ANNUAL REPORT 2021

SCHOOL OF PHARMACEUTICAL SCIENCES (ISPSO)

INTRODUCTION FROM THE PRESIDENCY

Comme chaque année, nous éditons le rapport annuel de la Section des sciences pharmaceutiques (ISPSO). Le rapport 2021 décrit les activités administratives et d'enseignement de la Section (ISPSO) ainsi que les activités de toutes les unités de recherche qui lui sont rattachées.

Cette année a été à nouveau perturbée par la crise sanitaire qui a partiellement réduit les activités de recherche et d'enseignement de notre Section. Fort de l'expérience acquise en 2020 et avec l'aide de tous les services de l'Université, toutes les unités de recherche et d'enseignement ont toutefois pu pleinement assumer leur mission en combinant des activités en présentiel et en virtuel.

La Section (ISPSO) a à nouveau et dans un contexte difficile assumé ses missions avec succès en augmentant l'obtention de fonds externes compétitifs et en accueillant un nombre record d'étudiant-es inscrit-es. Concernant les activités scientifiques (page 14 du rapport), celles-ci ont été maintenues, voire même développées en termes de publications et nous nous réjouissons de constater que la participation à des congrès est en augmentation avec un nombre important de conférences et de posters présentés permettant d'accroitre la visibilité de notre Section comme en témoignent nos excellents classements. Durant cette année 2021, nous avons également rédigé le Rapport de planification 2023-2026 qui nous aidera à faire face aux nombreux défis des années à venir.

La Présidence de la Section est très reconnaissante envers toutes ses collaboratrices et tous ses collaborateurs de leur engagement durant cette année 2021, nous permettant d'offrir une formation de très haute qualité à nos étudiant-es et à produire des activités de recherche reconnues mondialement.

As every year, we publish the annual report of the School of Pharmaceutical Sciences (ISPSO). The report 2021 describes the administrative and teaching activities of the School as well as the activities of all the research units.

This year was again disrupted by the health crisis which impacted on the research and teaching activities of our School However, with the experience gained in 2020 and with the help of all the services of the University, all the research and teaching units were able to fully assume their mission by combining face-to-face and virtual activities.

The School has once again, in a difficult context, successfully carried out its missions by increasing the acquisition of competitive external funding and by welcoming a record number of students. As regards to scientific activities (page 14 of the report), these have been maintained and even developed in terms of publications and we are pleased to note that participation in congresses is increasing with a significant number of conferences and posters presented, thus increasing the visibility of our Section as shown by our excellent placements in international rankings. During this year 2021, we also prepared the 2023-2026 Planning Report which will help us to face the many challenges of the coming years.

The Presidency of the Section is very grateful to all its collaborators for their commitment during 2021, enabling us to offer a very high-quality education to our students and to produce internationally recognised research activities.

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DIRECTION AND ADMINISTRATION

BOARD MEMBERS

Prof Jean-Luc Veuthey, President
Prof Eric Allémann, Vice President
Prof Chantal Csajka, Vice President

ADMINISTRATION

Mrs Françoise Védy, Administrator, 100%
Mrs Danielle Coosemans, Administrative Assistant, 60%
Mrs Sylvia Passaquay Rion, Administrative Assistant, 50%, 60% (from 01.02.2021)

STUDENTS SECRETARY

Mrs Elena Onate, Administrative Assistant, 90%
Mrs Elisa Masson, Secretary, 80%, 60% (since 01.11.2021)
Mrs Fiona Sanmartin Gonzalez, Secretary, 60% (since 01.04.2021), 100% (since 01.08.2021)

ACADEMIC ADVISOR

Dr Elisabeth Rivara-Minten, Academic Advisor, 40%
Dr Gaëlle Vacher, Academic Advisor Biomedical Sciences, 10%

IT STAFF

Mr Christophe Francey, DevOps IT, 50%
Mr Loris Franco, System Administrator, 100%
Mr Yann Manet, System Administrator, 100%
Mr Xavier Melich, Helpdesk Support, 80%

DOCTORAL PROGRAM

Dr Beatrice Kaufmann, Coordinator, 15%
Mrs Florence Von Ow, Secretary, 25%

ABBREVIATIONS

PO	*Full Professor*
PAS	*Associate Professor*
PAST	*Assistant Professor*
PTI	*Adjunct Professor*
PI	*Visiting Professor*
PD	*Privat-Docent*
MER / CC	*Senior Lecturer*
CE	*Lecturer*
CS	*Research Associate and Senior Research Associate*
MA	*Senior Research and Teaching Assistant*
POSTDOC	*Postdoctoral Scholar*
ASS	*Research and Teaching Assistant*

RESEARCH UNITS

ANALYTICAL SCIENCES

Prof Jean-Luc VEUTHEY, PO
Prof Serge RUDAZ, PAS
Dr Davy GUILLARME, CC, MER

BIOMOLECULAR AND PHARMACEUTICAL MODELLING

Prof Francesco Luigi GERVASIO, PO

BIOPHARMACY

Prof Gerrit BORCHARD, PO
Dr Olivier JORDAN, MER

CLINICAL PHARMACOLOGY AND TOXICOLOGY

Prof Jules DESMEULES, PO

CLINICAL PHARMACY SCIENCES

Prof Chantal CSAJKA, PO

COMMUNITY PHARMACY PRACTICE

Dr Jérôme BERGER, CE
Dr Philippe LAURENT, CC
Dr Martin BERNHARDT, CC

HOSPITAL PHARMACY (HUG / CHUV)

Prof Pascal BONNABRY, PAS
Prof Farshid SADEGHIPOUR, PTI

IMMUNOPHARMACOLOGY OF CANCER

Prof Carole BOURQUIN, PO

MOLECULAR PHARMACOLOGY

Prof Patrycja NOWAK-SLIWINSKA, PA

PHARMACEUTICAL BIOCHEMISTRY

Prof Leonardo SCAPOZZA, PO
Prof Yogeshvar KALIA, PAS
Dr Emmanuel VARESIO, MER

PHARMACEUTICAL TECHNOLOGY

Prof Eric ALLÉMANN, PO
Prof Norbert LANGE, PAS
Dr Florence DELIE-SALMON, MER

PHARMACOGNOSY

Prof Muriel CUENDET, PAS

PHYTOCHEMISTRY & BIOACTIVE NATURAL PRODUCTS

Prof Jean-Luc WOLFENDER, PO
Dr Emerson FERREIRA-QUEIROZ, MER

MEDICATION ADHERENCE AND INTERPROFESSIONALITY

Prof Marie-Paule SCHNEIDER, PTI
Dre Anne-Laure BLANC, CE
Mrs Imane IRAQI, CE
Dr Erik PAUS, CE

DATA ANAYTICS LAB

Prof Stéphane GUERRIER, PAST

SCHOOL OF PHARMACEUTICAL SCIENCES
COMMITTEE SITUATION ON JANUARY 1st, 2021

TEACHING COMMITTEE – President: Prof Muriel Cuendet

REGULATIONS AND EQUIVALENCE COMMITTEE – President: Prof Serge Rudaz

GRADES, EXAMINATIONS AND DEROGATIONS COMMITTEE – President: Prof Jean-Luc Veuthey

CONTINUING EDUCATION AND PUBLIC COURSES COMMITTEE – President: Prof Gerrit Borchard

EXTERNAL DOCTORAL STUDENTS AND TRAINEES ADMISSION COMMITTEE – President: Prof Gerrit Borchard

DOCTORAL PROGRAMME COMMITTEE – President: Prof Yogeshvar Kalia

SECONDARY EDUCATION COMMITTEE – President: Mrs Elena Onate

BUDGET COMMITTEE – President: Prof Carole Bourquin (Mrs Françoise Védy ad-interim since 28.06.2021)

IT COMMITTEE – President: Prof Francesco Luigi Gervasio

SECURITY AND PREMISES COMMITTEE – President: Prof Jean-Luc Veuthey

SCIENTIFIC COMMITTEE – Presidents: Prof Francesco Luigi Gervasio and Prof Leonardo Scapozza

GLOBAL PHARMACY COMMITTEE – President: Prof Pascal Bonnabry

SHARED INSTRUMENTATION COMMITTEE – President: Prof Eric Allémann

PRACTICAL WORK COMMITTEE – President: Dr Florence Delie

BIOMEDICAL SCIENCES TEACHING COMMITTEE – Presidents: Prof Pierre Cosson (Medicine) and Prof Leonardo Scapozza

CMU LIBRARY INSTANCE – Responsible: Prof Serge Rudaz

STAFF

PROFESSORS

Eric ALLÉMANN, 100%
Tudor ARVINTE, 10%
Pascal BONNABRY, 15% (+HUG)
Gerrit BORCHARD, 100%
Carole BOURQUIN, 80% (+20% Faculty of Medicine, but 100% paid by the Section)
Chantal CSAJKA, 50% (+UNIL)
Muriel CUENDET, 100%
Jules DESMEULES, 20 % (paid by Faculty of Medicine)
Francesco Luigi GERVASIO, 100%
Stéphane GUERRIER, 50% (+ 50% GSEM)
Yogeshvar KALIA, 100%
Norbert LANGE, 100%
Patrycja NOWAK-SLIWINSKA, 100%
Serge RUDAZ, 100%
Farshid SADEGHIPOUR, 15% (+CHUV)
Leonardo SCAPOZZA, 100%
Marie-Paule SCHNEIDER, 50% (+Pharma24)
Jean-Luc VEUTHEY, 100%
Jean-Luc WOLFENDER, 100%
Frédéric ZENHAUSERN, 20% (non-salaried)

SENIOR LECTURERS

Florence DELIE-SALMON, 100%
Emerson FERREIRA QUEIROZ, 100%
Davy GUILLARME, 100%
Olivier JORDAN, 100%
Philippe LAURENT, 12.5%
Alain MERKLI, 5%
Emmanuel VARESIO, 50% (+50% Faculty of Sciences)

INVITED RESEARCHERS

Furkan IQBAL *(01.09.2021-30.11.2021)*
Gilmar THIM *(01.11.2021-31.01.2022)*

LECTURERS

Jérôme BERGER, 20% (+Unisanté)
Martin BERNHARDT, 10%, 20% *(since 01.10.2021)*
Anne-Laure BLANC, 20% *(since 01.06.2021)*
Chin Bin EAP, 10% (+UNIL)
Pascal FURRER, 100%
Imane IRAQI, 40% *(since 01.08.2021)*
Erik PAUS, 40% *(since 01.06.2021)*
Karl PERRON, 40% (+ 60% BIVEG)
Christian KOLLER, 5%
Elisabeth RIVARA-MINTEN, 40%
Philippe LAURENT, 12.5%

PRIVAT DOCENTS

Johnny BENEY
Youssef DAALI (+ 20% Faculty of Medicine)
Sandrine FLEURY SOUVERAIN
Marco PRUNOTTO
Pierre VOIROL
Nicolas WIDMER

SENIOR RESEARCH ASSOCIATES

Julien BOCCARD, 100%
Sylvian CRETTON, 100%
Olivier DORCHIES, 100%
Carolina ESTARELLAS MARTIN, 20% *(until 28.02.2021)*
Szabolcs FEKETE, 100% *(until 31.03.2021)*
Victor GONZALEZ RUIZ, 100%
Thomas GURRY, 100 %, 50% *(since 01.10.2021)*
Beatrice KAUFMANN, 60 % (+15% Faculty)
Maria LAPTEVA, 80%
Laurence NEFF, 80%
Gaëlle VACHER, 80% *(since 01.03.2021)*
Sophie WURTH, 40% *(until 28.02.2021)*
Magali ZEISSER-LABOUEBE, 80%

SENIOR RESEARCH AND TEACHING ASSISTANTS

Pierre-Marie ALLARD, 100% *(until 31.07.2021)*
Valentina D'ATRI, 100%
Hesham HAMED, 100%, 70% *(since 01.07.2021)*
Isabel MEISTER, 90% *(since 01.08.2021)*
David PEJOSKI, 100%
Aurélien POMMIER, 80%, 100% *(since 01.09.2021)*
Viola PUDDINU, 100%
Sébastien TARDY, 100%
Elena TOBOLKINA, 100%

POSTDOCTORAL SCHOLARS

Margot BOUJUT, 100% *(since 01.02.2021)*
Thomas BOUVAREL, 100% *(since 01.10.2021)*
Evelina CARDOSO, 40% *(since 01.05.2021)*

Miguel DE FIGUEIREDO, 100% *(since 01.09.2021)*
Riccardo DEIDDA, 100% *(since 01.12.2021)*
Isabel FERNANDEZ COIRA, 100%
Ioannis GALDADAS, 85% *(since 01.06.2021)*
Dorothea GOBBO, 80% *(since 01.05.2021)*
Si GOU, 85%
Ladislav HOVAN, 85%
Sébastien JENNI, 90% *(since 01.09.2021)*
Nasreddine KANFAR, 100% *(01.04.2021-31.05.2021 and since 01.12.2021)*
Gioachino Luca LOSACCO, 100% *(July 2021)*
Rémy MARCELLIN-GROS, 85% *(since 01.05.2021)*
Eulalia OLESTI MUNOZ, 100%
Sakthikumar RAGUPATHY, 85%
Carlos RODRIGUEZ NOGALEZ, 100%
Laurence SCHUMACHER, 100% *(since 01.11.2021)*

RESEARCH AND TEACHING ASSISTANTS

Kenza ABOUIR
Souad ADRIOUACH
Abdulelah ALFATTANI
Carole BANDIERA
Cintia BAPTISTA MARQUES
Ana Beatriz BASTOS SOARES DOS SANTOS
William BELLO
Martijn BEMELMANS
Léa BODEN
Bart BOERSMA
Alberto BORSATTO
Alexandre BORY
Joël BRUNNER
Benjamin BUGNON
Carlotta CECCHINI
Aude COUMAU
Claire COUMAU
Aditya DARADE
Carlota DE LACERDA SALGADO
Guillaume DISNER
Filippo DONATI
Eloïse DUCREY
Bastiaan DUIVELSHOF
Eloïse DUPUYCHAFFRAY
Lamyae EL MORABIT
Radhia EL PHIL
Micaela FARIA FREITAS
Jonathan FARO BARROS
Sabrina FERRE
Angelica FERRO
Audrey FLORNOY
Alexandra GARNIER
Laure GARNIER
Frédéric GASPAR
Arnaud GAUDRY
Elinam GAYI
Sergey GIREL
Paula GONZALEZ FERNANDEZ
Laura Gisela GONZALEZ IGLESIAS
Ghali GUEDIRA
Margaux HERITIER
Sébastien HEVIN
Robin HUBER
Laura IACOBUCCI
Mégane JERMINI
Maurice KARRENBROCK
Martin KIENING
Olivier Auguste KIRCHHOFFER
Marko KRSTIC
Honorine LARDEUX
Céline LEMOINE
Camille LENOIR
Angela LISIBACH
Alexandra LITVINENKO
Sophie LONCHAMPT
Gioacchino Luca LOSACCO
Gaëlle MAGLIOCCO
Franck MARQUET
Julianne MAURIN
Tamara MELNIK
Stéphanie MENA
Valentin MIEVILLE
Luca MORICI
Hugo MORIN
Amarande MURISIER
Sara PANNILUNGHI
Allegra PELETTA
Léonie PELLISSIER
Yuan James PETERMANN
Marija PETROVIC
Laeticia PINTO
Hélène POINOT
Alexandre PORCELLO
Julie QUARTIER
Luis QUIROS GUERRERO
Mandimbinomena Adèle RAKOTONIRINA
George RAMZY
Magdalena RAUSCH
Rafael RINCON
Benjamin ROSSIER
Thomas RUDOLF VON ROHR
Adriano RUTZ

Ece SAHI ILHAN
Phedra Firdaws SAHRAOUI
Suzanne Sherihan SAHRAOUI
Sara SANSALONI PASTOR
Cindy SCHELKER
Laurence SCHUMACHER
Ozlem SEVIK
Whitney SHATZ
Elodie SIMI
Christian SKALAFOURIS
Weronika SPALENIAK
Sofia SPATARO
Camille STAMPFLI
Camille SUESS
Jérémie TACHET
Betul TASKOPARAN
Gioele VISCONTI
Tatjana VUJIC
Julia WAGNER
Leqi WANG

RESEARCH ASSISTANTS (ARE)

Camelia BAKHTYARI
Nina Lou CAZIER
Charlotte GROMETTO
Catarina GONCALVES MILHO
Anne-Mary AMADASUN SIDNEY
Antoine HOSTETTLER
Victoryavarman KOH
Alexandra MARCLAY
David OHAYON
Pierre REPITON
Aleya SCHUEMANN
Henry ZIVKOVIC
Stéphanie WASF
Marie WURRY

INTERNSHIP STUDENTS / VISITING SCHOLARS

Alexandre CARREIRA DA CRUZ *(01.09.2021-31.08.2022)*
Jaqueline CALDERON REYES *(03.09.-31.12.2021)*
Laura DE LOS SANTOS CASTILLO PEINADO *(01.03-31.05.2021)*
Eleonora GIANQUINTO *(01.09.-31.12.2021)*
Hugo GIZARDIN-FREDON *(06.09-17.12.2021)*
Maxime GUIBERT *(01.06.-31.07.2021)*
Noëlla GROSSI *(until August 2021)*
Narjara LARANJA *(until February 2021)*
Oliwia MAJCHRZAK *(01.05.-31.07.2021)*
Tiago MENDONCA FERNANDEX *(07.06.-19.11.2021)*
Christian PERALTA VITERI *(15.10.2021-15.10.2022)*
Gajraj RATHORE *(until March 2021)*
Kalani RATNAM
Telma RODRIGUES *(30.08.-17.09.2021)*
Alessandro SCAPOZZA *(23.08.-03.09.2021)*

JOINTLY SUPERVISED PHD STUDENTS AND JOINTLY SUPERVISED PHD STUDENTS FROM ANOTHER UNIVERSITY

Mirko BONELLI
Angélique BOURQUI
Anne CAYRON
Perrine COURLET (C. Csajka ISPSO / L. Décosterd UNIL)
Rys EVANS
Dina HANY
Sreemanjari KANDHASAMY
Ewa KOWOLIK

Dominykas LUKAUSKIS
Solène MASLOH (Artois University (France) / Geneva University)
Maria QUILES DEL REY
Rakesh RAMJIAWAN
Anne RAVIX

ADMINISTRATIVE STAFF

Nathalie CHIAVAROLI, 50%
Danielle COOSEMANS, 60%
Marilyn FREIRE BARJA ZLASSI, 80%
Nathalie GOFFIN, 80%
Dominique HUNZIKER, 80% *(until 30.04.2021)*
Elisa MASSON, 80%, 60% *(since 01.12.2021)*
Elena ONATE, 90%
Sylvia PASSAQUAY-RION, 50%, 60% *(since 01.02.2021)*
Miroslava REBETEZ-GRALEWICZ, 70%, 90% *(01.04-30.11.2021)*
Mrs Fiona SANMARTIN GONZALEZ, Secretary, 60% *(since 01.04.2021)*, 100% *(since 01.08.2021)*
Natalie SCHREGLE, 80%
Françoise VÉDY, 100%
Florence VON OW, 90% (25% progdoc + 70% Research unit secretary +5% secretary CAS)
Anne-Françoise WITTA, 50%

IT STAFF

Christophe FRANCEY, 50%
Loris FRANCO, 100%
Yann MANET, 100%
Xavier MELICH, 80%

TECHNICAL STAFF

Montserrat ALVAREZ, 100%
Frédéric BORLAT, 100%
Nathalie BOULENS, 60%
Carole DUPRAZ, 35%
Christophe FRANCEY, 100% (incl. 50% DevOps IT)
Sarah GARDI, 100%
Aurélie GOUILLER, 90%
Tayeb JBILOU, 80%
Laurence MARCOURT, 100%
Aristea MASSARAS, 100%
Xavier MELICH, 100% (incl. 80% IT Helpdesk support)
Hélène MOTTAZ, 50% *(until 30.11.2021)*
Jessica ORTELLI, 90%
Marco PERDIGAO, 100%
Olivier PETERMANN, 80%
Barbara PINHEIRO, 40%
Colette SAUTY, 25%
Cédric SCHELLING, 100%
Emmanuelle SUBLET, 70%

BUDGET

SALARY AND OPERATIONAL BUDGETS (CHF)	2021	2020	2019	2018	2017
Staff salary (incl. social charges)	12 252 781	12 054 874	11 851 759	11 969 356	11 844 570
Operational budget	1 168 166	1 149 166	1 143 666	1 133 916	1 137 693
Total	**13 420 947**	**13 204 040**	**12 995 425**	**13 103 272**	**12 982 263**

INVESTMENT BUDGET (CHF)	2021	2020	2019	2018	2017
Faculty investment	292 653	287 577	246 855	248 218	213 993
Section investment	290 979	290 979	290 979	290 979	279 787
Total	**583 632**	**578 556**	**537 834**	**539 197**	**493 780**

EXTERNAL FUNDS (CHF)	2021	2020	2019 (*)
Research funds (SNSF and others)	7 040 856	6 724 496	5 535 149
Service agreements and related activities	783 419	890 169	1 160 619
Total	**7 824 274**	**7 614 665**	**6 695 768**

(*) Modification in 2020 of the funds calculation rule for J. Desmeules in order to take into account his activity rate (20%) in the Section.

EXTERNAL FUNDS (CHF)	2018	2017
Total	**4 391 261**	**5 420 959**

TOTAL BUDGET (CHF)	2021	2020	2019 (*)	2018	2017
Total	**21 828 853**	**21 397 261**	**20 229 027**	**18 033 730**	**18 897 002**

(*) Modification in 2020 of the funds calculation rule for J. Desmeules in order to take into account his activity rate (20%) in the Section.

