established EV isolation methods used by the consortium	IBBR-CNR	G POCSFALVI	First 3 months after the contract signed	
	Gabriella Pocsfalvi (PI)	IBBR	Membrane and EV biophysics; Advanced and novel EV isolation methods	IBBR-CNR	V KRALJ IGLIC A IGLIC	Months 04-07	
	Gabriella Pocsfalvi (PI)	IBBR	Vesicle size fractionation by tangential flow filtration	ITS / Sligo	N. TOUZET	Months 12-24	
	Post-doc and/or Mauro Manno (Task Leader)	IBF	Advanced and novel SEC-based EV isolation methods & membrane biophysics	IBBR-CNR	G POCSFALVI V KRALJ IGLIC A IGLIC	Months 06-07	1 week
	Elena Barone (PhD)	ITS	Vesicle size fractionation by tangential flow filtration	ITS / Sligo	N TOUZET	Months 03-09	continuous
	Anita Aranyos (PhD)	ITS	Vesicle size fractionation by tangential flow filtration	ITS / Sligo	N TOUZET	Months 03-09	continuous
	David Fierli (PhD)	ITS	Vesicle size fractionation by tangential flow filtration	ITS / Sligo	N TOUZET	Months 03-09	continuous
	Immacolata Fiume (PhD)	IBBR	Acquisition of new knowledge in molecular imprinting techniques Training in laboratory skills relative to polymer synthesis for bioseparation	IBBR-CNR	From ER Online-courses, Literature invited researcher	1 st year 2 nd year: expert	

	PostDocor PhD	IBBR (Di Schiavi)	Acquisition of knowledge& skills relative to established EV isolation methods used by the consortium (UC, SEC and commercial kits). Instructions on vesicle handling and storage andon quality control standards after sample shipment	IBBR-CNR Napoli	G POCSFALVI	Months 13-14	2 weeks
2.2	ImmacolataFiume (PhD)	IBBR	1. Acquisition of new knowledge in molecular imprinting techniques; 2. Basic level training in laboratory skills in polymer synthesis for bioseparation	IBBR-CNR	ER; online-courses Literature; invited researcher	1 st year 2 nd year: invited expert	
	PostDoc and PhD	ETHZ	Acquisition of knowledge & skills relative to established EV isolation methods used by the consortium (UC, SEC and commercial kits).	IBBR-CNR	G POCSFALVI	Months 6-8	
	GabriellaPocsfalvi (PI)	IBBR	1.Synthesis routes of MiPs, 2. Scaling-up and industrialization process	IBBR-CNR	Autodidact invitedexpert	1 st year 2 nd year: Invited expert 3 rd yea	
	PostDoc and PhD	ETHZ	Synthesis of chromatographic materials	ETH Zurich	Literature	Months 6-12	continuous
	PostDoc and PhD	ETHZ	Bioprocesses, continuous operation, downstream and upstream. Synthetic polymer reaction engineering and colloid engineering.	ETH Zurich	P AROSIO	1 st year 2 nd year	
	ER to be hired	IBBR	Bioprocesses, continuous operation, downstream and upstream. Synthetic polymer reaction engineering and colloid engineering.	ETH Zurich	P AROSIO	2 nd year	
2.3	PostDoc TBD	IBIM	Standardisation of EV procedures	IBIM-CNR IBIM-IEOS IBIM-IGB UL	A BONGIOVANNI on-line training G LIGUORI AM KISSLINGER V KRALJ IGLIC A IGLIC	Months 10-12 and Months 21-23	continuous

Table 3. VES4US training activities relative to the tasks of Work Package 3.