BUDGET 2021	FTE
Scientific personnel	2.60
Technicians	2.00
Laboratory and Technical Assistants	11.70
Technical and Lab Aides	0.60
Total technical personnel	***16.90***
Administration heads, Departments heads, Adm Clerks	3.00
Secretaries, Accountants, Library help	6.20
Total administrative personnel	***9.20***
TOTAL Technical and Administrative personnel ('PAT')	***26.10***
Full Professors	7.80
Associate Professors	4.35
Adjunct Professors	0.55
Subtotal Faculty	**12.70**
Lecturers, Academic Advisors ('Chargés d'Ens., Cons. Etudes')	4.12
Senior Lecturers ('MER, Chefs de Clinique scient.')	5.78
Senior Lecturers ('Chargés de cours')	0.81
(Senior) Research Associates ('Collab. Scientifiques I et II')	1.00
Subtotal Intermediate corps	**11.71**
Total Faculty	***24.41***
Research and Teaching Fellows	4.20
PhD students, Post-doctoral fellows	35.82
Subtotal Research and Teaching Fellows, PhD students, Post-docs	**40.02**
TOTAL Teaching personnel ('PENS')	***64.43***

STAFF SCHOOL OF PHARMACEUTICAL SCIENCES	2021	2020	2019	2018	2017
Total	239	249	254	242	216

2021 AT A GLANCE

2021 TOTAL BUDGET (CHF)	21 828 853

TOTAL STUDENTS	2021	2020	2019	2018	2017
Bachelor	366	337	352	339	309
Master	209	182	170	152	152
Master in biomedical sciences (*)	28	13	--	--	--
Master of advanced studies	24	24	20	20	19
Total	**627**	**556**	**542**	**511**	**480**

(*) The Master in biomedical sciences was launched in 2020.

TOTAL Ph.D. STUDENTS AND POSTDOCTORAL FELLOWS	2021	2020	2019	2018	2017
Ph.D. students	102	113	111	100	90
Postdoctoral fellows	18	20	23	26	18
MA	9	9	7	8	9
Total	**129**	**142**	**141**	**134**	**117**

SCIENTIFIC ACTIVITIES	2021	2020	2019
Publications with impact factor	260	251	212
Publications without impact factor	30	45	91
Patents	2	9	6
Books and chapters	5	7	8
Congresses / conferences organisation	32	21	40
Posters presentations	127	58	179
Oral presentations	82	42	134
Invited oral presentations	98	77	177
Number of projects at FNRS and assimilated (Research funds)	85	85	79
Service agreements and related activities	35	23	38
Ph.D. theses presented	19	22	18
Awards and distinctions	22	23	31
Public outreach activities	20	45	48

2021 KEY EVENTS

The Section's Scientific Commission has drafted the 2023-2026 Planning Report which outlines the missions and challenges to tackle for this period. Priorities include: the emergence of interdisciplinary areas; preparing for faculty retirements; strengthening existing research areas; developing new areas; promoting the Section's identity and fostering equal opportunity.

Classification (ranking) by domains

Our School of Pharmaceutical Sciences obtained an excellent ranking of 33 according to QS World University Rankings by Subject "Pharmacy and pharmacology".

This ranking identifies the world's leading universities in 51 disciplines, grouped into five broad subject areas (Arts & Humanities, Engineering and Technology, Life Sciences & Medicine, Natural Sciences and Social Sciences & Management).

Research citations, along with the results of major global surveys of employers and academics are used to rank universities. They are compiled annually in order to identify the leading universities in a particular subject.

In the Shanghai ranking, our School of pharmaceutical sciences was not well classified (201-300) due in major part to a lack of publication in a selected journal. It is planned to submit publications in the journal selected by this ranking.

Teaching activities

The fall semester 2021 was also the start of the reformed Master in Pharmacy that provides training even closer adapted to the requirements of all aspects of the pharmacist profession. In addition, we have the full responsibility of the Master of biomedical sciences in collaboration with the Faculty of medicine in charge of the bachelor.

We have completed the teaching load mapping allowing us to distribute the DIP resources in terms of teaching staff positions between the research and teaching Units of the School.

On August 26, faculty members of the Section gathered for a day of brainstorming and strategic planning at an off-site meeting. Different topics were discussed such as: review of the activities for the academic year 2020-2021; planification report for the period 2023-2026; presentation of selected members for constituting a Scientific Advisory Board; tools to increase the visibility of the Section; discussion on academic successions; position of the Section inside the University (faculty of sciences vs faculty of medicine)

In October 2021, the Section organised a three-day symposium and workshop on the characterisation of nanomedicines - Galenus NanoGVA - at Campus Biotech with 15 international speakers and about 100 participants.

In 2021, the Section also took over responsibility for the administrative and financial management of the federal pharmacy examinations. Previously, this mandate had been entrusted to the Geneva-Lausanne School of Pharmacy (EPGL) / Lausanne University Medical Clinic (PMU) under the responsibility of Prof. Olivier Bugnon.

ANALYTICAL SCIENCES

Professor Serge RUDAZ
Professor Jean-Luc VEUTHEY
Doctor Davy GUILLARME

General description of the Unit

The group focuses its activities on separation techniques, mainly liquid chromatography (LC), capillary electrophoresis (CE) and supercritical fluid chromatography (SFC) coupled with various detectors, including mass spectrometry (MS) for the analysis and bioanalysis of pharmaceutical substances. New chromatographic supports and sample preparation approaches are evaluated and original strategies to gain selectivity and/or sensitivity of the analytical process are developed. Reduction of the total analysis time is also studied. Special focus is given to the analytical characterization of biopharmaceutical products, including monoclonal antibodies and related compounds, as well as oligonucleotides.

The research of this group also aims at the development of new strategies for targeted and untargeted metabolomic analyses with a focus on the analysis of low molecular weight compounds in biological matrices. Since 2010, the group is also investigating original approaches dedicated to the analysis of data produced by MS couplings, including CE. The use of chemometric tools for developing analytical methods, determining optimized or robust conditions, as well as for analysing data with pattern recognition techniques are applied in many projects within the School of Pharmaceutical Sciences and numerous external academic and/or industrial collaborations. Aspects of dimensionality reduction and multi-block analysis are addressed through collaborative projects in the fields of toxicology, biology, biochemistry, and pharmacology.

Specific research fields

- Liquid chromatography (LC)
- Capillary electrophoresis (CE)
- Supercritical fluid chromatography (SFC)
- Hyphenation to mass spectrometry (MS)
- Sample preparation
- Analytical Method Validation
- Chemometrics
- Metabolomics
- Toxicology
- Oligonucleotides
- Monoclonal antibodies

2021 at a glance

- Publications with impact factor: 44
- Publications without impact factor: 3
- Patents: 0
- Book and chapters: 3
- Congresses / conferences organisation: 2
- Posters presentations: 12
- Oral presentations: 16
- Invited oral presentations: 24

- Number of projects at FNRS and assimilated (Research funds): 12
- Service agreements and related activities: 1
- Ph.D. Theses presented in 2021: 1
- Awards and distinctions: 5
- Public outreach activities: 0

Research funds

Bayer
Industry
Development of innovative analytical strategies for therapeutic peptides, oligonucleotides and radionuclide conjugates
Main applicant: Davy Guillarme
Total funding of the project: € 180'000.- (CHF 195'840.-)
Total duration of the project: 3 years
Allocation 2021: € 30'000.- (CHF 32'730.-)
Starting date: 01.08.2021

Ferring International Center S.A.
Industry
Analytical characterization of FERRING monoclonal antibody
Main applicant: Davy Guillarme
Total funding of the project: CHF 88'148.-
Total duration of the project: 2 years
Allocation 2021: CHF 45'000.-
Starting date: 01.10.2019

Ferring-BISPE
Industry
Analytical characterization of bispecific and trispecific antibodies
Main applicant: Davy Guillarme
Total funding of the project: CHF 92'538.-
Total duration of the project: 3 years
Allocation 2021: CHF 40'000.-
Starting date: 01.10.2021

Genentech
Industry
Development of innovative methods for functional testing of mAbs based on the use of affinity chromatography columns
Main applicant: Davy Guillarme
Total funding of the project: US 20'000.- (CHF 18'600,00)
Total duration of the project: 1 years
Allocation 2021: US 10'000.- (CHF 9'300.-)
Starting date: 01.08.2021

Merck Sharp & Dohme Corp.
Industry
Exacting modifier additive and decompression cooling effects in analytical and preparative SFC using infrared thermal imaging and other techniques
Main applicant: Davy Guillarme
Total funding of the project: $ 50'000.-
Total duration of the project: 2 years
Allocation 2021: $ 25'000.- (CHF 24'670.-)
Starting date: 01.06.2020

Fonds Marc Birgkit
Institutional

Main applicant: Serge Rudaz
Total funding of the project: CHF 40'000.-
Total duration of the project: 1 year
Allocation 2021: CHF 40'000.-
Starting date: 01.07.2021

Fondation Schmidheiny
Institutional
Main applicant: Serge Rudaz
Total funding of the project: CHF 50'000.-
Total duration of the project: 1 year
Allocation 2021: CHF 50'000.-
Starting date: 01.07.2021

Omics-Russia
Institutional
Development and application of extended steroid profiling to clinical practice: a metabolomics approach
Main applicant: Serge Rudaz
Total funding of the project: 17'000.-
Total duration of the project: 2 years
Allocation 2021: 0.-
Starting date: 01.10.2020

ROCHE-BISPE
Industry
Improvement of chromatographic and LC-MS-based characterization of diverse complex protein formats for research and early development
Main applicant: Davy Guillarme
Total funding of the project: € 165'470.- (CHF 183'110.-)
Total duration of the project: 2 years
Allocation 2021: € 82'750.- (CHF 91'240.-)
Starting date: 01.05.2021

ROCHE-AAVs
Industry
Development of innovative liquid chromatography methods for the characterization of gene therapy products
Main applicant: Davy Guillarme
Total funding of the project: € 183'810.- (CHF 204'120.-)
Total duration of the project: 2 years
Allocation 2021: € 45'950.- (CHF 51'000.-)
Starting date: 01.05.2021

SCAHT4-GL-21-01
Institutional
Bioanalytical and metabolomic readouts for toxicology
Main applicant: Serge Rudaz
Total funding of the project: CHF 420'000.-
Total duration of the project: 2 years
Allocation 2021: CHF 210'000.-
Starting date: 01.01.2021

Steroid Pass
Institutional
Biostatistic analysis of Athletes: toward a Blood Steroid Passport
Main applicant: Serge Rudaz
Total funding of the project: CHF 200'000.-
Total duration of the project: 2 years
Allocation 2021: CHF 100'000.-
Starting date: 01.04.2021

Total amount for all research funds for 2021: CHF 693'940.-

Service agreements and related activities

Waters-Fekete
Industry
Main applicant: Jean-Luc Veuthey
Total funding of the project: CHF 16'500.-
Total duration of the project: 2 years
Allocation 2021: CHF 8'250.-
Starting date: 01.04.2021

Total amount (for all service agreements and related activities) for 2021: CHF 8'250.-

Scientific publications (with impact factor)

Fekete, S.; Murisier, A.; Sandra, K.; Guillarme, D., Hydrophobic Interaction Chromatography (HIC) for the Characterization of Therapeutic Monoclonal Antibodies and Related Products, Part 1 Theoretical Aspects. LC-GC Eur 2021, 34, 101-105. *0.529*

Guillarme, D.; Bobably, B.; Veuthey, JL., Free Excel Software for Performing Virtual Liquid Chromatography. LC-GC North America 2021, 39, 144-145. *0.482*

Boccard, J.; Schvartz, D.; Codesido, S.; Hanafi, M.; Gagnebin, Y.; Ponte, B.; Jourdan, F.; Rudaz, S., Gaining Insights Into Metabolic Networks Using Chemometrics and Bioinformatics: Chronic Kidney Disease as a Clinical Model. Front Mol Biosci 2021, 8, 682559. *5.246*

Camperi, J.; Goyon, A.; Guillarme, D.; Zhang, K.; Stella, C., Multi-dimensional LC-MS: the next generation characterization of antibody-based therapeutics by unified online bottom-up, middle-up and intact approaches. Analyst 2021, 146 (3), 747-769. *4.616*

Camperi, J.; Grunert, I.; Heinrich, K.; Winter, M.; Ozipek, S.; Hoelterhoff, S.; Weindl, T.; Mayr, K.; Bulau, P.; Meier, M.; Molhoj, M.; Leiss, M.; Guillarme, D.; Bathke, A.; Stella, C., Inter-laboratory study to evaluate the performance of automated online characterization of antibody charge variants by multi-dimensional LC-MS/MS. Talanta 2021, 234, 122628. *6.057*

Codesido, S.; Drouin, N.; Ferre, S.; Schappler, J.; Rudaz, S.; Gonzalez-Ruiz, V., New insights into the conversion of electropherograms to the effective electrophoretic mobility scale. Electrophoresis 2021, 42 (19), 1875-1884. *3.535*

Codesido, S.; Guillarme, D.; Fekete, S., Algorithms to optimize multi-column Chromatographic separations of proteins. J Chromatogr A 2021, 1637, 461838. *4.759*

D'Atri, V.; Guillarme, D., Characterization of Glycosylated Proteins at Subunit Level by HILIC/MS. Methods Mol Biol 2021, 2271, 85-95. *1.167*

Deidda, R.; Coppey, F.; Damergi, D.; Schelling, C.; Coic, L.; Veuthey, J. L.; Sacre, P. Y.; De Bleye, C.; Hubert, P.; Esseiva, P.; Ziemons, E., New perspective for the in-field analysis of cannabis samples using handheld near-infrared spectroscopy: A casestudy focusing on the determination of Delta(9)-tetrahydrocannabinol. J Pharm Biomed Anal 2021, 202, 114150. *3.935*

Deidda, R.; Schelling, C.; Roussel, J. M.; Dispas, A.; De Bleye, C.; Ziemons, É.; Hubert, P.; Veuthey, J. L., The analysis of cannabinoids in cannabis samples by

supercritical fluid chromatography and ultra-high-performance liquid chromatography: A comparison study. Anal Sci Adv 2021, 2 (1-2), 2-14. *2.769*

Desligniere, E.; Ehkirch, A.; Duivelshof, B. L.; Toftevall, H.; Sjogren, J.; Guillarme, D.; D'Atri, V.; Beck, A.; Hernandez-Alba, O.; Cianferani, S., State-of-the-Art Native Mass Spectrometry and Ion Mobility Methods to Monitor Homogeneous Site-Specific Antibody-Drug Conjugates Synthesis. Pharmaceuticals 2021, 14 (6). *5.677*

Dispas, A.; Clarke, A.; Grand-Guillaume Perrenoud, A.; Losacco, L. G.; Veuthey, J. L.; Gros, Q.; Molineau, J.; Noireau, A.; West, C.; Salafia, F.; Zoccali, M.; Mondello, L.; Guillen, A.; Wang, J.; Zhang, K.; Jochems, P.; Schad, G.; Nakajima, K.; Horie, S.; Joseph, J.; Parr, M. K.; Billemont, P.; Severino, A.; Schneider, S.; Naegele, E.; Kutscher, D.; Wikfors, R.; Black, R.; Ingvaldson, L.; Da Silva, J. O.; Bennett, R.; Regalado, E. L.; Hoang, T. P. T.; Touboul, D.; Nikolova, Y.; Kamenova-Nacheva, M.; Dimitrov, V.; Berger, B. K.; Schug, K. A.; Kerviel-Guillon, S.; Mauge, F.; Takahashi, M.; Izumi, Y.; Bamba, T.; Rouviere, F.; Heinisch, S.; Guillarme, D.; Hubert, P., Interlaboratory study of a supercritical fluid chromatography method for the determination of pharmaceutical impurities: Evaluation of multi-systems reproducibility. J Pharm Biomed Anal 2021, 203, 114206. *3.935*

Duivelshof, B. L.; Denorme, S.; Sandra, K.; Liu, X.; Beck, A.; Lauber, M. A.; Guillarme, D.; D'Atri, V., Quantitative N-Glycan Profiling of Therapeutic Monoclonal Antibodies Performed by Middle-Up Level HILIC-HRMS Analysis. Pharmaceutics 2021, 13 (11). *5.677*

Duivelshof, B. L.; Murisier, A.; Camperi, J.; Fekete, S.; Beck, A.; Guillarme, D.; D'Atri, V., Therapeutic Fc-fusion proteins: Current analytical strategies. J Sep Sci 2021, 44 (1), 35-62. *3.645*

Fekete, S.; Bobaly, B.; Nguyen, J. M.; Beck, A.; Veuthey, J. L.; Wyndham, K.; Lauber, M. A.; Guillarme, D., Use of Ultrashort Columns for Therapeutic Protein Separations. Part 1: Theoretical Considerations and Proof of Concept. Anal Chem 2021, 93 (3), 1277-1284. *6.986*

Fekete, S.; Murisier, A.; Beck, A.; Lawhorn, J.; Ritchie, H.; Boyes, B.; Guillarme, D., New wide-pore superficially porous stationary phases with low hydrophobicity applied for the analysis of monoclonal antibodies. J Chromatogr A 2021, 1642, 462050. *4.759*

Fekete, S.; Murisier, A.; Lauber, M.; Guillarme, D., Empirical correction of non-linear pH gradients and a tool for application to protein ion exchange chromatography. J Chromatogr A 2021, 1651, 462320. *4.759*

Fekete, S.; Murisier, A.; Losacco, G. L.; Lawhorn, J.; Godinho, J. M.; Ritchie, H.; Boyes, B. E.; Guillarme, D., Using 1.5 mm internal diameter columns for optimal compatibility with current liquid chromatographic systems. J Chromatogr A 2021, 1650, 462258. *4.759*

Fekete, S.; Murisier, A.; Nguyen, J. M.; Bolton, M. J.; Belanger, J.; Beck, A.; Veuthey, J. L.; Wyndham, K.; Lauber, M. A.; Guillarme, D., Use of Ultra-short Columns for Therapeutic Protein Separations, Part 2: Designing the Optimal Column Dimension for Reversed-Phase Liquid Chromatography. Anal Chem 2021, 93 (3), 1285-1293. *6.986*

Ferre, S.; Drouin, N.; Gonzalez-Ruiz, V.; Rudaz, S., Evaluation of a nanoflow interface based on the triple-tube coaxial sheath-flow sprayer for capillary electrophoresis-mass spectrometry coupling in metabolomics. J Chromatogr A 2021, 1641, 461982. *4.759*

Franzen, J.; Jermann, F.; Ghisletta, P.; Rudaz, S.; Bondolfi, G.; Tran, N. T., Psychological Distress and Well-Being among Students of Health Disciplines: The Importance of Academic Satisfaction. Int J Environ Res Public Health 2021, 18 (4). *3.390*

Guichard, N.; Boccard, J.; Rudaz, S.; Bonnabry, P.; Fleury Souverain, S., Wipe-sampling procedure optimisation for the determination of 23 antineoplastic drugs used in the hospital pharmacy. Eur J Hosp Pharm 2021, 28 (2), 94-99. *0.83*

Harrill, J. A.; Viant, M. R.; Yauk, C. L.; Sachana, M.; Gant, T. W.; Auerbach, S. S.; Beger, R. D.; Bouhifd, M.; O'Brien, J.; Burgoon, L.; Caiment, F.; Carpi, D.; Chen, T.; Chorley, B. N.; Colbourne, J.; Corvi, R.; Debrauwer, L.; O'Donovan, C.; Ebbels, T. M. D.; Ekman, D. R.; Faulhammer, F.; Gribaldo, L.; Hilton, G. M.; Jones, S. P.; Kende, A.; Lawson, T. N.; Leite, S. B.; Leonards, P. E. G.; Luijten, M.; Martin, A.; Moussa, L.; Rudaz, S.; Schmitz, O.; Sobanski, T.; Strauss, V.; Vaccari, M.; Vijay, V.; Weber, R. J. M.; Williams, A. J.; Williams, A.; Thomas, R. S.; Whelan, M., Progress towards an OECD reporting framework for transcriptomics and metabolomics in regulatory toxicology. Regul Toxicol Pharmacol 2021, 125, 105020. *3.271*

Lardeux, H.; Duivelshof, B. L.; Colas, O.; Beck, A.; McCalley, D. V.; Guillarme, D.; D'Atri, V., Alternative mobile phase additives for the characterization of protein biopharmaceuticals in liquid chromatography - Mass spectrometry. Anal Chim Acta 2021, 1156, 338347. *6.558*

Losacco, G. L.; DaSilva, J. O.; Liu, J.; Regalado, E. L.; Veuthey, J. L.; Guillarme, D., Expanding the range of sub/supercritical fluid chromatography: Advantageous use of methanesulfonic acid in water-rich modifiers for peptide analysis. J Chromatogr A 2021, 1642, 462048. *4.759*

Losacco, G. L.; Veuthey, J.-L.; Guillarme, D., Metamorphosis of supercritical fluid chromatography: A viable tool for the analysis of polar compounds? TrAC Trends in Analytical Chemistry 2021, 141. *12.296*

Moyne, O.; Castelli, F.; Bicout, D. J.; Boccard, J.; Camara, B.; Cournoyer, B.; Faudry, E.; Terrier, S.; Hannani, D.; Huot-Marchand, S.; Leger, C.; Maurin, M.; Ngo, T. D.; Plazy, C.; Quinn, R. A.; Attree, I.; Fenaille, F.; Toussaint, B.; Le Gouellec, A., Metabotypes of Pseudomonas aeruginosa Correlate with Antibiotic Resistance, Virulence and Clinical Outcome in Cystic Fibrosis Chronic Infections. Metabolites 2021, 11 (2). *4.932*

Mueller, F.; Losacco, G. L.; Nicoli, R.; Guillarme, D.; Thomas, A.; Grata, E., Enantiomeric methadone quantitation on real post-mortem dried matrix spots samples: Comparison of liquid chromatography and supercritical fluid chromatography coupled to mass spectrometry. J Chromatogr B 2021, 1177, 122755. *3.205*

Murisier, A.; Duivelshof, B. L.; Fekete, S.; Bourquin, J.; Schmudlach, A.; Lauber, M. A.; Nguyen, J. M.; Beck, A.; Guillarme, D.; D'Atri, V., Towards a simple on-line coupling of ion exchange chromatography and native mass spectrometry for the detailed characterization of monoclonal antibodies. J Chromatogr A 2021, 1655, 462499. *4.759*

Murisier, A.; Fekete, S.; Guillarme, D.; D'Atri, V., The importance of being metal-free: The critical choice of column hardware for size exclusion chromatography coupled to high resolution mass spectrometry. Anal Chim Acta 2021, 1183, 338987. *6.558*

Navarro-Huerta, J. A.; Murisier, A.; Nguyen, J. M.; Lauber, M. A.; Beck, A.; Guillarme, D.; Fekete, S., Ultra-short ion-exchange columns for fast charge variants analysis of therapeutic proteins. J Chromatogr A 2021, 1657, 462568. *4.759*

Nguyen, J. M.; Liu, X.; DeLoffi, M.; Murisier, A.; Fekete, S.; Guillarme, D.; Lauber, M. A., Aptamer-based immunoaffinity LC-MS using an ultra-short column for rapid attomole level quantitation of intact mAbs. J Chromatogr B 2021, 1173, 122694. *3.205*

Olesik, S.; West, C.; Guillarme, D.; Mangelings, D.; Novakova, L., Analytical challenges encountered and the potential of supercritical fluid chromatography: A perspective of five experts. Anal Sci Adv 2021, 2 (1-2), 76-80. *2.769*

Olesti, E.; Boccard, J.; Visconti, G.; Gonzalez-Ruiz, V.; Rudaz, S., From a single steroid to the steroidome: Trends and analytical challenges. J Steroid Biochem Mol Biol 2021, 206, 105797. *4.03*

Olesti, E.; Gonzalez-Ruiz, V.; Wilks, M. F.; Boccard, J.; Rudaz, S., Approaches in metabolomics for regulatory toxicology applications. Analyst 2021, 146 (6), 1820-1834. *4.616*

Pamies, D.; Sartori, C.; Schvartz, D.; Gonzalez-Ruiz, V.; Pellerin, L.; Nunes, C.; Tavel, D.; Maillard, V.; Boccard, J.; Rudaz, S.; Sanchez, J. C.; Zurich, M. G., Neuroinflammatory Response to TNFalpha and IL1beta Cytokines Is Accompanied by an Increase in Glycolysis in Human Astrocytes In Vitro. Int J Mol Sci 2021, 22 (8). *5.924*

Pellissier, L.; Koval, A.; Marcourt, L.; Ferreira Queiroz, E.; Lecoultre, N.; Leoni, S.; Quiros-Guerrero, L. M.; Barthelemy, M.; Duivelshof, B. L.; Guillarme, D.; Tardy, S.; Eparvier, V.; Perron, K.; Chave, J.; Stien, D.; Gindro, K.; Katanaev, V.; Wolfender, J. L., Isolation and Identification of Isocoumarin Derivatives With Specific Inhibitory Activity Against Wnt Pathway and Metabolome Characterization of Lasiodiplodia venezuelensis. Front Chem 2021, 9, 664489. *3.693*

Plachka, K.; Pezzatti, J.; Musenga, A.; Nicoli, R.; Kuuranne, T.; Rudaz, S.; Novakova, L.; Guillarme, D., Ion mobility-high resolution mass spectrometry in doping control analysis. Part II: Comparison of acquisition modes with and without ion mobility. Anal Chim Acta 2021, 1175, 338739. *6.558*

Hernandez-Jerez, A. F.; Adriaanse, P.; Aldrich, A.; Berny, P.; Coja, T.; Duquesne, S.; Focks, A.; Marinovich, M.; Millet, M.; Pelkonen, O.; Pieper, S.; Tiktak, A.; Topping, C. J.; Widenfalk, A.; Wilks, M.; Wolterink, G.; Gundert-Remy, U.; Louisse, J.; Rudaz, S.; Testai, E.; Lostia, A.; Dorne, J. L.; Parra Morte, J. M., Scientific Opinion of the Scientific Panel on Plant Protection Products and their Residues (PPR Panel) on testing and interpretation of comparative in vitro metabolism studies. EFSA J 2021, 19 (12), e06970. *3.336*

Salamin, O.; Nicoli, R.; Langer, T.; Boccard, J.; Grundisch, C. S.; Xu, C.; Rudaz, S.; Kuuranne, T.; Pitteloud, N.; Saugy, M., Longitudinal evaluation of multiple biomarkers for the detection of testosterone gel administration in women with normal menstrual cycle. Drug Test Anal 2021. *3.345*

Salamin, O.; Nicoli, R.; Xu, C.; Boccard, J.; Rudaz, S.; Pitteloud, N.; Saugy, M.; Kuuranne, T., Steroid profiling by UHPLC-MS/MS in dried blood spots collected fromhealthy women with and without testosterone gel administration. J Pharm Biomed Anal 2021, 204, 114280. *3.935*

Sannicolo, S.; Giaj Levra, M.; Le Gouellec, A.; Aspord, C.; Boccard, J.; Chaperot, L.; Toussaint, B.; Moro-Sibilot, D.; Hannani, D.; Toffart, A. C., Identification of a predictive metabolic signature of response to immune checkpoint inhibitors in non-small cell lung cancer: METABO-ICI clinical study protocol. Respir Med Res 2021, 80, 100845. *1.125*

Tobolkina, E.; Rudaz, S., Capillary Electrophoresis Instruments for Medical Applications and Falsified Drug Analysis/Quality Control in Developing Countries. Anal Chem 2021, 93 (23), 8107-8115. *6.986*

Wagner-Rousset, E.; Colas, O.; Chenu, S.; Francois, Y. N.; Guillarme, D.; Cianferani, S.; Tsybin, Y. O.; Sjogren, J.; Delobel, A.; Beck, A., Fast Afucosylation Profiling of Glycoengineered Antibody Subunits by Middle-Up Mass Spectrometry. Methods Mol Biol 2021, 2271, 73-83. *1.167*

Publications without impact factor

Fekete, S.; D'Atri, V.; Guillarme, D., Chromatographic Strategies for the Successful Characterization of Protein Biopharmaceuticals. Optimization in HPLC 2021, 57-72.

Dispas, A.; Guillarme, D.; Naegele, E.; Kutscher, D., Detection of Low-Level Impurities in Salbutamol Using the Agilent 1260 Infinity II SFC System with a Variable Wavelength Detector. Application note SFC Agilent 2021 2021, 1-6.

Barbas, C.; Chamkvetadze, B.; Furnaleto, S.; Ganzera, M.; Haginaka, M. J.; Li, S., Moddel, R.; Ozkan S.; Veuthey J-L., Preface. J Pharm Biomed Anal, 2021, 196, 113898.

Books or books chapters

D'Atri V., Guillarme D., Characterization of Glycosylated Proteins at Subunit Level by HILIC/MS, [in] A. Delobel (eds) Mass Spectrometry of Glycoproteins. Methods in Molecular Biology, Humana, New York, NY, 2021, 85-95.

Fekete S., D'Atri V., D. Guillarme D., Chromatographic strategies for the successful characterization of protein biopharmaceuticals [in] S. Kromidas (eds) Performance Optimization in HPLC: concept and strategies, 2021, 57-71.

Wagner-Rousset E., Colas O., Chenu S., Francois Y.N., Guillarme D., Cianferani S., Tsybin Y.O., Sjogren J., Delobel A., Beck A., Fast afucosylation profiling of glyco-engineered antibody subunits by middle up Mass Spectrometry, [in] Mass spectrometry of glycoproteins, Methods in molecular biology, 2021, 2271, 73-83.

Congresses / conferences and Symposia

- Congresses / conferences organisation: 2
- Posters presentations: 12
- Oral presentations: 16
- Invited oral presentations: 24

Ph.D. Theses presented in 2021

Gioacchino Luca Losacco
Evolution of Sub/Supercritical Fluid Chromatography-Mass Spectrometry for the Analysis of Highly Polar Compounds and Biological Matrices
Jean-Luc Veuthey and Davy Guillarme

Awards and distinction

Duivelshof B.L., Beck A., Liu X., Lauber M., Veuthey J.L., Guillarme D., D'atri V., What Is The Quantitative Potential of a Middle-up HILIC-HRMS Approach for Glycoprofiling of Monoclonal Antibodies?, **Gold VIJI award 2021 for oral communication**, SBCN 2021 - virtual event, May 2021.

Guillarme, D., **Elected among the 100 most influential people in analytical sciences** – ranking reported in the analytical scientist, 2021, 100, 12-51.

El Morabit L., From phenotype to AOP, a metabolomic approach for neurotoxicity, **Best presentation of my thesis in 180 seconds**, SCAHT – virtual retreat, December 2021.

Lardeux H., Goyon A., Zhang K., Guillarme D., D'Atri V., Oligonucléotides et adsorption en chromatographie liquide : quelle technologie de surface choisir ? **2021 Best poster award, 1st price**, SEP 2021, October 2021, Paris (France).

Salamin O., Nicoli R., Langer T., Boccard J., Schweizer Grundisch C., Xu Ch., Rudaz S., Pitteloud N., Saugy M., Kuuranne T., Longitudinal evaluation of multiple biomarkers for the detection of testosterone gel administration in women with normal menstrual cycle, **Best Oral Presentation**,
39th Cologne Mandfred Donike Workshop on Dope analysis, March 22nd - April 16th, 2021, Cologne (Germany).

BIOMOLECULAR AND PHARMACEUTICAL MODELLING

Professor Francesco Luigi GERVASIO

General description of Unit

The Biomolecular & Pharmaceutical Modelling Group (FAMOB), led by Prof. Francesco Luigi Gervasio, focusses on the development of methods for biomolecular simulations and drug discovery with emphasis on enhanced sampling simulation methods and free energy calculations. The group crucially contributed to the development of methods for overcoming the timescale problem (metadynamics, parallel-tempering metadynamics, path collective variables) which are widely used across different fields ranging from drug discovery and biophysics to nanotechnology. The group has also developed algorithms to sample hidden (cryptic) drug binding pockets in 'undruggable' proteins (SWISH).
The research group applies these methods to develop new drugs and to study a multitude of complex biophysical phenomena, including protein dynamics and folding, ligand binding, allosteric activation mechanisms in GPCRs and protein kinases, the formation of cryptic binding sites and the modes of action of cancer-causing mutations. The simulations conducted by the group have guided the design of several allosteric inhibitors some of which are now in pre-clinical development as anticancer drugs. The group has a fruitful line of experimental research (NMR, SPR, mutagenesis) to validate the computational predictions, as well as a number of successful collaborations with pharmaceutical companies (such as UCB, J&J and AstraZeneca).

Specific research fields

- Modelling the regulation of therapeutic proteins by allosteric mechanisms and post-translational modification.
- Prediction of binding thermodynamics and kinetics and its optimization to increase the efficacy and decrease the toxicity of drugs.
- Understanding cryptic binding sites and predicting their location on pharmaceutical targets.
- Computing accurate absolute ligand binding free energies.
- Multi-scale simulation approach to engineer nanocarriers.
- Understanding the activation mechanisms of drug targets such as kinases and GPCRs.
- Combining experiments and simulations to model the dynamics of biomacromolecules.
- Quantifying the effects of genetic mutations on protein structure and function.

2021 at a glance

- Publications with impact factor: 9
- Publications without impact factor: 0
- Patents: 0
- Book and chapters: 0
- Congresses / conferences organisation: 1
- Posters presentations: 7
- Oral presentations: 9
- Invited oral presentations: 7
- Number of projects at FNRS and assimilated (Research funds): 6
- Service agreements and related activities: 0
- Ph.D. Theses presented in 2021: 1
- Awards and distinctions: 1
- Public outreach activities: 0

Research funds

FNSF
Understanding and Modelling Cryptic Binding Pockets for Biology and Drug Discovery
Main applicant: Prof. Francesco Luigi Gervasio
Total funding of the project: CHF 679'870.-
Total duration of the project: 4 years
Allocation 2021: CHF 0.-
Starting date: 01.03.2022

FNSF BRIDGE
ABCD Antibodies: Recombinant antibodies for research
Main applicant: Prof. Pierre Cosson, Prof. Francesco Luigi Gervasio (co-applicant)
Total funding of the project: CHF 446'224.- (CHF 200'112.-)
Total duration of the project: 2 years
Allocation 2021: CHF 0.-
Starting date: 01.05.2022

PRACE Call 23 for Project Access
Combining and Testing Collective-Variable-Based Free Energy Algorithms for Efficient Calculations of Absolute Binding Free Energies Proposal No. 2021240103
Main applicant: Prof. Francesco Luigi Gervasio
Total funding of the project: 75'000.- CHF (110'294 node hours)
Total duration of the project: 1 year
Allocation 2021: CHF 18'750.-
Starting date: 01.10.2021

CSCS Swiss National Supercomputing Centre Production Project
Understanding the mechanisms of activation of class A G-protein-coupled receptors by ligands with different efficacy profiles (s1107)
Main applicant: Prof. Francesco Luigi Gervasio
Total funding of the project: 85'000.- CHF (125'000 node hours)
Total duration of the project: 1 year
Allocation 2021: CHF 21'250.-
Starting date: 01.10.2021

PRACE COVID-Fasttrack grant 6 million core-hours on HAWK (GCS@HLRS, Germany)
Main applicant: Prof. Francesco Luigi Gervasio
Total funding of the project: CHF 61'740.-
Funding duration: 12 months
Allocation 2021: CHF 25'725.-
Starting date: 01.05.2020

PRACE COVID-Fasttrack grant 30 mio core-hours on HAWK (GCS@HLRS, Germany)
Main applicant: Prof. Francesco Luigi Gervasio
Total funding of the project: CHF 308'700.-
Funding duration: 12 months
Allocation 2021: CHF 128'625.-
Starting date: 01.05.2020

Total amount for all research funds for 2021: CHF 194'350.-

Scientific publications (with impact factor)

Galdadas, I.; Qu, S.; Oliveira, A.S.F.; Olehnovics, E.; Mack, A.R.; Mojica, M.F.; Agarwal, P.K.; Tooke,C.L.; Gervasio, F.L. ; Spencer, J. ; Bonomo, R.A. ; Mulholland, A.J.; Haider, S.; Allosteric communication in class A β-lactamases occurs via cooperative coupling of loop dynamics. eLife 10: e66567, 2021. doi: 10.7554/eLife.66567 *8.14*

Shukla, V.K.; Siemons, L.; Gervasio, F.L.; Hansen, D.F.
Aromatic side-chain flips orchestrate the conformational sampling of functional loops in Human Histone Deacetylase 8. Chemical Science, 12, 9318-9327, 202. doi: 10.1039/D1SC01929E, 2021 *9.83*

Ilmjärv, S.; Abdul, F.; Acosta-Gutiérrez, S.; Estarellas, C.; Galdadas, I.; Casimir, M.; Alessandrini, M.; Gervasio, F.L.; Krause, K.H.
Concurrent mutations in RNA-dependent RNA polymerase and spike protein emerged as the epidemiologically most successful SARS-CoV-2 variant. Sci Rep 11, 13705, 2021. https://doi.org/10.1016/s1473-3099(20)30484-9 *4.38*

Galdadas, I.; Carlino, L.; Ward, R.A; Hughes, S.J.; Haider, S.; Gervasio, F.L.
Structural basis of the effect of activating mutations on the EGF receptor Elife 10, e65824, 2021. doi: 10.7554/eLife.65824 *8.14*

Acosta Gutierrez, S.; Marchello, G.; De Pace, C. ; Ing, G.; Lopez Vazquez, C.; Pilotto, S.; Werner, F.; Wilkinson, N.; Gervasio, F.L; Ruiz-Perez, L.; Battaglia, G.
Beyond Structure. Imaging Protein Dynamics at Physiological Temperatures. Biophys J, 120,173a, 2021 *4.03*

De Pace, C.; Acosta-Gutierrez, S.; Ing, G.; Marchello, G.; Pilotto, S.; Werner, F.; Wilkinson, N.; Leite, D.; Gervasio, F.L.; Ruiz-Pérez, L.; Battaglia, G.
Imaging Protein Dynamics in Liquid Water, Microsc. Microanal. 27, 15-16, 2021 *3.43*

Ing, G.; De Pace, C.; Guitierrez, S.; Marchello, G.; Pilotto, S.; Leite, D.; Wilkinson, N.; Werner, F.; Gervasio, F.L.; Ruiz-Pérez, L.; Battaglia, G.
Liquid-Phase Electron Microscopy in Structural Protein Studies. Microscopy and Microanalysis, 27, 89-90, 2021 *3.42*

Noble Jesus, C.; Evans, R.; Forth, J.; Estarellas, C.; Gervasio, F.L.; Battaglia, G.
Amphiphilic Histidine-Based Oligopeptides Exhibit pH-Reversible Fibril Formation.
ACS Macro Letters 10, 984-989, 2021 https://doi.org/10.1021/acsmacrolett.1c00142 *6.90*

Cignoni, E.; Lapillo, M.; Cupellini, L.; Acosta-Gutiérrez, S.; Gervasio, F.L.; Mennucci, B.;
A different perspective for nonphotochemical quenching in plant antenna complexes,
Nature Comm. 12, 1-9, 2021 https://doi.org/10.1038/s41467-021-27526-8 *14.92*

Congresses / conferences and Symposia

- Congresses / conferences organisation: 1
- Posters presentations: 7
- Oral presentations: 9
- Invited oral presentations: 7

Ph.D. Theses presented in 2021

Ioannis Galdadas
Understanding the effect of oncogenic mutations on kinases
Prof. F.L. Gervasio

Awards and distinction

Prize for the Best Poster at the CECAM workshop: Quantifying Protein Dynamics and Allosteric regulation in the cell with emerging technologies: From Cryo-EM and NMR to Multiscale Simulations, Networks and Machine Learning
Person name: Ioannis GALADADAS

Location: CECAM-HQ-EPFL, Lausanne, Switzerland & on-line
Date: September 17, 2021

Congresses / Conferences organisation

Person name: Ioannis GALADADAS
Location: CECAM-HQ-EPFL, Lausanne, Switzerland & on-line
Date: September 17, 2021

BIOPHARMACY

Professor Gerrit BORCHARD
Doctor Olivier JORDAN

General description of the Unit

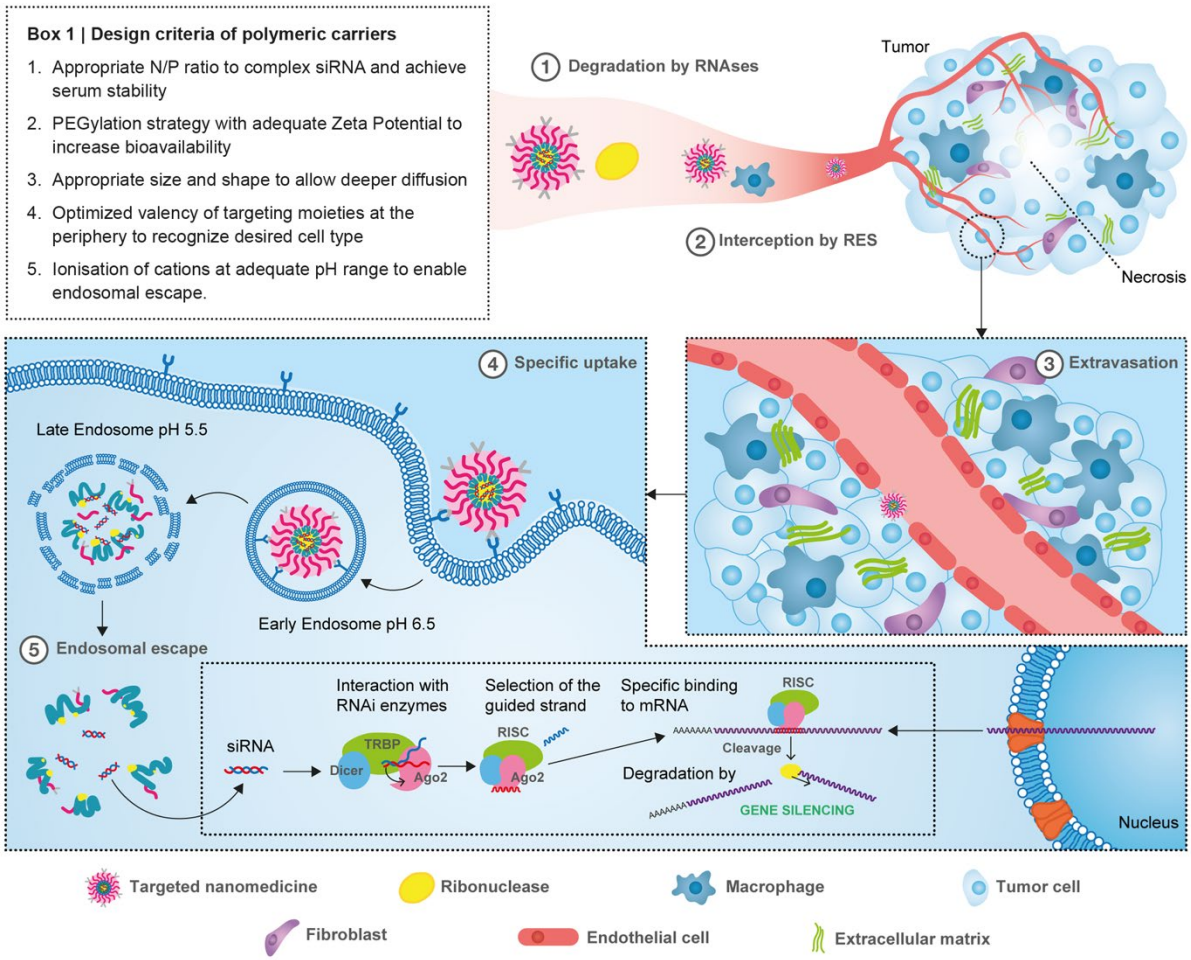
Formulation and delivery of nucleic acid-based medicines - A paradigm shift

Using drugs based on genetic material was shown to be a powerful tool to ward off a pandemic. This could have only been achieved by the intricate knowledge of the mechanism of action of such drugs, and their formulation into suitable delivery systems. The latter are responsible for the maintenance of drug stability and their delivery to their target, in this case the ribosomes located in the cytosol of immune cells. In several projects we are examining rationale approaches of how the balance between efficacy of nucleic acid drug action and their safety can be achieved.