WP-3							
RelevantTasks	Training beneficent / role	Institutionoftrainee	Training activities	Host + location	Training provider	Training period	Frequency
3.1	MeiyuGai (Postdoc)	MPIP	Instructions on vesicle handling and storage by producing partners, development of quality control standards after sample shipment	MPIP	G POCSFALVI A IGLIC A BONGIOVANNI	Months 03-06	continuous
	MeiyuGai (Postdoc)	MPIP	Training for sample preparation and conduction of TEM measurements of vesicles, using model systems (liposomes)	MPIP	MPIP group leader (I LIEBERWIRTH)	Months 03-06	1 week
	MeiyuGai (Postdoc)	MPIP	Training for size distribution analysis via DLS, using model systems (liposomes)	MPIP	Technician (C ROSENAUER)	Months 01-04	1 week
	MeiyuGai (Postdoc)	MPIP	Training on characterization methods for vesicle charge: zeta potential and particle charge detection (PCD)	MPIP	Technician (E MUTH)	Months 01-04	1 week
	MeiyuGai (Postdoc)	MPIP	Training on data analysis and interpretation for stability of vesicles in biological fluids (blood plasma)	MPIP	S MORSBACH	Months 01-06	1 week
	PostDoc and PhD	ETHZ	Physical characterisation of EVs isolated from microalgal cultures	IBF-CNR	M MANNO	Months 06-12	
	PostDoc and PhD	ETHZ	Immunoblotting-based characterisation of EVs isolated from microalgal cultures	IBIM-CNR	A BONGIOVANNI	Months 06-12	
	PostDoc and PhD	ETHZ	Characterization methods for vesicle charge:zeta potential and particle charge detection. Stability analysis of vesicles in biological fluids.	MPIP		Months 06-12	
	David Fierli (PhD)	ITS	Physical characterisation of EVs isolated from microalgal cultures	CNR / IBF / Palermo	M MANNO	Months 06-12	1 week
	David Fierli (PhD)	ITS	Immunoblotting-based characterisation of EVs isolated from microalgal cultures	CNR / IBIM / Palermo	A BONGIOVANNI	Months 06-12	1 week

	Postdoc TBD	IBF	Physical characterisation of EVs isolated from microalgal culture	CNR/IBF	M. MANNO	Months 12-24	continuous
	PostDoc and PhD	IBIM	Physical characterisation of EVs isolated from microalgal cultures	CNR / IBF / Palermo	M MANNO V. MARTORANA R. CARROTTA	Months 06-08 Months 16-18	continuous
	David Fierli (PhD)	ITS	Course on 'Basics of extracellular vesicles' (www.courser.org)	Online	Universityof California	Months 02-04	weekly lectures
	Anita Aranyos (PhD)	ITS	Course on 'Basics of extracellular vesicles' (www.courser.org)	Online	Universityof California	Months 02-04	weekly lectures
	Elena Barone (PhD)	ITS	Course on 'Basics of extracellular vesicles' (www.courser.org)	Online	Universityof California	Months 02-04	weekly lectures
3.2	PostDoc and PhD	ETHZ	Microfluidic technology, optical and fluorescence microscopy. Applications in measurements of sizes, interactions, rheology, micro-rheology, separation.	ETH Zurich	P AROSIO	1 st year 2 nd year	
	Meiyu Gai (Postdoc)	MPIP	Methodology of microfluidics for comparison of samples between labs, forwarding of SOPs	MPIP	P AROSIO	Months 12-18	continuous
	Postdoc and M. Manno	IBF	Methodology of microfluidics for comparison of samples between labs	ETHZ	P AROSIO	Months 12-18	
	David Fierli (PhD)	ITS	Microfluidics-based separation and isolation of microalgal cells and vesicles	ETHZ	P AROSIO	Months 27-33	1 week
3.3	Anita Aranyos (PhD)	ITS	Proteomics and metabolomics based analysis of microalgal biomass and vesicles	CNR / IBBR / Napoli	G POCSFALVI	Months 18-24	1 week
	Postdoc	IBF	Proteomics and metabolomics based analysis of microalgal biomass and vesicles	CNR / IBBR / Napoli	G POCSFALVI	Months 18-24	
	Meiyu Gai (Postdoc)	MPIP	Methodology of protein and biocargo characterization for comparison of samples between labs, forwarding of SOPs	MPIP	G POCSFALVI	Months 18-24	continuous
3.4	PostDoc TBD	IBIM	LipidprofilingofEVs	Autodidact Learning and invited expert	A BONGIOVANNI	Months 18-20	continuous

Table 4. VES4US training activities relative to the tasks of Work Package 4.

WP-4							
RelevantTasks	Training beneficent / role	Institutionoftrainee	Training activities	Host + location	Training provider	Training period	Frequency
4.1	Anita Aranyos (PhD)	ITS	Assessment of microalgal vesicle loading and/or functionalisation efficiency	MPIP	K LANDFESTER	Months 18-24	1 week
	PostDoc and PhD TBD	IBIM	Microalgal vesicle loading strategies	MPIP	K LANDFESTER	Months 18-24	1 week
	Postdoc (TBD) and Rita Carrotta (researcher)	IBF	Microalgal vesicles loading strategy	MPIP	K LANDFESTER	Months 18-24	1 week
4.2	MeiyuGai (Postdoc)	MPIP	Training for general preparation of liposomes as model systems for functionalization strategy	MPIP	S MORSBACH	Months 06-12	3 weeks
	MeiyuGai (Postdoc)	MPIP	Development of synthetic skills for protein functionalization with azide groups	MPIP	K LANDFESTER	Months 06-12	3 weeks
	MeiyuGai (Postdoc)	MPIP	Development of synthetic skills for vesicle functionalization with alkine groups and subsequently copper-free click chemistry approaches	MPIP	K LANDFESTER	Months 06-12	3 weeks
	MeiyuGai (Postdoc)	MPIP	Communication of protocols for subsequent in vitro and in vivo testing of vesicles to optimize sample preparation and delivery for experiments	MPIP	A BONGIOVANNI N TOUZET E DI SCHIAVI	Months 06-12	continuous
	MeiyuGai (Postdoc)	MPIP	Knowledge exchange about handling of siRNA or other genetic material as cargo	MPIP	Literatureresearch h A BONGIOVANNI	Months 12-24	continuous
	MeiyuGai (Postdoc)	MPIP	Development of functional assays for determination of successful surface functionalization of vesicles	MPIP	K LANDFESTER	Months 12-24	3 weeks
	MeiyuGai (Postdoc)	MPIP	SOPs for preparing required samples for microfluidics	MPIP	P AROSIO	Months 12-24	continuous
4.3	PostDoc and PhD	ETHZ	Purification and characterization of functionalized EVs	ETH Zurich	Expertise gained during tasks 2.1, 2.2, 3.1, 3.2 consortium labs	Months 12-24	

Table 5. VES4US training activities relative to the tasks of Work Package 5.

WP-5							
RelevantTasks	Training beneficent / role	Institution of trainee	Training activities	Host + location	Training provider	Training period	Frequency
5.1	PostDoc and PhD	IBIM	Confocal microscopy \techniques	IBIM and consortium member labs	Autodidact Learning and invited expert	Months06-18	continuous
	Post-doc (TBD)	IBF	Training on EV uptake by Confocal Microscopy	Consortium member labs	Exchange via staff and student travel among the consortium member labs	Months 12-24	continuous
	PostDoc and PhD	ETHZ	Purification of functionalized EVs	ETH Zurich	Expertise gained during tasks 2.1, 2.2, 3.1, 3.2	Months 12-24	
	Rachel Parkes (PhD)	ITS	Bioactivity of microalgal extracts on human cell lines	CNR / IBIM / Palermo	A BONGIOVANNI	Months 28-33	2 weeks
5.2	Elena Barone (PhD)	ITS	Flow-cytometry based analysis of microalgae, vesicles and bacteria	UL	V IGLIC	Months 24-30	1 week
5.3	Elena Barone (PhD)	ITS	Bioactivity of microalgal extracts on invertebrate model <i>C. elegans</i>	IBBR / CNR / Napoli	E DI SCHIAVI	Months18-24	2 weeks
	PostDocor PhD	IBBR (Di Schiavi)	Acquisition of knowledge& skills relative to methods specific to the invertebrate model <i>C. elegans</i> -	IBBR-CNR Napoli	E DI SCHIAVI	Months 13-18	continuous

Table 6. VES4US training activities relative to the tasks of Work Package 6.

WP-6							
Relevant Tasks	Training beneficent / role	Institution of trainee	Training activities	Host + location	Training provider	Training period	Frequency
6.1	ALL PARTNERS (experienced researchers, Post Docs, task leaders, PIs, admin staff)	ALL CONSORTIUM	EU Project management	Online	CNR-IBIM + ZABALA	Months 00-36	One session in Month 6 and more if needed
6.2	TASK LEADERS	ALL CONSORTIUM	Principles and Tools for quality management of a research laboratory and Definition of a Quality Plan Month 1: Quality principles and Quality Documents Month4-5: Lab Notebook, SOPs, Guidelines Month 8. Training on the job, troubleshooting and optimization of Quality Tools Month 12 Definition of a Quality Plan Month 18. Optimization of the Quality Plan Month 24 Validation of Quality Plan	Online and consortium meetings	A KISSLINGER G LIGUORI	Months 01-24	continuous
	TASK LEADERS	CNR / IBBR UL	Tools and Models for the definition of Standard operating procedures	Online CNR /IBBR / IEOS / IGB (Naples)	A KISSLINGER G LIGUORI	Months 05-07	continuous
	ALL PARTNERS (students, technicians, researchers, Post Docs, task leaders, PIs)	ALL CONSORTIUM	Application of quality management tools in a research laboratory	Online CNR / IEOS and IGB (Naples)	A KISSLINGER G LIGUORI	Months 01-36	continuous