We have engaged in a project that explored the potential development of a pharmaceutical platform, which can also serve as a model to improve analytical techniques, mainly computational simulation in investigating interaction between carriers such as polymers and nanoparticles and small interfering RNA (siRNA). In particular, we investigated to apply drug design methods to the delivery of siRNA, to observe whether computational modeling may be of help to improve development of polymeric biomaterials for siRNA delivery.

Based on previous research on methoxypoly (ethylene glycol)-*b*-poly (*D*,*L*-lactic acid) (mPEG-PLA) pharmaceutical platform, the idea in this project was to tailor this promising carrier by addition of a minimum number of cationic side groups along the core-forming polymer backbone. A lot of knowledge on mPEG-PLA has been acquired in our research group in the past by investigating the effects of the drug's physico-chemical parameters on the incorporation into mPEG-PLA micellar system leading to various formulations for different disease treatments under development. Therefore, we created a simple, analyzable, and calculable micellar system based on mPEG-PLA copolymer.

siRNA targeting the signal transducer and transcription 3 (STAT3), known for having an oncogenic role, was selected. The pleiotropic nature of this protein implies that treatments targeting STAT3 must be carried out carefully by selecting specific tumor types, such as NSCLC cell lines mutated by EGFR. This study therefore focused on a micellar support that is relatively simple to manufacture. By examining the possibility of integrating a defined size polymer allowing incorporation of therapeutic agents that are particularly hydrophilic, its biocompatibility and efficacy within the context of lung cancer treatment was evaluated. Drug design methods were applied to the delivery of STAT3-siRNA and to study downregulation of this protein by RNAi in NSCLC cellular models.



Schematic illustration of challenges to successful siRNA delivery. Main biological barriers and cytoplasmic processing of RNAi silencing.

2021 at a glance

- Publications with impact factor: 11
- Publications without impact factor: 1
- Patents: 0
- Book and chapters: 1
- Congresses / conferences organisation: 12
- Posters presentations: 19
- Oral presentations: 2
- Invited oral presentations: 21
- Number of projects at FNRS and assimilated (Research funds): 2
- Service agreements and related activities: 2
- Ph.D. Theses presented in 2021: 3
- Awards and distinctions: 1
- Public outreach activities: 0

Research funds

FNRS
SNSF
Tailored Adjuvants for Vaccine Formulations
Main applicant: G. Borchard
Total funding of the project: CHF 319'040.-
Total duration of the project: 4 years
Allocation 2021: CHF 51'210.-
Starting date: 01.07.2019

Innosuisse
Institutional
Innovative drug delivery systems to fight vessel stenosis after vascular surgery
Main applicant: Olivier Jordan
Total funding of the project: CHF 175'907.-
Total duration of the project: 1.5 years
Allocation 2021: CHF 87'953.50
Starting date : 01.12.2021

Total amount for all research funds for 2021: CHF 139'163.50

Service agreements and related activities

Innogap Fund
Total amount for 2021 CHF 5'000.-

NanoGVA Galenus Symposium
Total amount for 2021 CHF 25'712.62

Total amount for all research funds for 2021: CHF 30'712.62

Scientific publications (with impact factor)

Ragupathy, S.; Brunner, J.; Borchard, G., Short peptide sequence enhances epithelial permeability through interaction with protein kinase C, European Journal of Pharmaceutical Sciences 2021; 160. 105747 doi: 10.1016/j.ejps.2021.105747 *4.38*

Brunner, J.; Ragupathy, S.; Borchard, G., Target specific tight junction modulators, Advanced Drug Delivery Reviews 2021, 171, 266-288; doi: 10.1016/j.addr.2021.02.008 *15.47*

Peletta, A.; Prompetchara, E.; Tharakhet, K.; Kaewpang, P.; Buranapraditkun, S.; Techawiwattanaboon, T.; Jbilou, T.; Krangvichian, P.; Sirivichayakul, S.; Manopwisedjaroen, S.; Thitithanyanont, A.; Patarakul, K.; Ruxrungtham, K.; Ketloy, C.; Borchard, G., Toward a more equitable SARS-CoV-2 vaccine distribution: a cationic liposome formulation enhances the immunogenicity of a SARS-CoV-2 DNA vaccine candidate. Vaccines 2021, 9, 874. doi: 10.3390/vaccines 9080874 *4.42*

Petrovic, M.; Borchard, G.; Jordan, O.,
Considerations for the delivery of STING ligands in cancer immunotherapy.
J. Control. Rel. 2021, 339, 235-247. doi: 10.1016/j.jconrel.2021.09.033 *9.78*

Marquet, F.; Patrulea, V.; Borchard, G., Comparison of triblock copolymeric micelles based on α- and ε-poly(L-Lysine): A Cornelian Choice. Polymer J. 2021, 54, 199-209 doi: 10.1038/s41428-021-00552-5. *3.08*

Klein, K.; Borchard, G.; Shah, V.P.; Flühmann, B.; McNeil, S.E.; de Vlieger, J.S.B., A science-based, pragmatic regulatory approach for complex generics through 505(j) or 505(b)(2) pathways. Ann. N.Y. Acad. Sci. 2021, 1502, 5-13. doi: 10.1111/nyas.14662. *5.69*

Lemoine, C.H.; Nidom, R.V.; Ventura, R.; Indrasari, S.; Normalina, I.; Santoso, K.P.; Derouet, F.; Barnier-Quer, C.; Collin, N.; Borchard, G.; Nidom, C.A., Better pandemic influenza preparedness through adjuvant technology transfer; challenges and lessons learned. Vaccines 2021, 9, 461. doi: 10.3390/vaccines9050461. *4.42*

Kawano, Y.; Patrulea, V.; Jordan, O.; Borchard, G.; Lyoda, T.; Kageyama, R.; Morita, A.; Seino, S.; Yoshida H.; Hanawa, T., Wound healing promotion by hyaluronic acid: effect of molecular weight on gene expression and *in vivo* wound closure. Pharmaceuticals 2021, 14, 301. doi: 10.3390/ph14040301. *5.86*

Patrulea, V.; Gan, B.H.; Perron, K.; Cai, X.; Abdel-Sayed, P.; Sublet, E.; Ducret, V.; Porroche Nerhot, N.; Applegate, L.A.; Borchard, G.; Reymond, J.L.; Jordan, O., Synergistic effects of antimicrobial peptide dendrimer-chitosan polymer conjugates against Pseudomonas aeruginosa. Carbohydrate Polymers 280:119025 (2021). doi: 10.1016/j.carbpol.2021.119025 *9.38*

Laurent, A.; Porcello, A.; Fernandez, P.G.; Jeannerat, A.; Peneveyre, C.; Abdel-Sayed,P.; Scarletta, C.; Hirt-Burri, N.; Michetti, M.; de Buys Roessingh, A.; Raffoul, W.; Allémann, E.; Jordan, O.; Applegate, L.A., Combination of Hyaluronan and Lyophilized Progenitor Cell Derivatives: Stabilization of Functional Hydrogel Products for Therapeutic Management of Tendinous Tissue Disorders. Pharmaceutics 13 :2196 (2021). doi: 10.3390/pharmaceutics 13122196. 6.32

Salgado, C.; Jordan, O.; Allémann, E., Osteoarthritis In Vitro Models: Applications and Implications in Development of Intra-Articular Drug Delivery Systems. Pharmaceutics 13:60 (2021). doi: 10.3390/pharmaceutics13010060. *6.32*

Scientific publications (without impact factor)

Borchard, G.; Moll, C., Studies of Pharmaceutical Sciences in Switzerland. SWISS PHARMA 3/21, Verlag Dr. Felix Wüst AG, Küsnacht, Switzerland, 2021.

Books or books chapters

Marquet, F.; Borchard, G., Polymeric micelles for targeted delivery of siRNA in cancer therapy: State of the art. In: P. Kesharwani and K. Greish (Eds.), Polymeric micelles for drug delivery. Elsevier, Amsterdam (2021) *accepted for publication.*

Ph.D. Theses presented in 2021

Carlota De Lacerda Salgado
Intra-articular sustained release carriers for osteoarthritis management: formulation and bioactivity evaluation studies
Eric Allémann and Olivier Jordan

Céline Lemoine
Towards single-dose pandemic influenza vaccines: Investigating delayed release and adjuvanted approaches in the context of technology transfer to Indonesia
Gerrit Borchard and Christophe Barnier-Quer

Franck Marquet
Novel micellar drug carrier systems for gene therapies
Gerrit Borchard and Michael Möller

Congresses / conferences and Symposia

- Congresses / conferences organisation: 12
- Posters presentations: 19
- Oral presentations: 2
- Invited oral presentations: 21

Awards and distinction

1st poster prize of the Swiss Acad. Pharm. Sci. 14th Swiss Pharma Science Day, virtual conference, Switzerland, August 25, 2021. Poster A Porcello et al., Thermoresponsive hyaluronan-based hydrogels for the formulation of standardized transplants in tendon regenerative medicine.

CLINICAL PHARMACOLOGY AND TOXICOLOGY

Professor Jules DESMEULES

General description of Unit

Our research aims to study the variation of drug responses by evaluating drug transportation and the enzymes involved in the metabolism of xenobiotics such as cytochromes P450 through *in vitro* (microsomes, cells) or *in vivo* models (phenotyping, genotyping, pharmacokinetic, toxicogenetic and pharmacogenetics clinical and epidemiological studies), and studies related to efficacy or the safety usage of drugs. The other field developed by the clinical pharmacology and toxicology is directed to studies related to chronic pain and the usage and misuse of analgesics.

Specific research fields

- Measuring the impact of pharmacogenomics on drug response focusing mainly in opioids, antiplatelet drugs, anti-HIV drugs, oncologic treatments,
- Developing tools to measure the activity of metabolic enzymes, predict therapeutic responses (phenotyping cocktails, PB-PK simulation) and to detect drug-drug interactions,
- Evaluating the role of genomics in the assessment of adverse drug reactions,
- Developing neurophysiological evaluation methods for testing the efficacy of peripheral and central analgesics (psychometric and neurophysiological-quantitative sensory testing evaluation), in acute and chronic pain syndromes,
- Promote translational research by enhancing synergies between basic sciences and clinical medicine.

Established collaborations with different units from ISPSO, HUG, and the faculty of medicine of Geneva University and other national and international research groups.

From ISPSO, collaborations are ongoing with different groups:

Prof. Carole Bourquin;

Prof. Patrycja Nowak;

Prof. Serge Rudaz;

Prof. Jean Luc Veuthey;

Prof. Jean-Luc Wolfender, Prof. Emerson Queiroz.

Other collaborations are ongoing with different groups from HUG and faculty of medicine:

Prof. Marc Ansari's oncopediatric group;

Prof. Barbara Broers' group;

Prof. P. Fontana and Prof. J.L. Reny's Geneva Platelet group;

Dr Markus Kosel's psychiatric group;

Prof. Christian Lovis's group;

Prof. Sophie Pautex's group;

Prof. Jean-Charles Sanchez's group.

National and International collaborations:

Prof. Aurelien Thomas' group (Lausanne University); Swiss Center for Applied Human Toxicology;

Certara (Simcyp) and the University of Manchester;

Prof. Gisèle Pickering, Clinical pharmacology University Hospitals of Clermond-Ferrand, France.

2021 at a glance

- Publications with impact factor: 51
- Publications without impact factor: 7
- Patents: 1
- Book and chapters: 0
- Congresses / conferences organisation: 5
- Posters presentations: 8
- Oral presentations: 8
- Invited oral presentations: 5
- Number of projects at FNRS and assimilated (Research funds): 8
- Service agreements and related activities: 2
- Ph.D. Theses presented in 2021: 2
- Awards and distinctions: 2
- Public outreach activities: 5

Research funds

Public funds

FNRS 182686
Identification of genetic determinants for central pain sensitization in fibromyalgia patients
Prof. Jules DESMEULES
CHF 387'300.-
3 years : 2019-2022

FNRS 182361
Impact of CYP2D6 Genetic Polymorphisms on the vulnerability to Drug-Drug Interactions with tramadol: a gene-environment interaction study
Prof. Youssef DAALI, Prof. Caroline SAMER
CHF 298'291.-
4 years : 2018-2022

Swiss Innovation Agency 37848.1
NDMC as a new antihyperalgesic
Prof. Marie BESSON, CC, PD
CHF 454'971.-

Private Funds

Fondation Leenaards
Impacts of touch-massage on the experience of patients with chronic pain and on the provider-patient relationship in inpatient settings: a mixed study.
Prof. Maria Goreti DA ROCHA RODRIGUES, Prof. Jules DESMEULES, Catherine BOLLONDI PAULY, Prof. Christine CEDRASCHI, Prof. François CURTIN.
CHF 128'000.-
2 years : 2019-2021

Institutional funds

Projet de Recherche et Développement
Impact de l'IL-6 sur l'activité des CYP450 mesurée par papier buvard
Camille LENOIR, Prof. Caroline SAMER
CHF 50'000.-
2018-ongoing

Projet de Recherche et Développement
Pupillométrie comme méthode de phénotypage du CYP2D6
Dr Frédérique RODIEUX
CHF 50'000.-

2017-ongoing

Projet de Recherche et Développement PRD2-2017-1
thrombotic risk in patients with nephrotic syndrome
Dr Jean Terrier
CHF 30'000
2021-Ongoing

Fond départemental recherche clinique et fondamentale (département de médecine)
Etude OptimAT
Dr Jean Terrier
CHF 30'000
2021-Ongoing

Total amount for all research funds going on for 2021: CHF 1'428'562.-

Service agreements and related activities

Center of Research & Expertise in antidoping sciences (REDs) & Prof. Youssef Daali, laboratoire de pharmacologie et toxicologie cliniques : CHF 35'000.-

SCAHT for the coordination MAS TOX & Prof. Caroline Samer: CHF 20'000.-

Total amount (for all service agreements and related activities) for 2021: CHF 55'000.-

Scientific publications (with impact factor 2020)

Czarnetzki, C.; Albrecht, E.; Desmeules, J.; Kern, C.; Corpataux, JB.; Gander, S.; Kuijk, SMJV.; Tramèr, MR., Dexamethasone for the treatment of established postoperative nausea and vomiting: A randomized dose finding trial. Eur J Anaesthesiol 2021, Nov 16. Online ahead of print. *4.14*

Lenoir, C.; Niederer, A.; Rollason, V.; Desmeules, J.; Daali, Y.; Samer, C., Prediction of cytochromes P450 3A and 2C19 modulation by both inflammation and drug interactions using physiologically based pharmacokinetics. CPT Pharmacometrics Syst Pharmacol. 2022 Jan;11(1):30-43. doi: 10.1002/psp4.12730. Epub 2021 Nov 17. *4.05*

Abouir, K.; Samer CF.; Gloor, Y.; Desmeules J.; Daali Y., Reviewing Data Integretated for PBPK Model Development to Predict Metabolic Drug-Drug Interactions: Shifting Perspectives and Emerging Trends. Front Pharmacol. 2021 Oct 28; 12:708299. doi: 10.3389/fphar.2021.708299. eCollection 2021. *5.81*

Magliocco, G.; Le Bloc'h, F.; Thomas, A.; Desmeules, J.; Daali, Y.,
Simultaneous determination of melatonin and 6-hydroxymelatonin in human overnight urine by LC-MS/MS. J Chromatograph B Analyt Technol Biomed Life Sci 2021, Sep 1;1181:122938. doi: 10.1016/j.jchromb.2021.122938. Epub 2021 Sep 8. *3.02*

Ing Lorenzini, K.; Desmeules J.; Rollason, V.; Bertin, S.; Besson, M.; Daali, Y.; Samer,C., CYP450 Genotype-Phenotype Concordance Using the Geneva Micrococktail in a Clinical Setting. Front Pharmacol 2021, Aug 26;12:730637. doi: 10.3389/fphar.2021.730637. eCollection 2021. *5.81*

Lenoir, C.; Terrier, J.; Gloor, Y.; Curtin, F.; Rollason, V.; Desmeules, J.; Daali, Y.; Reny, JL.; Samer, C., Impact of SARS-CoV-2 Infection (COVID-19) on Cytochromes P450 Activity Assessed by the Geneva Cocktail. Clin Pharmacol Ther 2021 Nov;110(5):1358-1367. *6.87*

Lenoir, C.; Rodieux, F.; Desmeules J.; Rollason, V.; Samer, C., Impact of Inflammation on Cytochromes P450 Activity in Pediatrics: A Systematic Review. Clin Pharmacokinet 2021, Dec;60(12):1537-1555. doi: 10.1007/s40262-021-01064-4. Epub 2021 Aug 31. *6.44*

Magliocco, G.; Desmeules, J.; Matthey, A.; Quiros-Guerrero, LM.; Bararpour, N.; Joye, T.; Marcourt, L.; Queiroz, EF.; Wolfender, JL.; Gloor, Y.; Thomas, A.; Daali, Y.; Metabolomics reveals biomarkers in human urine and plasma to predict cytochrome P450 2D6 (CYP2D6) activity. Br J Pharmacol 2021 Dec;178(23):4708-4725. *8.73*

Lonchampt, S.; Gerber, F.; Aubry, JM.; Desmeules, J.; Kosel, M.; Besson, M., Prevalence of Polypharmacy and Inappropriate Medication in Adults With Intellectual Disabilities in a Hospital Setting in Switzerland. Front Psychiatry 2021, Jun 25;12:614825. doi: 10.3389/fpsyt.2021.614825. eCollection 2021. *3.53*

Roulet, L.; Rollason, V.; Desmeules, J.; Piguet, Valérie., Tapentadol Versus Tramadol: A Narrative and Comparative Review of Their Pharmacological Efficacy and Safety Profiles in Adult Patients. Drugs 2021 Jul;81(11):1247-1272. *9.54*

Magliocco, G.; Desmeules, J.; Bosilkovska, M.; Thomas, A.; Daali, Y., The 1β-Hydroxy-Deoxycholic Acid to Deoxycholic Acid Urinary Metabolic Ratio: Toward a Phenotyping of CYP3A Using an Endogenous Marker ? J Pers Med 2021 Feb 20;11(2):150. *4.45*

Da Rocha Rodrigues, MG.; Bollondi Pauly, C.; Thentz, C.; Boegli, M.; Curtin, F.; Luthy, C.; Cedraschi, C.; Desmeules, J., Impact of Touch massage on the experience of patients with chronic pain: A protocol for a mixed method study. Complement Ther Clin Pract 2021, May;43:101276. doi: 10.1016/j.ctcp.2020.101276. Epub 2020 Nov 28. *2.07*

Lenoir, C.; Daali, Y.; Rollason, V.; Curtin, F.; Gloor, Y.; Bosilkovska, M.; Walder, B.; Gabay, C.; Nissen, MJ.; Desmeules, J.; Hannouche, D.; Samer, C., Impact of Acute Inflammation on Cytochrome P450 Activity Assessed by the Geneva Cocktail. Clin Pharmacol Ther 2021 Jun;109(6):1668-1676. *6.87*

Ben Hassine, K.; Nava, T., Théoret, Y.; Nath, CE.; Daali, Y.; Kassir, N.; Lewis, V.; Bredius, RGM.; Shaw, PJ.; Bittencourt, H.; Krajinovic, M.; Uppugunduri, CRS.; Ansari, M., Precision Dosing of intravenous busulfan in pediatric hematopoietic stem cell transplantation: Results from a multicenter population pharmacokinetic study. CPT Pharmacometrics Syst Pharmacol 2021 Sep;10(9):1043-1056. *4.05*

Neyshaburinezhad, N.; Ghasim, H.; Rouini, M.; Daali, Y.; Ardakani, YH., Frequency of Important CYP450 Enzyme Gene Polymorphisms in the Iranian Population in Comparison with Other Major Populations: A Comprehensive Review of the Human Data. J Pers Med 2021 Aug 18; 11(8)804. *4.45*

Wagner, J.; Gössl, D.; Ustyanovska, N.; Xiong, M.; Hauser, D.; Zhuzhgova, O.; Hocevar, S.; Taskoparan, B.; Poller, L.; Datz, S.; Engelke, H.; Daali, Y.; Bein, T.; Bourquin, C., Mesoporous Silica Nanoparticles as pH-Responsive Carrier for the Immune-Activating Drug Resiquimod Enhance the Local Immune Response in Mice. ACS Nano 2021 Mar 23;15(3):4450-4466. *15.88*

Cagno, V.; Magliocco, G.; Tapparel, C.; Daali, Y., The tyrosine kinase inhibitor nilotinib inhibits SARA-CoV-2 in vitro. Basic Clin Pharmacol Toxicol 2021 Apr;128(4):621-624. *2.65*

Vandenberghe, F.; Gilet, P.; Daali, Y.; Favre, L.; Eap, CB., Bioavailability of Vortioxetine After a Roux-en-Y Gastric Bypass. Obes Surg 2021 Mar;31(3):1353-1356 *4.12*

Darwich, AS.; Polasek, TM.; Aronson, JK.; Ogungbenro, K.; Wright, DFB.; Achour, B.; Reny, JL.; Daali, Y.; Eiermann, B.; Cook, J.; Lesko, L.; McLachlan, AJ.; Rostami-Hodjegan, A., Model-Informed Precision Dosing: Background, Requirements, Validation, Implementation, and Forward Trajectory of Individualizing Drug Therapy. Annu Rev Pharmacol Toxicol 2021 Jan 6;61:225-245 *13.82*

Cloesmeijer, ME.; van Esdonk, MJ.; Lynn, AM.; Smits, A.; Tibboel, D.; Daali, Y.; Olkkola, KT.; Allegaert, K.; Mian, P., Impact of enantiomer-specific changes in pharmacokinetics between infants and adults on the target concentration of racemic ketorolac: A pooled analysis. Br J Clin Pharmacol 2021 Mar;87(3):1443-1454 *4.33*

Barbolini, L.; Terrier, J.; Marti, C.; Samer, C.; Daali, Y.; Fontana, P.; Reny, JL., Mixing Drugs and Genetics: A Complex Hemorrhagic Cocktail. Am J Med 2021, Mar;134(3): e211-e212. doi: 10.1016/j.amjmed.2020.07.032. Epub 2020 Aug 25. *4.96*

Antonio, JA.; Rollason, V.; Musumeci, S.; Finckh, A.; Lazarou, I.; Laffitte; E.; Nendaz, M.; Serratrice, J.; Coen, M., Mazzotti reaction: Ivermectin-associated polyarthritis after delayed scabies treatment. Case report and review of the literature. Therapie 2021, Oct 14:S0040-5957(21)00205-5. doi: 10.1016/j.therap.2021.10.001. Online ahead of print. *2.07*

Fernandez, S.; Lenoir, C.; Samer, C.; Rollason, V., Drug-Drug Interactions Leading to Adverse Drug Reactions with Rivaroxaban: A systematic Review of the Literature and Analysis of VigiBase. J Pers Med 2021 Mar 30;11(4):250. *4.45*

Coen, M.; Jandus, P.; Rollason, V.; Seebach, J.; Serratrice, J., Cinderella side effect: Intravenous corticosteroid-induced bradycardia. Therapie 2021 Sep-Oct;76(5):480-481. *2.07*

Pauliat, E.; Onken, M.; Weber-Schoenendorfer, C.; Rousson, V.; Addor, MC.; Baud, D.; Théaudin, M.; Diav-Citrin, O.; Cottin, J.; Agustri, A.; Rollason, V.; Kaplan, YC.; Kennedy, D.; Kadioglu, M.; Rothuizen, LE.; Livio, F.; Buclin, T.; Panchaud, A.; Winterfeld, U., Pregnancy outcome following first-trimester exposure to fingolimod: A collaborative ENTIS study. Mult Scler 2021 Mar;27(3):475-478. *5.41*

Bégin, MJ.; Audet, MC.; Chevalley, T.; Portela, M.; Padlina, I.; Hannouche, D.; Ing Lorenzini, K.; Meier, R.; Peter, R.; Uebelhart, B.; Rizzoli, R.; Ferrari, S.; Biver, E., Fracture Risk Following an Atypical Femoral Fracture. J Bone Miner Res 2022, Jan;37(1):87-94. doi: 10.1002/jbmr.4461. Epub 2021 Nov 9. *6.74*

Busse, JW.; Vankrunkelsven, P.; Zeng, L.; Heen, AF.; Merglen, A.; Campbell, F.; Granan, LP.; Aertgeerts, B.; Buchbinder, R.; Coen, M.; Juurlink, D.; Samer, C.; Siemieniuk, RAC.; Kumar, N.; Coper, L.; Brown, J.; Lytvyn, L.; Zeraatkar, D.; Wang, L.; Guyatt, GH.; Vandvik, PO.; Agoritsas, T., Medical cannabis or cannabinoids for chronic pain: a clinical practice guideline. BMJ 2021, Sep 8; 374:n2040. doi: 10.1136/bmj.n2040. *39.89*

Piletta-Zanin, A.; De Mul, A.; Rock, N.; Lescuyer, P.; Samer, C.; Rodieux, F., Case Report: Low Hematocrit Leading to Tacrolimus Toxicity. Front Pharmacol 2021, Aug 16;12:717148. doi: 10.3389/fphar.2021.717148. eCollection 2021. *5.81*

Suppan, M.; Beckmann, TS.; Gercekci, C.; Sigrist, T.; Savoldelli, GL.; Fournier, R.; Samer, C., Development and Preliminary Validation of LoAD Calc, a Mobile App for Calculating the Maximum Safe Single Dose of Local Anesthesics. Healthcare (Basel) 2021, Jun 25;9(7):799. doi: 10.3390/healthcare9070799. *1.58*

Terrier, J.; Gaspar, F.; Fontana, P.; Daali, Y.; Reny, JL.; Csajka, C.; Samer, C,. Drug-Drug Interactions with Direct Oral Anticoagulants: Practical Recommendations for Clinicians. Am J Med 2021 Aug;134(8):939-942. *4.96*

Skalafouris, C.; Samer, C.; Stirnemann, J.; Grosgurin, O.; Eggimann, F.; Grauser, D.; Reny, JL.; Bonnabry, P.; Guignard, B., Electronic monitoring of potential adverse drug events related to lopinavir/ritonavir and hydroxychloroquine during the first wave of COVID-19. Eur J Hosp Pharm 2021, 8: ejhpharm-2020-002667. doi: 10.1136/ejhpharm-2020-002667. Online ahead of print. *0.83*

Srinivasamurthy, SK.; Ashokkumar, R.; Kodidela, S.; Howard, SC.; Samer, C.; Chakradhara Rao, US., Impact of computerized physician order entry (CPOE) on the incidence of chemotherapy-related medication errors: a systematic review. Eur J Clin Pharmacol 2021 Aug;77(8):1123-1131. *2.96*

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Samer, C.; Lacombe, K.; Calmy, A., Cyber harassment of female scientists will not be the new norm. Lancet Infect Dis 2021 Apr; 21(4):457:458. *25.07*

Lacour, M.; Bloudeau, L.; Combescure, C.; Haddad, K.; Hugon, F.; Suppan, L.; Rodieux, F.; Lovis, C.; Gervaix, A.; Ehrler, F.; Manzano, S.; Siebert, JN.; PedAMINES Prehospital Group., Impact of a Mobile App on Paramedics' Perceived and Physiologic Stress Response During Simulated Prehospital Pediatric Cardiopulmonary Resuscitation: Study Nested Within a Multicenter Randomized Controlled Trial. JMIR Mhealth Uhealth 2021, Oct 7; 9(10):e31748. doi: 10.2196/31748. *4.77*

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Anci, E.; Braun, C.; Marinosci, A.; Rodieux, F.; Midun, E.; Torres, MJ. ; Caubet, JC., Viral Infections and Cutaneous Drug-Related Eruptions. Front Pharmacol 2021, Mar 10;11:586407. doi: 10.3389/fphar.2020.586407. eCollection 2020. *5.81*

Corso, M.; Cancelliere, C.; Mior, S.; Salmi, LR.; Cedraschi, C.; Nordin, M.; Sci, DM.; Taylor-Vaisey, A.; Côté, P., Are Nonpharmacologic Interventions Delivered Through Synchronous Telehealth as Effective and Safe as In-Person Interventions for the Management of Patients With Nonacute Musculoskeletal Conditions? A Systematic Rapid Review. Arch Phys Med Rehabil 2022 Jan;103(1):145-154.e11. doi: 10.1016/j.apmr.2021.09.007. Epub 2021 Nov 2. *3.96*

Cantero, C ; Pasquina, P. ; Dao, MD. ; Cedraschi, C. ; Adler, D. ; Plojoux, J. ; Janssens, JP., Impact of Confinement in Patients under Long-Term Noninvasive Ventilation during the First Wave of the SARS-CoV-2 Pandemic: A Remarkable Resilience. Respiration 2021;100(9):909-917. *2.67*

Sorondo, D.; Delpierre, C.; Côté, P.; Salmi, LR. ; Cedraschi, C. ; Taylor-Vaisey, A. ; Leumeunier, N., Determinants of clinical practice guidelines' utilization for the management of musculoskeletal disorders: a scoping review. BMC Musculoskelet Disord 2021, Jun 1;22(1):507. doi: 10.1186/s12891-021-04204-w. *2.24*

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Lenoir, C.; Rollason, V.; Desmeules, J.; Daali, Y.; Samer, C., Influence of inflammation on cytochromes P450 activity in adults: a systematic review of the literature. Frontiers in Pharmacology 2021, Nov 16;12:733935. doi: 10.3389/fphar.2021.733935. eCollection 2021. *5.81*

Skalafouris, C.; Samer, C.; Stirnemann, J.; Grosgurin, O.; Eggimann, F.; Grauser, D.; Reny, JL.; Bonnabry, P.; Guignard, B., Electronic monitoring of potential adverse drug events related to lopinavir/ritonavir and hydroxychloroquine during the first wave of COVID-19. European Journal of Hospital Pharmacy 2021, Apr 8: ejhpharm-2020-002667. doi: 10.1136/ejhpharm-2020-002667. Online ahead of print. *0.9*

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Srinivasamurthy, SK.; Ashokkumar, R.; Kodidela, S.; Howard, SC.; Samer, C.; Chakradhara, Rao US. Impact of Computerised Physician Order Entry (CPOE) on the Incidence of Chemotherapy-related Medication Errors: A Systematic Review. European Journal of Clinical

Pharmacology 2021, 77(8):1123-1131. *2.9*

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Vernaz, N.; Agoritsas, T.; Calmy, A.; Gayet-Ageron, A.; Gold, G.; Perrier, A.; Picard, F.; Prendki, V.; Reny, JL.; Samer, C.; Stirnemann, J.; Vetter, P.; Zanella, MC.; Zekry, D.; Baggio, S., Early experimental COVID-19 therapies: impact on length of stay, mortality, and related costs. Swiss Med Wkly. 2020 Dec 31; 150:w20446. doi: 10.4414/smw.2020.20446. eCollection 2020 Dec 14. *1.82*

Hofmann, M.; Besson, M., Gabapentinoids: The rise of a new misuse epidemics? Psychiatry Res 2021 Nov; 305:114193. doi: 10.1016/j.psychres.2021.114193. Epub 2021 Aug 28. *3.22*

Meszaros, EP.; Stancu, C.; Costanza, A.; Besson, M.; Sarasin, F.; Bondolfi, G.; Ambrosetti, J., Antibiomania: a case report of clarithromycin and amoxicillin-clavulanic acid induced manic episodes separately. BMC Psychiatry. 2021 Aug 11;21(1):399. doi: 10.1186/s12888-021-03397-7. *3.63*

Scientific publications (without impact factor)

Roulet, L.; Rollason, V.; Desmeules, J.; Piguet, V., Monoaminergic opioids: which one should we choose? Rev Med Jun 23;17(744):1218-1223.

Souche, A.; Piguet, V.; Besson, M.; Bourezg, A.; Desmeules, J.; Cedraschi, C., Activity, decentration and cognitive restructuring in cognitive-behavioural therapy - practice-based aspects. Rev Med Suisse 2021 June 23;17(744):1204-1207.

Allaz, AF.; Mateiciuc Leutke, S.; Cedraschi, C., On some links between pain and emotions. Rev Med Suisse 2021 Jun 23 ;17(44) :1200-1203.

Molinard-Chenu, A.; Cedraschi, C.; Chytas, V. Personalized approach in chronic pain psychotherapy. Rev Med Suisse 2021 Feb 10;17(725):293-296.

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Sergentanis, I.; Vibert, V.; Costanza, A.; De Néris, M. ; Besson, M. ; Kosel, M. ; Bondolfi, G. ; Ambrosetti, J., About the use of ketamine in emergency psychiatric settings. Rev Med Suisse 2021 Feb 10;17(725):303-306.

Baggio, S.; Samer, C.; Agoritsas, T.; Calmy, A.; Jacquerioz, F.; Gayet-Ageron, A.; Legouis, D.; Perrier, A.; Reny, J.; Stirnemann, J.; Vetter, P.; Wolff, H.; Zekry, D.; Vernaz, N.; Prendki, V., Co-medications administered with hydroxychloroquine in COVID-19 inpatients: prevalence and ethical implications. Swiss Medical Weekly Op-eds 2021.

Patents

Besson Marie [CH]; Daali Youssef [CH]; Desmeules Jules [CH]; Matthey Alain [CH]; Ralvenius William T [CH]; Zeilhofer Hans Ulrich [CH], Use of N-Desmethylclobazam in the treatment of chronic pain disorders and related methods, Patent number EP16709145.3

Congresses / conferences and Symposia

- Congresses / conferences organisation: 5
- Posters presentations: 8
- Oral presentations: 8
- Invited oral presentations: 5

Ph.D. Theses presented in 2021

Lonchampt, Sophie
Evaluation et systématisation des pratiques de prescription médicamenteuse chez les adultes avec déficience intellectuelle
Thesis number 5604
Director Prof. Desmeules, J.
Co-directors Prof. Besson, M; Dr Kosel, M.

Mouterde, Mederic
Étude de la diversité et de l'évolution des pharmacogènes dans les populations humaines par combinaison de données phénotypiques et génomiques
Thesis number 105
Director Prof. Desmeules, J.
Co-director Dr Poloni, E.

Awards and distinction

Distinction pour la meilleure formation d' enseignement de toxicologie de la Société Suisse de Centre de Compétence en Chimie et Toxicologie Analytique ccCTA 2021MAS en Toxicology

ASCPT 2020 Presidential Trainee Award
Lenoir, Camille
"Impact of acute inflammation on cytochromes P450 activity measured with dried blood spot."

Public outreach activities (radio, television and other media)

J. Desmeules, K. Ing Lorenzini. Dans les bras de morphine. TSR, Temps présent, January 28th, 2021, Geneva (Switzerland).

C. Samer. Vitamine D : un remède face à l'hiver et au COVID-19 ? Le Matin, February 2021.

C. Samer. La médecine personnalisée, ce n'est pas le futur, mais le présent. Planète Santé, March 2021.

C. Samer. Zoom sur les médicaments. Pulsations, April 2021.

C. Samer. Quels risquent court-on en conduisant sous l'influence de médicaments ? TCS MyMed, April 2021.

CLINICAL PHARMACY SCIENCES

Professor Chantal CSAJKA

General description of the Unit

The mission of the clinical pharmacy science group is to promote post-approval drug optimisation revolving around three main axes. The first research focus is therapeutic individualisation by the comprehension of the demographic, physiopathologic, environmental or genetic determinants influencing therapeutic response or toxicity. The second axe comprises research on security and efficacy of drugs, in particular in vulnerable population (paediatrics, geriatrics, oncology) and the third research focus is the development of tools and guidelines allowing for therapeutic optimisation. The methods used are based on quantitative and qualitative techniques, including modelling and simulations and biostatistics. The overall goal of the research is to increase the knowledge on the pharmacokinetics and pharmacokinetic-pharmacodynamic relationships of commercialized drugs at particular risk and to improve drugs' safety and efficacy to optimize their use in clinical practice.

Specific research fields

The following achievements have taken place in 2021.

- **Drug individualisation**. Several projects on the pharmacokinetic characterisation of antiretroviral and psychoactive drugs have been fulfilled, with direct implication for clinical practice. In oncology, a clinical study aiming at better defining therapeutic targets of tyrosine kinase inhibitors and adherence patterns of patients under long-term treatment is ongoing and several population analyses of targeted oncologic drugs have been translated into clinical recommendations. A research program on pharmacogenetic-based drug and dosage individualization has been initialized, aiming at evaluating and implementing novel genetic-based interventions by community and hospital pharmacists.

- **Drug security and efficacy**. Improvement of adverse drug events detection in a population of geriatric inpatients using data mining is ongoing (SNF project, collaboration between the HUG, CHUV, Baden and Zürich hospital). Innovative methods of structured data analyses and natural language processing to identify adverse drug events (ADEs) from electronic medical information systems are being developed. Several related projects are ongoing for the improvement of the security of use of antithrombotic drugs (collaboration with the HUG). Other projects dedicated to the prediction of ADEs in the geriatric population are ongoing, including a project on medication reconciliation between the community and hospital admission and discharge. A randomized clinical trial whose objective is to evaluate the efficacy of a Chinese medicinal herb in the treatment of acute bronchitis has been initiated (Leenards Foundation, Santeinegra). This study will evaluate whether complementary medicine can be integrated within conventional care; it could also provide an interesting alternative to the often inappropriate use of antibiotics in this indication.

- **Tools for drug optimisation in clinical practice**. The collaborative project with the HEIG-VD aiming at developing a software (www.tucuxi.ch) for Bayesian dosage adjustment is still ongoing. An electronic tool for drug-drug interaction involving antithrombotics is currently being developed.

2021 at a glance

- Publications with impact factor: 16
- Publications without impact factor: 1
- Patents: 0
- Book and chapters: 1
- Congresses / conferences organisation: 0
- Posters presentations: 7
- Oral presentations: 1
- Invited oral presentations: 0
- Number of projects at FNRS and assimilated (Research funds): 2
- Service agreements and related activities: 0
- Ph.D. Theses presented in 2021: 1
- Awards and distinctions: 2
- Public outreach activities: 0

Research funds

FNRS
Automated detection of adverse drug events from older inpatients' electronic medical records using structured data mining and natural language processing

Main applicant:	Chantal Csajka
Total funding of the project:	CHF 602'560.-
Total duration of the project:	5 years
Allocation 2021:	CHF 0.-
Starting date:	01.09.2017

Fondation Leenards
Prise en charge de la bronchite aiguë – étude clinique randomisée portant sur un mélange d'herbes chinoises.

Main applicant:	co-PI P-Y. Rodondi, C. Csajka.
Total funding of the project:	CHF 200'000.-
Total duration of the project:	3 years
Allocation 2021:	CHF 66'000.-
Starting date:	01.01.2021

Total amount for all research funds for 2021: CHF 66'000.-

Scientific publications (with impact factor)

Terrier J, Gaspar F, Fontana P, Youssef D, Reny JL, Csajka C, Samer CF. Drug-drug interactions with direct oral anticoagulants : practical recommandations for clinicians. Am J Medicine. 2021 134(8): 939-942 *4.96*

Brioschi Guevara A, Bieler M, Altomare D, Berthier M, Csajka C, Dautricourt S, Démoniet JF, Dodich A, Frisoni GB, Miniussi C, Molinuervo JL, Ribaldi F, Scheltens P, Chételat G. Brain Health Services: organization, structure, and challenges for implementation. A user manual for Brain Health Services-part 1 of 6. Protocols for cognitive enhancement. A user manual for Brain Health Services-part 5 of 6. Alhzeimers Res Ther. 2021, 13(1):160 *6.98*

Ulldemolins M, Bastida C, Llaurado-Serra M, Csajka C, Rodriguez A, Badia J.R, Martin-Loeches I, Soy D. Once-daily 1 g ceftriaxone optimizes exposure in patients with septic shock and hypoalbuminemia receiving continuous veno-venous hemodiafiltration. Eur J Clin Pharmacol. 2021 Aug;77(8):1169-1180. *4.43*

Goutelle S, Woillard, J.-B., Buclin T; Bourguignon L, Yamada W, Csajka C, Neely M, Guidi M. Parametric and nonparametric methods in population pharmacokinetics: experts' discussion on use, strengths, and limitations. The Journal of clinical pharmacology 2021 online ahead of print. *3.12*

Courlet P, Guidi M, Alves Saldanha S, Cavassini M, Stoeckle M, Buclin T, Marzolini C, Decosterd L.A, Csajka C#. Population pharmacokinetic modelling to quantify the magnitude of drug-drug interactions between amlodipine and antiretroviral drugs. Eur J Clin Pharmacol. 2021 Jul; 77 (7) pp. 979-987. *4.43*

Courlet P, Guidi M., Alves Saldanha S, Stader F, Traytel A., Cavassini M, Stoeckle M, Buclin T, Marzolini C, Decosterd L.A, Csajka C and The Swiss HIV Cohort Study. Pharmacokinetic/Pharmacodynamic Modelling to Describe the Cholesterol Lowering Effect of Rosuvastatin in People Living with HIV. Clin Pharmacokinet. 2021 Mar;60(3):379-390. *6.44*

Fahrat A, Abou-Karroum R, Panchaud A, Csajka C*, Al-Hajje A*. Impact of pharmaceutical interventions in hospitalized patients: a comparative study between clinical pharmacists and explicit criteria-based tool. Current Therapeutic Research, 2021 in press *0.47*

Farhat A, Al-Hajje A, Csajka C, Panchaud A. Clinical and economic impacts of explicit tools detecting prescribing errors: A systematic review. Journal of clinical pharmacy and therapeutics. J Clin Pharm Ther. 2021 Aug;46(4):877-886. *2.51*

Farhat A, Panchaud A, Al-Hajje A, Lang P.O, Csajka C. Ability to detect potentially inappropriate prescribing in older patients: comparative analysis between PIM-Check and STOPP/STARTv2. European journal of clinical pharmacology. Eur J Clin Pharmacol. 2021 Jun 30. *2.95*

Lisibach A, Benelli V, Ceppi M.G, Waldner-Knogler K, Csajka C#, Lutters M. Quality of anticholinergic burden scales and their impact on clinical outcomes: a systematic review. Eur J Clin Pharmacol. 2021 Feb; 77(2):147-162. *2.95*

Bandiera C, Cardoso E, Locatelli I, Digklia A, Zaman K, Diciolla A, Cristina V, Stravodimou A, Veronica A L, Dolcan A, Sarivalasis A, Liapi A Bouchaab H, Orcurto A, Dotta-Celio, Peters S, Decosterd L, Widmer N, Wagner D, Csajka C, Schneider M P. Optimizing Oral Targeted Anticancer Therapies Study for Patients With Solid Cancer: Protocol for a Randomized Controlled Medication Adherence Program Along With Systematic Collection and Modeling of Pharmacokinetic and Pharmacodynamic Data. JMIR Res Protoc. 2021 Jun 29;10(6):e30090. *0.67*

Roux B, Sirois C, Niquille A, Spinewine A, Ouellet N, Pétein C, Sibille F.X, Csajka C, Reeve E, Villeneuve C, Laroche M-L. Cross-cultural adaptation and psychometric validation of the revised Patients' Attitudes Towards Deprescribing (rPATD) questionnaire in French. Res Social Adm Pharm. 2021 Aug; 17(8):1453-1462. *3.33*

Dao K, Fuchs A, André P, Giannoni E, Decosterd LA, Marchetti O, Asner SA, Pfister M, Widmer N, Buclin T, Csajka C, Guidi M. Dosing strategies of imipenem in neonates based on pharmacometric modelling and simulation. J Antimicrob Chemother. 2021 Nov 17:dkab394. Epub ahead of print. *5.79*

Bartelink IH, Bet PM, Widmer N, Guidi M, Duijvelaar E, Grob B, Honeywell R, Evelo A, Tielbeek IPE, Snape SD, Hamer H, Decosterd LA, Jan Bogaard H, Aman J, Swart EL. Elevated acute phase proteins affect pharmacokinetics in COVID-19 trials: Lessons from the CounterCOVID - imatinib study. CPT Pharmacometrics Syst Pharmacol. 2021 Oct 5. Epub ahead of print. *4.05*

Colombo I, Genta S, Martorana F, Guidi M, Frattini M, Samartzis EP, Brandt S, Gaggetta S, Moser L, Pascale M, Terrot T, Sessa C, Stathis A. Phase I Dose-Escalation Study of the Dual PI3K-mTORC1/2 Inhibitor Gedatolisib in Combination with Paclitaxel and Carboplatin in Patients with Advanced Solid Tumors. Clin Cancer Res. 2021 Sep 15; 27(18):5012-5019 *12.53*

Courlet P, Barbieux C, Sculier D, Wandeler G, Stoeckle M, Bernasconi E, Braun D, Vernazza P, Cavassini M, Marinosci A, Smit M, Günthard HF, Schmid P, Limacher A, Guidi M, Alves Saldanha S, Decosterd LA, Calmy A. Pharmacokinetic parameters and weight change in HIV patients newly switched to dolutegravir-based regimens in SIMPL'HIV clinical trial. Br J Clin Pharmacol. 2021 Nov; 87(11):4455-4460. *4.34*

Scientific publications (without impact factor)

Coumau C, Major K, Csajka C. La conciliation médicamenteuse : un processus clé dans la diminution du risque des erreurs médicamenteuses dans le parcours de soin du patient âgé. La Gazette Médicale. 2021 P.