	Anna Maria Kisslinger Giovanna Liguori (Task Leaders)	CNR / IEOS / IGB	Up-to-date on recent development of Quality Models and Reliable Quality (metrology, reliability, risk management)	Annual Meetings on quality	International and National Quality Associations	Months 01-36	3 Meetings
	Anna Maria Kisslinger Giovanna Liguori (Task Leaders)	CNR / IEOS / IGB	Participation to Seminars and Courses on Quality Management, Tools and Standards	Italy / Europe	International and national Quality Association	Months 01-36	
	Anna Maria Kisslinger Giovanna Liguori (Task Leaders)	CNR / IEOS / IGB	Stage on Good Practice and Quality management	Servei de Qualitat a la Recerca Agència de Polítiques i de Qualitat Universitat de Barcelona	CARMEN A: NAVARRO Cap de Servei de Qualita	Months 01-36	1-2 weeks
	ALL PARTNERS (students, technicians, researchers, Post Docs, task leaders, PIs)	ALL CONSORTIUM	- general training on quality management and the definition of a quality plan according to UNI EN ISO 9001:2015 and OECD GLP standards - quality procedures applied in the project (ex. filling lab-books, generating and storing data, review of guidelines, SOPS and GRP for VES4US)	Online CNR / IEOS / IGB	A KISSLINGER G LIGUORI	Months 01-06	continuous
6.3	Laura Corcuera (Project manager, PhD) Marta Yarnoz (Financial expert) Carla Sala (Communication and Dissemination) Susana Garayoa (Communication and Dissemination)	ZABALA	Exchange of ideas and expertise on knowledge sharing and data management	Online CNR / IEOS / IGB	A KISSLINGER G LIGUORI	Months 01-06	continuous

Table 7. VES4US training activities relative to the tasks of Work Package 7.

WP-7							
Relevant Tasks	Training beneficent / role	Institution of trainee	Training activities	Host + location	Training provider	Training period	Frequency
7.1-7.2	A Bongiovanni (WP Leader) Laura Corcuera (Project manager, PhD) Carla Sala (Communication and Dissemination) Susana Garayoa (Communication and Dissemination)	CNR / IBIM ZABALA	Stakeholder Engagement in FET	Online	EFFECT project (FETFX)	Month 03	1 workshop
	ALL PARTNERS (students, researchers, Task Leaders, PIs)	ALL CONSORTIUM	Networking and exchange of ideas for communication and dissemination	ALL CONSORTIUM	ALL CONSORTIUM	Months 00-36	continuous
	Antonella Cusimano; Antonella Bongiovanni; Daniele Romancino; PostDoc and PhD	IBIM	Up-to-date knowledge relative EV and dissemination of results	ISEV meeting 2019, 2020, 2021 EV-related meetings	EV scientific community	2019, 2020, 2021	3 conferences
	ALL PARTNERS (at least one person per partner)	CNR / IEOS / IGB	Strategies for efficient communication and dissemination	Online	ZABALA	Months 00-11	1 session
	ALL PARTNERS (students, researchers, Task Leaders, PIs)	ALL CONSORTIUM	VES4US dissemination and communication strategy	Online	ZABALA	Months 00-08	1 session
	Undergraduate students	ITS	Cultivation and use of microalgae for laboratory practicals	ITS	N TOUZET	Months 06-36	3-hour labs (1 per year)
7.3	ALL PARTNERS (students, researchers, Task Leaders, PIs)	ALL CONSORTIUM	Knowledge acquisition in IPR exploitation and translational aspects	Online	ZABALA	Months 24-36	1 session
	ALL PARTNERS (students, researchers, Task Leaders, PIs)	CNR / IEOS / IGB	Elaboration of Business Models and Exploitation plan	Online	ZABALA	Months 24-36	1 session

	Laura Corcuera (WP Leader) and/or Antonella Bongiovanni (WP Leader)	CNR and ZABALA	Exploring FET projects' exploitation potential	EBN Networking centre	FET2RIN project	Months 00-06	3 workshops
	ALL PARTNERS (students, researchers, Task Leaders, PIs)	ALL CONSORTIUM	How to boost FET project's exploitation of results	Online	ZABALA	Months 00-12	1 session



2. CONCLUSION

VES4US believes in the ideal of European integration based on the sharing of common values and the recognition of cultural variations in developing evidence-based frameworks for addressing hypothesis-driven research matters. As such, VES4US is committed towards the training of a highly qualified workforce to meet the future needs of the European society and to develop a knowledge-based economy. The inclusive and comprehensive training activities planned for the duration of the project are based on promoting exchanges ideas and will offer opportunities to individuals and teams to better appreciate the array of different approaches and attitudes to dealing with scientific questions, technicalities or management systems. It will also commit toward the embedding of excellence in delivering high-risk high-reward research by integrating quality management systems throughout its duration.