Books or books chapters

Colic N, Beeler P, Csajka C, Foufi V, Gaspar F, Le Pogam MA, Lisibach A, Lovis C, Lutters M. Rinaldi F. Automated Detection of Adverse Drug Events from Older Patients' Electronic Medical Records Using Text Mining. In: Del Bimbo A. et al. (eds) Pattern Recognition. ICPR International Workshops and Challenges. ICPR 2021. Lecture Notes in Computer Science, vol 12661. Springer, Cham. https://doi.org/10.1007/978-3-030-68763-2_15

Congresses / conferences and Symposia

- Congresses / conferences organisation: 0
- Posters presentations: 7
- Oral presentations: 1
- Invited oral presentations: 0

Ph.D. Theses presented in 2021

Angela Lisibach « Development and validation of automatic tools to improve adverse drug event management in hospitalized older patients ».", Prof. Chantal Csajka, thesis Director

Awards and distinction

Coumau, C., Nguyen S, Major K, Bosshard W, Csajka C., Evaluation of the medication reconciliation at different stages of the care process in a cohort of geriatric inpatients: first steps towards a medication reconciliation tool », Congress GSASA 2021, Prix Junior GSASA

Lisibach A, Haltinne N, Beeler P, Burden A, Csajka C, Lutters M. Developing and validating a prediction model for in-hospital mortality associated with anticholinergic drug burden among older hospitalised patients with dementia, meilleure communication orale, ESCP Virtual symposium 19 – 21 October 2021.

COMMUNITY PHARMACY PRACTICE

Doctor Jérôme BERGER

General description of Unit

The Community Pharmacy of Unisanté offers specific opportunities for the clinical pharmaceutical sciences in Western Switzerland and for the Faculty of Medicine in Lausanne.

Unisanté is the university centre dedicated to primary care and public health in Lausanne, which corresponds to the modern vision of health systems giving priority to interprofessional collaboration, optimisation of resources and partnering with patients considered in all their individuality. The team of the Community Pharmacy is fully involved in Unisanté's missions (www.unisante.ch).

The Community pharmacy practice research unit is currently affiliated to:

- Centre for Primary Care and Public Health (Unisanté), University of Lausanne
- Institute of Pharmaceutical Sciences of Western Switzerland (ISPSO), University of Geneva, University of Lausanne)
- School of Pharmaceutical Sciences, University of Geneva
- Centre for Research and Innovation in Clinical Pharmaceutical Sciences, University of Lausanne

The Community Pharmacy is a key sector of the Department of Ambulatory Care in Unisanté. Our expertise is recognised at the regional, national and international levels for its clinical, research/development and educational activities. Our work focuses on understanding the determinants, development, implementation and clinical, humanistic, economic evaluation of pharmacy services around the topic "smarter medication in primary care and public health".

Specific research fields

Smarter medication in primary care and public health

The main research and teaching activities of the research unit are focused on development, implementation and evaluation of person-centred and integrated community pharmacy services for "smarter medication in primary care and public health":

- chronic care management programs,
- optimization of drug therapy,
- interprofessional care models
- technological innovations (e-Health)
- professional developments, methodological expertise and developments.

2021 at a glance

- Publications with impact factor: 15
- Publications without impact factor: 12
- Patents: 0
- Book and chapters: 0
- Congresses / conferences organisation: 0
- Posters presentations: 1

- Oral presentations: 4
- Invited oral presentations: 0
- Number of projects at FNRS and assimilated (Research funds): 4
- Service agreements and related activities: 13
- Ph.D. Theses presented in 2021: 0
- Awards and distinctions: 0
- Public outreach activities: 0

Research funds

SNSF

FNRS (NRP 74)
How to improve care integration, coordination and continuity? Designing policy from population needs and preferences
Main applicant: J. Marti
Co-applicants: C. Perraudin, I. Peytremann Bridevaux and J. Wagner
Total funding of the project: CHF 337'060.-
Total duration of the project: 3 years
Allocation 2021: CHF112'353.-
Starting date: 01.02.2019

Institutional

CANTONAL OFFICE OF PUBLIC HEALTH – VAUD
Développement, implémentation et évaluation scientifique du programme interprofessionnel vaudois de cercles de qualité médecins-pharmaciens-soignants des établissements médico-sociaux pour personnes âgées (EMS)
Main applicants: J. Berger and A. Niquille Charrière
Total funding of the project: CHF 180'000.-
Total duration of the project: 1 year
Allocation 2021: CHF 180'000.-
Starting date: 01.01.2021

CANTONAL OFFICE OF PUBLIC HEALTH – VAUD
MEDICATION REVIEW IN NURSING HOMES
Main applicants: J. Berger and A. Niquille Charrière
Allocation 2021: CHF 87'150.-
Starting date: 01.01.2021

CANTONAL OFFICE OF PUBLIC HEALTH – VAUD AND
SOCIETE VAUDOISE DE PHARMACIE
Médicaments à jour ? - MAJ
Feasibility study of a pharmacist-led medication reconciliation service ("brown bag" type) for patients with polypharmacy
Main applicants: J. Berger
Total funding of the project: CHF 111'190.-
Allocation 2021: CHF 0.- (pending COVID-19)
Starting date: 01.01.2021

Total amount for all research funds for 2021: CHF 379'503.-

Service agreements and related activities

CANTONAL OFFICE OF PUBLIC HEALTH – VAUD
MENTORAT FPH

Main applicants: J. Berger
Allocation 2021: CHF 32’500.-
Starting date: 31.03.2021

CANTONAL OFFICE OF PUBLIC HEALTH – VAUD
Organisation and animation of a Quality Circle Physicians-Pharmacists-Nurses in the nursing homes of the « Fondation Asile des Aveugles (FAA) and Nursing Home Béthanie»
Main applicants: J. Berger and C. Bremond
Allocation 2021: CHF 40’802.-
Starting date: 01.01.2021

FEDERAL OFFICE OF PUBLIC HEALTH (FOPH) / Institute of pharmaceutical sciences of Western Switzerland (ISPSO), University of Geneva, University of Lausanne
Service agreement (Examen fédéral OSCE en Pharmacie 2021)
Main applicant: J. Berger
Total amount 2021: CHF 103'875.-

FEDERAL OFFICE OF PUBLIC HEALTH (FOPH) / Institute of pharmaceutical sciences of Western Switzerland (ISPSO), University of Geneva, University of Lausanne
Service agreement (Examen fédéral QCM pharmacoéconomie en Pharmacie 2021)
Main applicant: J. Berger and C. Perraudin
Total amount 2021: CHF 3'000.-

C33SAG
Service agreement
Total amount 2021: CHF 10’120.-

CP3
Service agreement
Total amount 2021: CHF 19’450.-

DCIFA21
Service agreement
Total amount 2021: CHF 90’000.-

PHA11
Service agreement
Total amount 2021: CHF 12’750.-

SUS4
Service agreement
Total amount 2021: CHF 2’885.-

SEM21
Service agreement
Total amount 2021: CHF 35’646.-

SYMS
Service agreement
Total amount 2021: CHF 4’000.-

SV3
Service agreement
Total amount 2021: CHF 12’850.-

U3
Service agreement
Total amount 2021: CHF 52’706.-

Total amount (for all service agreements and related activities) for 2021: CHF 420'584.-

Scientific publications (with impact factor)

Bourdin, A.; Schneider, MP.; Locatelli, I.; Schluep, M.; Bugnon, O.; Berger, J.
Longitudinal analysis of safety and medication adherence of patients in the fingolimod patient support program: a real-world observational study.
Scientific Reports 2021, 11:4107. *4.380*

Michiels, Y.; Houhou-Fidouh, N.; Collin, G.; Kohli, E.; Berger, J.
Impact of low-dose methotrexate-adalimumab combination therapy on the antibody response induced by the mRNA-1273 SARS-CoV-2 vaccine: case of an elderly patient with rheumatoid arthritis.
Vaccines 2021, 9 (8): 833. *4.422*

Michiels, Y.; Houhou-Fidouh, N.; Collin, G.; Berger, J.; Kohli, E.
Humoral response Induced by Prime-Boost Vaccination with the ChAdOx1 nCoV-19 and mRNA BNT162b2 Vaccines in a Teriflunomide-Treated Multiple Sclerosis Patient.
Vaccines 2021, 9 (10), 1140. *4.422*

Stämpfli, D.; Martinez-De la Torre, A.; Simi, E.; Du Pasquier, S.; Berger, J.; Burden, A. M.
Community Pharmacist-Administered COVID-19 Vaccinations: A Pilot Customer Survey on Satisfaction and Motivation to Get Vaccinated.
Vaccines 2021, (9): 1320. *4.422*

Dotta-Celio, J.; Alatri, A.; Salvi, M.; Mazzolai, L.; Schneider, MP.
Rivaroxaban and medication adherence – A cohort study (RIVA): Qualitative results.
Thrombosis Update 2021, 4, 100057. *3.944*

Cateau, D.; Ballabeni, P.L.; Niquille, A.
Effects of an interprofessional Quality Circle-Deprescribing Module (QC-DeMo) in Swiss nursing homes: a randomised controlled trial.
BMC Geriatrics 2021, 21: 289. *3.921*

Cateau, D.; Ballabeni, P.; Niquille, A.
Effects of an interprofessional deprescribing intervention in Swiss nursing homes: the Individual Deprescribing Intervention (IDeI) randomised controlled trial.
BMC Geriatrics 2021, 21: 655. *3.921*

Bourdin, A.; Dotta-Celio, J.; Niquille, A.; Berger, J.
Response to the first wave of the COVID-19 pandemic in the community pharmacy of a University Center for Primary Care and Public Health.
Research in Social and Administrative Pharmacy 2021, 06 (16); S1551-7411(21)00212-6. *3.336*

Bawab, N.; Moullin, J. C.; Bugnon, O.; Perraudin, C.
Implementation Evaluation of an Interprofessional Programme (Siscare) for Supporting Patients with Type 2 Diabetes in a primary care setting.
Research in Social and Administrative Pharmacy 2021, 11 (17) 1968-1977. *3.336*

Bawab, N.; Zuercher, E.; Carron, T.; Chinet, L.; Bugnon, O.; Peytremann-Bridevaux, I.; Berger, J.
Interest in and use of person-centred pharmacy services - a Swiss study of people with diabetes.
BMC Health Services Research 2021, 21, 216. *2.655*

Gautier, J.F.; Boitard, C.; Michiels, Y.; Raymond, G.; Vergez, G.; Guedon, G.
Impact of personalized text messages from pharmacists on medication adherence in type 2 diabetes in France: A real-world, randomized, comparative study.
Patient Educ Couns 2021, 09 104 (9): 2250-2258. *2.232*

Quintana Barcena, P.; Sinner, C; Berger, J.

Domiciliary Medication Review (ReMeDo): development, reliability and acceptability of a tool for community pharmacists.
Accepté dans International Journal of Pharmacy Practice 2021, 12. 1-7. *1.350*

Bandiera, C.; Dotta-Celio, J.; Locatelli, I.; Nobre, D.; Wuerzner, G.; Pruijm, M.; Lamine, F.; Burnier, M.; Zanchi, A.; Schneider, MP.
Interprofessional Medication Adherence Program for Patients With Diabetic Kidney Disease: Protocol for a Randomized Controlled and Qualitative Study (PANDIA-IRIS).
JMIR Research Protocols 2021, 19, 10 (3) e25966. *1.250*

Bandiera, C.; Cardoso, E.; Locatelli, I.; Digklia, A.; Zaman, K.; Diciolla, A.; Cristina V.; Stravodimou, A.; Aedo Lopez, V.; Dolcan, A.; Sarivalasis, A.; Liapi, A.; Bouchaab, H.; Orcurto, A.; Dotta-Celio, J.; Peters, S.; Decosterd, L.; Widmer, N.; Wagner, D.; Csajka, C.; Schneider, MP.
Optimizing oral targeted anticancer therapies study for patients with solid cancer: protocol for a randomized controlled medication adherence program along with systematic collection and modeling of pharmacokinetic and pharmacodynamic data.
JMIR Research Protocols 2021, 29, 10 (6) e30090. *1.250*

Bandiera, C.; Dotta-Celio, J.; Locatelli, I.; Nobre, D.; Wuerzner, G.; Pruijm, M.;Lamine, F.; Burnier, M.; Zanchi, A.; Schneider, MP.
Interprofessional Medication Adherence Program for Patients With Diabetic Kidney Disease: Protocol for a Randomized Controlled and Qualitative Study (PANDIA-IRIS).
JMIR Research Protocols 2021, 19, 10 (3) e25966. *1.250*

Scientific publications (without impact factor)

Bienvenu, C.; Dotta-Celio, J.; Berger, J. Building pharmacists' capacity to partner with patients in their digital health use: a collaborative patient-pharmacist teaching method.
FIP digital health in pharmacy education report: developing a digitally enabled pharmaceutical workforce 2021; 120-121.

Cateau D.; Niquille A. Comment simplifier la médication sans péjorer la situation des patients ? Bilan d'un projet de déprescription en EMS.
La Gazette Médicale 2021, 05.

Clinical practice guidelines

Kälin, V.; Berger, J. Fosfomycine granulé/poudre: modifications des recommandations - Suppression de l'indication dans la prise en charge des bactériuries asymptomatiques. Imed 2021, 2.

Kälin, V.; Berger, J. Fluoroquinolones administrées par voie systémique et inhalée - risque de régurgitation/insuffisance des valves cardiaques. Imed 2021, 8.

Kälin, V.; Berger, J. Métamizole : Risque de lésion hépatique iatrogène. Imed 2021, 2021

Kälin, V.; Berger, J. Pharmacovigilance: Vaccins à ARNm contre la COVID-19 (Moderna® et Comirnaty®): risque de myocardite et de péricardite. Imed 2021, 8.

Agostini-Ferrier, S.; Kälin, V.; Rochat, C.; Berger, J. Hygiène des mains : solutions hydroalcooliques disponibles à Unisanté. Ipharm 2021, 9 (1)

Agostini-Ferrier, S.; Kälin, V.; Rochat, C.; Berger, J. Le soin des mains : crèmes hydratantes remboursées par l'assurance de base. Ipharm 2021, 09 (2)

Escaith, M.; Kälin, V.; Barbalat, MJ.; Carli, D.; Berger, J. Anti-malarique: prophylaxie et traitement de secours – 1ère partie / Malariamedikamente: Prophylaxe und Notfallbehandlung – Teil 1. pharmaJournal 2021, 5, 6-9.

Escaith, M.; Kälin, V.; Barbalat, MJ.; Carli, D.; Berger, J. Anti-malarique: prophylaxie et traitement de secours – 2ème partie: les groupes à risque / Malariamedikamente: Prophylaxe und Notfallbehandlung – Teil 2: Die Risikogruppen. pharmaJournal 2021, 6/7: 6-8.

Agostini-Ferrier, S.; Kälin, V.; Berger, J. Les blessures du sportif: Conseils de prise en charge et de prévention à l'officine / Sportverletzungen in der Apotheke: Empfehlungen zu Behandlung und Prävention. pharmaJournal 2021, 8: 4-8.

Escaith, M.; Kälin, V.; Berger, J. Migraines et traitements aigus : le point sur les triptans. pharmaJournal 2021, 10: 5-9.

Congresses / conferences and Symposia

- Congresses / conferences organisation: 0
- Posters presentations: 1
- Oral presentations: 4
- Invited oral presentations: 0

HOSPITAL PHARMACY (HUG)

Professor Pascal BONNABRY

General description of Unit

HUG hospital pharmacy group (http://pharmacie.hug.ch) develops research and education activities in hospital pharmacy. The undergraduate education is mainly focused on hospital pharmacy modules in BUSP2 and BUSP3. A post-graduate education (MAS) in hospital pharmacy is also proposed since 1999. This three-year program is a complete specialization in hospital pharmacy, associating theoretical and practical teachings, as well as a research project. Hospital pharmacy also propose positions for PhD students. The unit is also involved in global pharmacy, mainly with the project Pharm-Ed (www.Pharm-Ed.net) and in emergency and disaster pharmacy, by hosting the Swiss specialized centre of competence (SEDIP, www.disaster-pharmacy.ch).

Specific research fields

To optimize the safety, the efficiency and the traceability of drug use in hospitals:

- Processes
  - Risk analysis
  - Information technologies
  - Human factors, ergonomics and process efficiency
  - Continuity of care
  - Organization in humanitarian, emergency and disaster situations
- Persons
  - Inter-professionality
  - Innovative pedagogic approaches for knowledge transmission
  - Decision support
- Products
  - Optimisation of clinical and economic use
  - Development of hospital preparations
  - Stability studies
  - Analysis of hazardous drugs

2021 at a glance

- Publications with impact factor: 12
- Publications without impact factor: 3
- Patents: 0
- Book and chapters: 0
- Congresses / conferences organisation: 1
- Posters presentations: 10
- Oral presentations: 8
- Invited oral presentations: 6
- Number of projects at FNRS and assimilated (Research funds): 2
- Service agreements and related activities: 2
- Ph.D. Theses presented in 2021: 1
- Awards and distinctions: 0
- Public outreach activities: 0

Research funds

GSASA, Association suisse des pharmaciens de l'administration et des hôpitaux
Cockpit intelligent pour la gestion des ruptures d'approvisionnement : combinaison des données logistiques et cliniques
Main applicant: Pr Pascal Bonnabry, Yassine Dhif
Total funding of the project: CHF 75'000.-
Total duration of the project: to be determined
Allocation 2021: CHF 75'000.-

Octopharma, Debiopharm
Pharm-Ed: une plateforme d'enseignement de la pharmacie hospitalière pour les pays en développement
Main applicant: Pr Pascal Bonnabry
Total funding of the project: CHF 9'000.-
Total duration of the project: to be determined
Allocation 2021: CHF 9'000.-

Total amount for all research funds for 2021: CHF 84'000.-

Service agreements and related activities

Confédération Helvétique, Département fédéral de la Défense, de la Protection de la Population et des Sports (DPPS)
Service – Development – Research : Centre de pharmacie d'urgence et de catastrophe
Total amount for 2021: CHF 100'000.-

Fondation privée des HUG, pharmaGenève, Fondation Schmidheiny
Projet Pharmamobile
Main applicant: Pr Pascal Bonnabry
Total funding of the project: CHF 300'000.- (+ CHF 57'000.- of investments attributed by the section)
Total duration of the project: to be determined
Allocation 2021: 0.- (the project will start in 2022 with the obtained funding)
Starting date: 01.01.2022

Total amount (for all service agreements and related activities) for 2021: CHF 100'000.- (+ CHF 300'000.- collected for 2022)

Scientific publications (with impact factor)

Von Grünigen, S.; Geissbühler, A.; Bonnabry, P., Cyto-STAT: A self-assessment tool for the safe handling of cytotoxic drugs adapted for use in low-and middle-income countries. Journal of Oncology Pharmacy Practice 2021, 27, 1422-1431. *1.8*

Batson, S.; Herranz, A.; Rohrbach, N.; Canobbio, M.; Mitchell, S.; Bonnabry, P., Automation of in-hospital pharmacy dispensing: a systematic review. European Journal of Hospital Pharmacy 2021, 28, 58-64. *1.7*

Guichard, N.; Tobolkina, E.; El Morabit, L.; Bonnabry, P.; Vernaz, N.; Rudaz, S., Determination of antiretroviral drugs for buyers' club in Switzerland using capillary electrophoresis methods. Electrophoresis 2021, 42, 708-718. *3.1*

Garnier, A.; Vanherp, R.; Bonnabry, P.; Bouchoud, L., Use of simulation for education in hospital pharmaceutical technologies: a systematic review. European Journal of Hospital Pharmacy 2021, doi : 10.1136/ejhpharm-2021-003034. *1.7*

Von Grünigen, S.; Dessane, B.; Le Pape, P.; Falaschi, L.; Geissbühler, A.; Bonnabry, P., Development and Evaluation of an e-Learning Module for Low- and Middle-Income Countries on the Safe Handling of Chemotherapy Drugs. Journal of Cancer Education 2021, doi: 10.1007/s13187-021-02113-z. *2.0*

Jumeau, M. ; François, O. ; Bonnabry, P., Impact of automated dispensing cabinets on dispensing errors, interruptions and pillbox preparation time. European Journal of Hospital Pharmacy 2021, doi : 10.1136/ejhpharm-2021-002849. *1.7*

Sommer, I. ; Palmero, D. ; Fischer Fumeaux, CJ. ; Bonnabry, P. ; Bouchoud, L. ; Sadeghipour, F., Parenteral Nutrition Process Managemnet for Newborn and Preterm Infants – A Preliminary Risk Analysis. Therapeutics and Clinical Risk Management 2021, 17, 497-506. *2.1*

Skalafouris, C.; Samer, C.; Stirnemann, J.; Grosgurin, O.; Eggimann, F.; Grauser, D.; Reny, JL.; Bonnabry, P.; Guignard, B., Electronic monitoring of potential adverse drug events related to lopinavir/ritonavir and hydroxychloroquine during the first wave of COVID-19. European Journal of Hospital Pharmacy 2021, doi: 10.1136/ejhpharm-2020-002667. *1.7*

Schumacher, L.; Berthaudin, F.; Blanc, A-L.; Blatrie, C.; Staines, A.; Bonnabry, P.; Widmer, N., Using risk analysis to ensure patients' medication safety during hospital relocations and evacuations. European Journal of Hospital Pharmacy 2021, 28, s171-179. *1.7*

Von Grünigen, S.; Geissbühler, A.; Bonnabry P., The safe handling of chemotherapy drugs in low- and middle-income countries: an overview of practices. Journal of Oncology Pharmacy Practice 2021, doi: 10.1177/1078155221995539. *1.9*

Guichard, N.; Boccard, J.; Rudaz, S.; Bonnabry, P.; Fleury Souverain, S., Wipe-Sampling procedure optimization for the determination of 23 antineoplastic drugs used in the hospital pharmacy. European Journal of Hospital Pharmacy 2021, 28, 94-99. *1.7*

Rudolf von Rohr, T.; De Luca, R.; Bonnabry, P.; Pfister, R.; Fonzo-Christe, C., NeoCheck: a prescription-screening tool to optimize pharmacotherapy for hospitalized neonates. Swiss Medical Weekly 2021, 151:w20519. *2.2*

Scientific publications (without impact factor)

Garnier, A. ; Falaschi, L. ; Bonnabry, P. ; Bouchoud, L., New missions of a hospital pharmaceutical technology unit during the COVID-19 pandemic. Journal of Pharmaceutical Policy and Practice 2021, doi.org/10.1186/s40545-020-00283-7.

Bugnon, B.; Geissbuhler, A.; Bischoff, T.; Bonnabry, P.; Von Plessen, C. Improving Primary Care Medication Processes by Using Shared Electronic Medication Plans in Switzerland: Lessons Learned From a Participatory Action Research Study. JMIR Formative Research 2021, 1:e22319.

Von Grünigen, S.; Falaschi, L.; Guichard, N.; Fleury-Souverain, S.; Geissbühler, A.; Bonnabry, P., Development and Proof of Concept of an Audit Toolkit for the Safe Handling of Cytotoxic Drugs in Low- and Middle-Income Countries. JCO Global Oncology 2021, 7:1480-1489.

Congresses / conferences and Symposia

- Congresses / conferences organisation: 1
- Posters presentations: 10
- Oral presentations: 8
- Invited oral presentations: 6

Ph.D. Theses presented in 2021

Laurence Schumacher
Préparation et réponse des pharmacies hospitalières aux situations d'urgence et de catastrophe
Pr Pascal Bonnabry, PD Dr Nicolas Widmer

HOSPITAL PHARMACY (CHUV)

Professor Farshid SADEGHIPOUR

General description of Unit

CHUV hospital pharmacy group (https://www.chuv.ch/fr/pharmacie/pha-home) develops research and education activities in hospital and clinical pharmacy. The undergraduate education is mainly focused on hospital pharmacy modules in BUSP2 and BUSP3. A post-graduate education (MAS) in hospital pharmacy is also proposed since 1999. This three-year program is a complete specialization in hospital pharmacy, associating theoretical and practical teachings, as well as a research project. Hospital pharmacy also propose positions for PhD students. The unit is also involved in research in radiopharmaceuticals and autologous skin grafts in the therapy of patients with burn injuries.

Specific research fields

Optimization of clinical use of drugs
- Securing the drug use process in high risk care units
- Detection, prevention, management and evaluation of drug incompatibilities
- Therapeutic education with new technologies

Development of hospital pharmaceutical forms
- Development of ready-to-use pharmaceutical forms
- Formulation of paediatric parenteral nutrition

Pharmaceutical analysis
- Development and validation of generic separation methods for the dosage of active ingredients contained in hospital pharmaceutical formulations.
- Study of content and containers interactions in leachable and extractable events of different pharmaceutical packaging

Pharmacoeconomics and pharmacoepidemiology
- Economic evaluation of changes in therapeutic strategies in hospital

2021 at a glance

- Publications with impact factor: 8
- Publications without impact factor: 0
- Patents: 0
- Book and chapters: 0
- Congresses / conferences organisation: 3
- Posters presentations: 4
- Oral presentations: 0
- Invited oral presentations: 0
- Number of projects at FNRS and assimilated (Research funds): 0
- Service agreements and related activities: 2
- Ph.D. Theses presented in 2021: 0
- Awards and distinctions: 0
- Public outreach activities: 1

Scientific publications (with impact factor)

Sommer I., Palmero D., Fischer-Fumeaux C. J., Bonnabry P., Bouchoud L., Sadeghipour F., Parenteral Nutrition Process Management for Newborn and Preterm Infants – A Preliminary Risk; Analysis Therapeutics and Clinical Risk Management, 2021, 17: 497–506. doi: 10.2147/TCRM.S280938 *2.58*

Bruggmann C., Adjedj j., Sardy S., Muller O., Voirol P., Sadeghipour F.; Effects of the Interactive Web-Based Video "Mon Coeur, Mon BASIC" on Drug Adherence of Patients with Myocardial Infarction: A Randomized Study, 2021, JMIR (https://www.jmir.org), Vol 23, No 8; doi : 10.2196/21938 *5.18*

Ballif A., Gerber S., Carrez L., Audry M., Sadeghipour F., Mitouassiwou A., Croxatto A., Opota O., Prod'hom G., Henchoz S., Schoepfer A., Cavassini M., Galpérine T.; Transplantation de microbiote fécal : de l'évidence aux réalités du terrain,
Rev Med Suisse 2021; 17; 726-31; PMID: 33852207 *0.13*

Krstic M., Devaud, J.-C., Sadeghipour, F. ; Pharmacists' considerations on non-medical switching at the hospital: a systematic review of the economic outcomes of cost-saving therapeutic drug classes,
Eur J Hosp Pharm. 2021 Jan 20; doi: 10.1136/ejhpharm-2020-002652 *0.83*

Bruggmann C., Astaneh M., Lu H., Tozzi P., Ltaief Z., Voirol P., Sadeghipour F. ; Management of Atrial Fibrillation Following Cardiac Surgery: Observational Study and Development of a Standardized Protocol.
Annals of Pharmacotherapy; 2021, Vol. 55(7) 830–838;
https://doi.org/10.1177/1060028020973998 *3.15*

N. Perrottet, Fernández-Ruiz M, Binet I, Dickenmann M, Dahdal S, Hadaya K, Müller T, Schaub S, Koller M, Rotman S, Moll S, Hopfer H, Venetz JP, Aubert V, Bühler L, Steiger J, Manuel O, Pascual M, Golshayan D; Infectious complications and graft outcome following treatment of acute antibody-mediated rejection after kidney transplantation: A nationwide cohort study.; the Swiss Transplant Cohort Study (STCS).
PLoS One. 2021 Apr 30;16(4):e0250829. *3.24*

Delage JA, Gnesin S, Prior JO, Barbet J, Le Saëc P, Marionneau-Lambot S, Gouard S, Chérel M, Bourgeois M, Schaefer N, Viertl D, Fierle JK, Dunn SM, Faivre-Chauvet A.; Copper-64-Labeled 1C1m-Fc, a New Tool for TEM-1 PET Imaging and Prediction of Lutetium-177-Labeled 1C1m-Fc Therapy Efficacy and Safety
Cancers (Basel). 2021 Nov 25;13(23):5936. doi: 10.3390/cancers13235936. *6.64*

Delage JA, Faivre-Chauvet A., Barbet J. Fierle JK4, Schaefer N., Coukos G., Viertl D., Dunn SM, Gnesin S., Prior JO; Impact of DOTA Conjugation on Pharmacokinetics and Immunoreactivity of [177Lu]Lu-1C1m-Fc, an Anti TEM-1 Fusion Protein Antibody in a TEM-1 Positive Tumor Mouse Model;
Pharmaceutics 2021, 13, 96. https://doi.org/10.3390/pharmaceutics13010096 *6.32*

Congresses / conferences and Symposia

- Congresses / conferences organisation: 3
- Posters presentations: 4
- Oral presentations: 0
- Invited oral presentations: 0

Public outreach activities (radio, television and other media, community service)

F. Sadeghipour. «Ces médicaments qui font défaut à cause de la pandémie de Covid-19», par Richard Etienne ; Le Temps, 24 mars 2021

IMMUNOPHARMACOLOGY OF CANCER

Professor Carole BOURQUIN

(Co-Responsible in 2021: Dr Aurélien POMMIER)

General description of Unit

Our overall aim is to develop novel treatments to enhance the body's immune defences against cancer.

We aim to uncover new mechanisms leading to immune activation in cancer. Our goal is to identify novel targets to stimulate anticancer immunity and to demonstrate the impact of their pharmacological modulation. In this context, we have three main research axes focusing on innate immunity, immunometabolism and drug delivery.

One focus of our research is the role of players involved in the innate immune recognition of nucleic acids, such as endosomal Toll-like receptors, HMGB1 and STING. We study the effect of the pharmacological modulation of these receptors and immune mediators. We address the following questions:

- What is the impact of these pathways on different aspects of anticancer immunity?
- Can we enhance migration of immune cells into the tumor with pharmacological modulators of these pathways?
- Can we decrease cancer-associated immunosuppression by targeting these pathways?

The second focus of our research is the implementation of drug delivery systems, such as nanoparticles, to improve the therapeutic efficacy of immune modulators in cancer. We address the following questions:

- Can we use nanoparticles as a delivery system to focus the action of Toll-like receptor 7 agonists and prevent unwanted side effects?
- What are the optimal characteristics of nanocarriers to deliver drugs that target anticancer immunity?

A third focus of our research led by Dr Pommier is the impact of lipid metabolism on the anti-tumor immune response at different levels. At the systemic level, we study how a high-fat diet, obesity and steroid signalling may modify anticancer immunity and the response to immunotherapy. At the cellular level, we address the role of intratumoral lipid biosynthesis and steroid metabolism on the anti-tumor immune response. We address the following questions:

- What is the impact of gender and obesity on steroid-mediated immune modulation?
- Can we target steroid metabolism to enhance the anti-tumor immune response?

We address these scientific questions using translational approaches, starting with clinically relevant data to generate our hypotheses, which we then validate in preclinical models of gastrointestinal, skin, liver and renal cancer.

2021 at a glance

- Publications with impact factor: 2
- Publications without impact factor: 0
- Patents: 0
- Book and chapters: 0
- Congresses / conferences organisation: 0
- Posters presentations: 7
- Oral presentations: 7
- Invited oral presentations: 1
- Number of projects at FNRS and assimilated (Research funds): 8
- Service agreements and related activities: 0
- Ph.D. Theses presented in 2021: 1
- Awards and distinctions: 1
- Public outreach activities: 0

Research funds

Swiss National Science Foundation
Category: SNSF
“HMGB1 and Gasdermin D: intratumoral targets to improve the response to cancer immunotherapy”
(310030_182317/1)
Main applicant: Carole Bourquin
Total funding: CHF 700’000.-
Duration: 4 years
Allocation 2021: CHF 180'913.-
Starting date: 01.01.2019

Swiss National Science Foundation
Category: SNSF
"Synergistic targeted drug combinations for induction of sensitivity to immune checkpoint Inhibitors".
(310030_197878)
Main applicant: Patrycja Nowak-Sliwinska
Total funding: CHF 46’000.-
Duration: 4 years
Allocation 2021: CHF 11'000.-
Starting date: 01.01.2021

Swiss National Science Foundation
Category: SNSF
SPIRIT "Gasotransmitters in triple negative breast cancer
(IZSTZ0-198887)
Main applicant: Carole Bourquin
Total funding: CHF 498’880.-
Duration: 2 years
Allocation 2021: CHF 252'940.-
Starting date: 01.09.2021

Swiss Cancer Research Foundation
Category: Institutional
“Impact of obesity on anti-tumor response to immunotherapy.”
(KFS-4535-08-2018-R)
Main applicants : Carole Bourquin and Aurélien Pommier
Total funding: CHF 368’850.-
Duration: 3 years
Allocation 2021: CHF 122'850.-
Starting date: 01.03.2019

Cell Migration
Category: Institutional
Doctoral Program SwissUniversities
Main applicant: Carole Bourquin
Total funding: CHF 24'000.-
Duration: 3 years
Allocation 2021: 0.-
Starting date: 01.07.2018

Novartis Foundation
Category: Industrial
"Exploring the tumorigenic role of stomach microbiota in a spontaneous mouse model of gastric cancer"
Main applicants: Carole Bourquin and Viola Puddinu
Total funding: CHF 60'000.-
Duration: 1 ½ year
Allocation 2021: CHF 60'000.-
Starting date: 01.08.2020

Innosuisse
Category: Institutional
"First-in-class treatment for renal cancer"
Main applicants : Carole Bourquin and Aurélien Pommier
Total funding: CHF 307'281.30
Duration: 1 ½ year
Allocation 2021: CHF 92'184.30
Starting date: 01.08.2020

Doctoral Program Cell Migration
Category: Institutional
Doctoral Program SwissUniversities
Main applicant: Carole Bourquin
Total funding : CHF 8'000.-
Duration: annual
Allocation 2021: CHF 8'000.-
Starting date: 01.11.2020

Total amount for all research funds for 2021: CHF 727'887.30

Scientific publications (with impact factor)

Wagner J.*, Gößl D.*, Ustyanovska N., Xiong M., Hauser D., Zhuzhgova O., Hocevar S., Taskoparan B., Poller L., Datz S., Engelke H., Daali Y., Bein T.*, Bourquin C.*. (*shared first and senior authorship)
Mesoporous Silica Nanoparticles as pH-Responsive Carrier for the Immune-Activating Drug Resiquimod Enhance the Local Immune Response in Mice. ACS Nano, 2021, 15:4450–4466. *14.6*

Boersma B., Jiskoot W., Lowe P., Bourquin C.
The interleukin-1 cytokine family members: Role in cancer pathogenesis and potential therapeutic applications in cancer immunotherapy. Cytokine Growth Factor Reviews, 2021; 62:1-14 *7.6*

Congresses / conferences and Symposia

- Congresses / conferences organisation: 0
- Posters presentations: 7
- Oral presentations: 7

- Invited oral presentations: 1

Ph.D. Theses presented in 2021

Julia Wagner
Potential and Challenges in Improving Cancer Immunotherapy with Agonists for Nucleic Acid Sensors
Prof. Carole Bourquin

Awards and distinction

Puddinu V., Free Registration Grant. World Immune Regulation Meeting (WIRM) XIV, 30 June-03 July 2021, Virtual Conference, Davos (Switzerland)

MOLECULAR PHARMACOLOGY

Professor Patrycja NOWAK-SLIWINSKA

General description of Unit

Paradoxically, the growing arsenal of therapeutics, yielded by biomedical research and development, does not bring the degree of effectiveness that is necessary for the treatment of cancer. It is generally expected that the combination of drugs will bring the needed improvement of cancer therapy. Although promising personalized cancer treatment approaches are starting to find clinical utility, personalized design of optimized drug combinations (ODCs) is still in its infancy.
The overall aim of the *Molecular Pharmacology Group's* research is the discovery of ODCs for the treatment of complex diseases, mainly cancer, and at the fundamental level discovery of mechanism of action leading to design of new treatment strategies. Optimally combining drugs that are already clinically used holds the potential for rapid translation into the clinic, especially when used at low doses. We use a phenotypic statistics-based technology combined with data modelling to identify ODCs with a minimal *in vitro* experimental effort. The results are subsequently translated and validated in appropriate *in vivo* models.
The major clinical relevance of this strategy can be highlighted as follows: (i) the approach is personalized, resulting in patient-tailored individualized treatment, (ii) ODC treatment may be applicable to patients that failed conventional treatment, (iii) ODC treatment can be quickly adapted during the course of treatment addressing temporal tumor heterogeneity, when tumors get more aggressive or develop resistance. Moreover, our strategy uses fundamental research to reveal the ODC action mechanisms. The latter, in turn, may identify novel signalling pathways, unexpected mechanisms of resistance and may lead to new drug discovery alleys.

Specific research subfields

- Phenotypic multidrug combinations optimization for cancer treatment
- Cell fate and acquired drug resistance mechanism
- Drug combinations to boost the activity of immune checkpoint inhibitors
- Complex in vitro platforms to mimic tumor microenvironment

2021 at a glance

- Publications with impact factor: 7
- Publications without impact factor: 0
- Patents: 0
- Book and chapters: 0
- Congresses / conferences organisation: 3
- Posters presentations: 8
- Oral presentations: 4
- Invited oral presentations: 4
- Number of projects at FNRS and assimilated (Research funds): 7
- Service agreements and related activities: 0
- Ph.D. Theses presented in 2021: 1
- Awards and distinctions: 5
- Public outreach activities: 4

Research funds

Fondation privée des HUG
Institutional
Projet Booster
Main applicant: Magdalena Rausch
Total funding of the project: CHF 10'000.-
Total duration of the project: 1 year
Allocation 2021: CHF 10'000.-
Starting date: 01.01.2021

Fondation recherche suisse contre le cancer
Institutional
Targeting multipolar spindles in cancer cells with a synergistic drug combination
Main applicant: Prof. Patrycja Nowak-Sliwinska and Prof. Patrick Meraldi
Total funding of the project: CHF 346'650.-
Total duration of the project: 3 years
Allocation 2021: CHF 57'650.-
Starting date: 01.01.2021

Foundation or the cancer fight and for the medico-biological research
Institutional
Personalized drug combination optimization for effective treatment of colorectal cancer
Main applicant: Prof. Patrycja Nowak-Sliwinska
Total funding of the project: CHF 150'000.-
Total duration of the project: 3 years
Allocation 2021: CHF 50'000.-
Starting date: 01.11.2018

FNRS 310030_197878
SNSF
Synergistic targeted drug combinations for induction of sensitivity to immune checkpoint inhibitors
Main applicant: Prof. Patrycja Nowak-Sliwinska
Total funding of the project: CHF 599'329.-
Total duration of the project: 4 years
Allocation 2021: CHF 153'633.-
Starting date: 01.01.2021

Ligne genevoise contre le cancer
Institutional
Cibler les fuseaux multipolaires dans les cellules cancéreuses avec une combinaison multidrogue synergique
Main applicant: Prof. Patrycja Nowak-Sliwinska
Total funding of the project: CHF 88'609.-
Total duration of the project: 1 year
Allocation 2021: CHF 88'609.-
Starting date: 01.06.2021

Innovation Debiopharm Academia Leman (IDEAL)
Institutional
IDEAL 102
Main applicant: Prof. Patrycja Nowak-Sliwinska
Total funding of the project: CHF 50'000.-
Total duration of the project: 6 months
Allocation 2021: CHF 50'000.-
Starting date: 01.08.2021

DIP Mentorat
Title of the research project: Poste de mentore / Programme égalité UNIGE
Main applicant: Prof. Patrycja Nowak-Sliwinska

Total funding of the project: CHF 65'000.-
Total duration of the project: 2 years
Allocation 2021: CHF 40'000.-
Starting date: 15.05.2020

Total amount for all research funds for 2021: CHF 449'892.-.

Scientific publications (with impact factor)

Rausch M.; Rutz A.; Allard P.M.; Delucinge-Vivier C.; Docquier M.; Dormond O.; Dyson P.J.; Wolfender J.-L.; Nowak-Sliwinska P., Drug Repurposing to Identify a Synergistic High-Order Drug Combination to Treat Sunitinib-Resistant Renal Cell Carcinoma. Cancers 2021, 13 (16), 3978. *6.64*

Rausch M.; Rutz A.; Allard P.M.; Delucinge-Vivier C.; Docquier M.; Dormond O.; Wolfender J.L.; Nowak-Sliwinska P., Molecular and Functional Analysis of Sunitinib-Resistance Induction in Human Renal Cell Carcinoma Cells, Int J Mol Sci 2021, 22 (12), 6467. *5.92*

Smadja D.M.; Mentzer S.J.; Fontenay M.; Laffan M.A.; Ackermann M.; Helms J.; Jonigk D.; Chocron R.; Pier G.B.; Gendron N.; Pons S.; Diehl J.L.; Margadant C.; Guerin C.; Huijbers E.J.M.; Philippe A.; Chapuis N.; Nowak-Sliwinska P.; Karagiannidis C.; Sanchez O.; Kümpers P.; Skurnik D.; Randi A.M.; Griffioen A.W., COVID-19 is a systemic vascular hemopathy: insight for mechanistic and clinical aspects, Angiogenesis 2021, 4 (4), 755-788. *9.59*

Huinen Z.R.; Huijbers E.J.M.; van Beijnum J.R.; Nowak-Sliwinska P.; Griffioen A.W.; Anti-angiogenics overcome tumor endothelial cell anergy and improve immunotherapy outcomes, Nature Reviews in Clinical Oncology 2021, 18 (8), 527-540. *66.6*

Rausch M.; Blanc L.; De Souse Silva O.; Dormond O.; Griffioen A.W.; Nowak-Sliwinska P.; Characterization of renal cell carcinoma heterotypic 3D co-cultures with immune cell subsets, Cancers 2021, 13 (11), 2551. *6.64*

Ducrey E.; Castrogiovanni C.; Meraldi P.; Nowak-Sliwinska P.; Forcing dividing cancer cells to die; low-dose drug combinations to prevent spindle pole clustering, Apoptosis 2021, 26 (5-6), 248-252. *4.54*

Griffioen A.W.; Nowak-Sliwinska P., A quarter century of Apoptosis, Apoptosis 2021, 26 (5-6), 233-234. *4.54*

Congresses / conferences and Symposia

- Congresses / conferences organisation: 3
- Posters presentations: 8
- Oral presentations: 4
- Invited oral presentations: 4

Ph.D. Theses presented in 2021

Magdalena Rausch
New Multidrug Cocktails for Treatment-Naive and - Resistant Clear Cell Renal Cell Carcinoma
Patrycja Nowak-Sliwinska (UNIGE) and Leonardo Scapozza (UNIGE)

Awards and distinction

Ducrey, E., The microscopy image taken by Eloise Ducrey features the cover of **Apoptosis***, ed.* Springer Nature.

Nowak-Sliwinska, P., joins the board of **Science Innovation Hub**, University of Geneva, Geneva (Switzerland).

Nowak-Sliwinska, P., nominated (by the Rector) for the **Liliane Bettencourt Prize for Life Sciences**, Fondation Bettencourt Schueller, 2021 (Switzerland).

Rausch, M., **SSEP best poster prize.** LS2 Annual e-Meeting 2021, February 2021 (Switzerland).

Ramzy G, **Best poster prize**, Organoids in Cancer Research workshop, November 2021, Lausanne (Switzerland).

Public outreach activities (radio, television and other media, community service)

P. Nowak-Sliwinska, co-administrator of the LinkedIn of ISPSO, Faculty of Science, University of Geneva, Geneva (Switzerland).

P. Nowak-Sliwinska, Reproduire les tumeurs pour tester différents traitements. UNIGE Press Release, June 21st, 2021, Geneva (Switzerland).

P. Nowak-Sliwinska, movie creation on Molecular Pharmacology Group for science dissemination, Faculty of Science, University of Geneva, Geneva (Switzerland).

P. Nowak-Sliwinska, movie creation on Equality and Diversity Commission, Faculty of Science, University of Geneva, Geneva (Switzerland).

PHARMACEUTICAL BIOCHEMISTRY

Professor Yogeshvar KALIA
Professor Leonardo SCAPOZZA
PD Doctor Marco Prunotto

General description of Unit

The Pharmaceutical Biochemistry group) includes two distinct fields of research linked to the discovery and delivery of molecular therapeutics.

The first activity is in the Pharmaceutical Biochemistry/Chemistry field in which the research is focused on drug discovery and understanding ligand-macromolecule interactions to develop new therapeutic strategies including new chemical entities, new targets using an interdisciplinary approach based on the combination of Biochemistry/Biophysics and Chemistry with Computational Chemistry/Molecular Modelling. Additionally, an in vivo activity in the field of rare disease has been added in order to be able to do preclinical Proof of Concept.

The second is in the field of drug delivery and focuses on developing and investigating methods to increase molecular transport across biological barriers using chemical, formulation and technology-based enhancement techniques. Areas of interest include (i) topical and transdermal delivery of therapeutic agents by investigating the effect of molecular properties on both passive and active transport processes, (ii) use of formulation and technology-based methods to improve drug delivery to the eye, and (iii) development of an ex vivo model for drug absorption in the gastrointestinal tract.

Specific research fields

The research in the field of pharmaceutical biochemistry/chemistry covers three main topics, namely Cancer, Neglected Diseases, Rare Diseases and Antibiotics Research.

- In Cancer Research we have two main objectives, namely the development of a thymidine kinase-based safety and monitoring tool for stem cells therapy and the development of inhibitors of the tyrosine kinase domain of oncogenic fusion proteins involved in signalling pathways.
- Within the research area of Neglected Diseases and Rare Diseases we aim at elucidating and validating new potential drug targets for developing therapeutic strategies against orphan diseases e.g. dystrophy/SMA and the major parasitic diseases of the Third World e.g. Malaria, Tripanosomiasis and Leishmaniosis as well as finding potential lead compounds against such diseases.
- Within the area of Antibiotic Research, the objective is to find compounds inhibiting bacterial virulence with novel mechanisms of action.

The research in the field of drug delivery includes:

- Development of new formulations and physical enhancement techniques to increase topical and transdermal delivery of low and high molecular weight therapeutics.
- Development and optimization of methods to understand the spatio-temporal biodistribution of drugs in the skin and other tissues.
- Investigation into the use of formulation and technology-based methods to improve drug delivery to both the anterior and posterior segments of the eye.
- Optimization of passive and iontophoretic drug delivery to the oral cavity for targeted local therapy.
- Developing a physiological ex vivo model for drug absorption in the gastrointestinal tract.

Further minor activities based on molecular recognition-based approaches for improving formulation and delivery are on-going.

2021 at a glance

- Publications with impact factor: 32
- Publications without impact factor: 0
- Patents: 0
- Book and chapters: 0
- Congresses / conferences organisation: 1
- Posters presentations: 23
- Oral presentations: 7
- Invited oral presentations: 6
- Number of projects at FNRS and assimilated (Research funds): 16
- Service agreements and related activities: 3
- Ph.D. Theses presented in 2021: 3
- Awards and distinctions: 0
- Public outreach activities: 2

Research funds

SNF CRSII5_183536 Sinergia - S19485
“From medicinal plant to mechanism: Target deconvolution of phytochemicals for Trypanosoma cruzi”
Applicant: L. SCAPOZZA
Main applicant: P. MAESER (STPI)
Total funding of the project: CHF 293’632.- (from CHF 2'279'020.-)
Total duration of the project: 3.5 years
Allocation 2021: CHF 87’232.-
Starting date: 01.02.2019

Fondation GELU - S19549
“Exploring the role of KIAA1199/CEMIP axis in Alport syndrome, a paediatric rare disease condition resulting in end stage renal disease”
Main applicants: L. SCAPOZZA and M. PRUNOTTO
Total funding of the project: CHF 1’500’000.-
Total duration of the project: 6 years (2019 -2025)
Payment 2019: CHF 750’000.-
Payment for project prolongation in 2021: CHF 750’000.-
Allocation 2021: CHF 750'000.-
Starting date: 01.05.2019

SNF CRSII5_186405 Sinergia - S19590 - CRSII5 -186405 SIN UB
“Deciphering and Targeting the Cancer Ubiquitylome”
Applicant: L. SCAPOZZA
Main applicant: J-P. THEURILLAT (IOR),
Total funding of the project: CHF 733’641.- (from CHF 2'528'452.-)
Total duration of the project: 4 years
Allocation 2021: CHF 182’334.- (facture faite en octobre 2021, payment en 2022)
Starting date: 01.06.2019

Fondation Duchenne UK - S19651 - Duchenne UK 2
“Repurposing drugs to combat fibrosis in Duchenne patients: Pharmacotherapy studies in a murine model with enhanced fibrosis”
Main applicant: L. SCAPOZZA and O. DORCHIES
Total funding of the project: CHF 243’763.-
Total duration of the project: 28 months
Allocation 2021: CHF 119’467.-
Starting date: 01.10.2019

HIPPIE - S19810
“High-resolution Investigation of Personalised Post-prandial inflammation biomarkErs”

Main applicant: L. SCAPOZZA and T. GURRY
Total funding of the project: CHF 135'000.- (+ CHF 10'000.- en 2021)
Total duration of the project: 1 year
Allocation 2021: CHF 75'000.-
Starting date: 01.06.2020

DPP NL 18 consortia S19811
"Preclinical evaluation of branched chain amino acids to support protein metabolism in the early phase of muscular dystrophy : a consortium approach"
Main applicant: L. SCAPOZZA and O. DORCHIES
Total funding of the project: CHF 71'888.40
Total duration of the project: 2 years
Allocation 2021: CHF 34'597.87 (payment on 25.01.2022)
Starting date: 01.02.2019

INNO-44531.1 IP-LS - S19821
"Novel self-structuring gels for dermal filler applications"
Main applicant: Y. KALIA
Total funding of the project: CHF 177'068.-
Total duration of the project: 2 years
Allocation 2021: CHF 53'120.40
Starting date: 01.06.2020

INNO-44531.1 KYLYS - S19871
"Novel self-structuring gels for dermal filler applications"
Main applicant: Y. KALIA
Total funding of the project: CHF 25'000.-
Total duration of the project: 2 years
Allocation 2021: CHF 19'242.72
Starting date: 01.06.2020

SWISS E!114171 G2B - S19876
"G2B Gut-To-Blood: a platform for oral systemic delivery of targeted therapies"
Main applicant: L. SCAPOZZA
Total funding of the project: CHF 263'616.-
Total duration of the project: 3 years
Allocation 2021: CHF 0.-
Starting date: 01.10.2020

INNO-46357.1 IP-LS - S19892
A2AR negative allosteric modulators for cancer immunotherapy: validation of lead candidate"
Main applicant: L. SCAPOZZA
Total funding of the project: CHF 881'156.-
Total duration of the project: 18 months
Allocation 2020: CHF 440'578.-
Allocation 2021: CHF 264'346.80
Allocation 2022: CHF 176231.20
Starting date: 01.12.2020

AFM #23127 - S19893
"Duchenne muscular dystrophy: phenotyping and validation of better murine models for improving preclinical research and clinical translation"
Main applicant: L. SCAPOZZA and O. DORCHIES
Total funding of the project: CHF 96'238.-
Total duration of the project: 3 years
Allocation 2021: CHF 50'149.-
Allocation 2022: CHF 45'399.- (payment on 14.12.2021)
Starting date: 01.10.2020

INNOGAP AD2020 - S19925

"Solvent free approach for preparing nanosystems"
Main applicant: Y. KALIA
Total funding of the project: CHF 30'000.-
Total duration of the project: 1 year
Allocation 2021: CHF 30'000.-
Starting date: 01.12.2020

AFFILOGIC project - S19965
"Evolution d'une Nanofitine-médicament pour son administration par voie orale grâce à un module de passage actif de la barrière intestinale"
Main applicant: L. SCAPOZZA
Total funding of the project: CHF 19'096.10
Total duration of the project: 1 year
Allocation 2021: CHF 19'096.10
Starting date: 01.03.2021

SCHMIDH pericam - S110076
"Contribution to the acquisition of a Persiscam instrument"
Main applicant: L. SCAPOZZA
Total funding of the project: CHF 20'000.-
Total duration of the project: 12 months
Allocation 2021: CHF 20'000.-
Starting date: 01.10.2021

SACAD - S110102
"Contribution to the acquisition of a source DESI for MS"
Main applicant: Y. KALIA
Total funding of the project: CHF 17'048.-
Total duration of the project: 2 months
Allocation 2021: CHF 17'048.-
Starting date: 01.11.2021

TEOX-HA – S110103
"Development of an Ex Vivo Skin Model to Investigate the Effect of Hyaluronic Acid Filler on Skin Biology"
Main applicant: Y. KALIA
Total funding of the project: CHF 140'000.-
Total duration of the project: 17 months
Allocation 2021: CHF 35'772.55
Starting date: 01.11.2021

Total amount for all research funds for 2021: CHF 1'757'406.44

<u>Service agreements and related activities</u>

MERZ 1 – S110025
"Formulation of ACB lotion for the tropical treatment of psoriasis"
Main applicant: Y. KALIA
Total funding of the project: CHF 240'000.-
Total duration of the project: 18 months
Allocation 2021: CHF 85'854.13
Starting date: 01.06.2021

MERZ 2 – S110026
"Consultancy agreement for scientific projects"
Main applicant: Y. KALIA
Total funding of the project: CHF 30'000.-
Total duration of the project: 18 months

Allocation 2021: CHF 30'662.19
Starting date: 01.06.2021

Divers mandats - S19534 – Nannopart service agreement
"Evaluation of acyclovir delivery to skin from innovative proprietary calixarene-based formulations supplied by COMPANY"
Main applicant : Y. KALIA
Total amount for 2021: CHF 4'705.-

Total amount (for all service agreements and related activities) for 2021: CHF 121'221.32

Scientific publications (with impact factor)

Angeletti, A.; Bruschi, M.; Moroni, G.; Sinico, R. A.; Franceschini, F.; Fredi, M.; Vaglio, A.; Cavagna, L.; Petretto, A.; Pratesi, F.; Migliorini, P.; Locatelli, F.; Pazzola, G.; Pesce, G.; Bagnasco, M.; Manfredi, A.; Ramirez, G. A.; Esposito, P.; Murdaca, G.; Negrini, S.; Cipriani, L.; Trezzi, B.; Emmi, G.; Cavazzana, I.; Binda, V.; d'Alessandro, M.; Fenaroli, P.; Pisani, I.; Garibotto, G.; Montecucco, C.; Santoro, D.; Scolari, F.; Volpi, S.; Mosca, M.; Tincani, A.; Candiano, G.; Prunotto, M.; Verrina, E.; Ravelli, A.; Ghiggeri, G. M., Second Wave Antibodies in Autoimmune Renal Diseases: The Case of Lupus Nephritis. *J Am Soc Nephrol* **2021**. *10.121*

Angeletti, A.; Volpi, S.; Bruschi, M.; Lugani, F.; Vaglio, A.; Prunotto, M.; Gattorno, M.; Schena, F.; Verrina, E.; Ravelli, A.; Ghiggeri, G. M., Neutrophil Extracellular Traps-DNase Balance and Autoimmunity. *Cells* **2021,** *10* (10). *4.33*

Bonfil, R. D.; Chen, W.; Vranic, S.; Sohail, A.; Shi, D.; Jang, H.; Kim, H. R.; Prunotto, M.; Fridman, R., Expression and subcellular localization of Discoidin Domain Receptor 1 (DDR1) define prostate cancer aggressiveness. *Cancer Cell Int* **2021,** *21* (1), 507. *1.322*

Bruschi, M.; Moroni, G.; Sinico, R. A.; Franceschini, F.; Fredi, M.; Vaglio, A.; Cavagna, L.; Petretto, A.; Pratesi, F.; Migliorini, P.; Locatelli, F.; Pazzola, G.; Pesce, G.; Bagnasco, M.; Manfredi, A.; Ramirez, G. A.; Esposito, P.; Murdaca, G.; Negrini, S.; Cipriani, L.; Trezzi, B.; Emmi, G.; Cavazzana, I.; Binda, V.; Fenaroli, P.; Pisani, I.; Garibotto, G.; Montecucco, C.; Santoro, D.; Scolari, F.; Mosca, M.; Tincani, A.; Candiano, G.; Prunotto, M.; Volpi, S.; Verrina, E.; Angeletti, A.; Ravelli, A.; Ghiggeri, G. M., Serum IgG2 antibody multicomposition in systemic lupus erythematosus and lupus nephritis (Part 1): cross-sectional analysis. *Rheumatology (Oxford)* **2021,** *60* (7), 3176-3188. *7.58*

Bruschi, M.; Moroni, G.; Sinico, R. A.; Franceschini, F.; Fredi, M.; Vaglio, A.; Cavagna, L.; Petretto, A.; Pratesi, F.; Migliorini, P.; Locatelli, F.; Pazzola, G.; Pesce, G.; Bagnasco, M.; Manfredi, A.; Ramirez, G. A.; Esposito, P.; Murdaca, G.; Negrini, S.; Cipriani, L.; Trezzi, B.; Emmi, G.; Cavazzana, I.; Binda, V.; d'Alessandro, M.; Fenaroli, P.; Pisani, I.; Garibotto, G.; Montecucco, C.; Santoro, D.; Scolari, F.; Volpi, S.; Mosca, M.; Tincani, A.; Candiano, G.; Prunotto, M.; Verrina, E.; Angeletti, A.; Ravelli, A.; Ghiggeri, G. M., Serum IgG2 antibody multi-composition in systemic lupus erythematosus and in lupus nephritis (Part 2): prospective study. *Rheumatology (Oxford)* **2021,** *60* (7), 3388-3397. *7.58*

Bruschi, M.; Moroni, G.; Sinico, R. A.; Franceschini, F.; Fredi, M.; Vaglio, A.; Cavagna, L.; Petretto, A.; Pratesi, F.; Migliorini, P.; Manfredi, A.; Ramirez, G. A.; Esposito, P.; Negrini, S.; Trezzi, B.; Emmi, G.; Santoro, D.; Scolari, F.; Volpi, S.; Mosca, M.; Tincani, A.; Candiano, G.; Prunotto, M.; Verrina, E.; Angeletti, A.; Ravelli, A.; Ghiggeri, G. M., Neutrophil Extracellular Traps in the Autoimmunity Context. *Front Med (Lausanne)* **2021,** *8*, 614829. *4.468*

Cecchini, C.; Pannilunghi, S.; Tardy, S.; Scapozza, L., From Conception to Development: Investigating PROTACs Features for Improved Cell Permeability and Successful Protein Degradation. *Front Chem* **2021,** *9*, 672267. *4.62*

Dahmana, N.; Mugnier, T.; Gabriel, D.; Favez, T.; Kowalczuk, L.; Behar-Cohen, F.; Gurny, R.; Kalia, Y. N., Polymeric micelle mediated follicular delivery of spironolactone: Targeting the mineralocorticoid receptor to prevent glucocorticoid-induced activation and delayed cutaneous wound healing. *Int J Pharm* **2021**, 604, 120773. *5.875*

Daneluti, A. L. M.; Guerra, L. O.; Velasco, M. V. R.; do Rosario Matos, J.; Baby, A. R.; Kalia, Y. N., Preclinical and clinical studies to evaluate cutaneous biodistribution, safety and efficacy of UV filters encapsulated in mesoporous silica SBA-15. *Eur J Pharm Biopharm* **2021**, 169, 113-124. *5.71*

Djeddi, S.; Reiss, D.; Menuet, A.; Freismuth, S.; de Carvalho Neves, J.; Djerroud, S.; Massana-Munoz, X.; Sosson, A. S.; Kretz, C.; Raffelsberger, W.; Keime, C.; Dorchies, O. M.; Thompson, J.; Laporte, J., Multi-omics comparisons of different forms of centronuclear myopathies and the effects of several therapeutic strategies. *Mol Ther* **2021,** *29* (8), 2514-2534. *11.454*

Dubey, S.; Perozzo, R.; Scapozza, L.; Kalia, Y. N., Using protease inhibitors to improve protein stability in the presence of skin: A case study on the stability of insulin like growth factor 1. *Eur J Pharm Biopharm* **2021**, 158, 379-381. *5.71*

Garofalo, M.; Piccoli, L.; Romeo, M.; Barzago, M. M.; Ravasio, S.; Foglierini, M.; Matkovic, M.; Sgrignani, J.; De Gasparo, R.; Prunotto, M.; Varani, L.; Diomede, L.; Michielin, O.; Lanzavecchia, A.; Cavalli, A., Machine learning analyses of antibody somatic mutations predict immunoglobulin light chain toxicity. *Nat Commun* **2021,** *12* (1), 3532. *14.919*

Gratieri, T.; Zarhloule, R.; Dubey, S.; Kalia, Y. N., The influence of skin barrier impairment on the iontophoretic transport of low and high molecular weight permeants. *Int J Pharm* **2021**, 602, 120607. *5.875*

Gurry, T.; Nguyen, L. T. T.; Yu, X.; Alm, E. J., Functional heterogeneity in the fermentation capabilities of the healthy human gut microbiota. *PLoS One* **2021,** *16* (7), e0254004. *3.24*

Gutierrez Becker, B.; Arcadu, F.; Thalhammer, A.; Gamez Serna, C.; Feehan, O.; Drawnel, F.; Oh, Y. S.; Prunotto, M., Training and deploying a deep learning model for endoscopic severity grading in ulcerative colitis using multicenter clinical trial data. *Ther Adv Gastrointest Endosc* **2021,** *14*, 2631774521990623. *4.33*

Houriet, J.; Arnold, Y. E.; Pellissier, L.; Kalia, Y. N.; Wolfender, J. L., Using Porcine Jejunum Ex Vivo to Study Absorption and Biotransformation of Natural Products in Plant Extracts: Pueraria lobata as a Case Study. *Metabolites* **2021**, 11 (8), 541. *4.932*

Kaufmann, B.; Boulle, P.; Berthou, F.; Fournier, M.; Beran, D.; Ciglenecki, I.; Townsend, M.; Schmidt, G.; Shah, M.; Cristofani, S.; Cavailler, P.; Foti, M.; Scapozza, L., Heat-stability study of various insulin types in tropical temperature conditions: New insights towards improving diabetes care. *PLoS One* **2021,** *16* (2), e0245372. *3.24*

Kim, J. J.; David, J. M.; Wilbon, S. S.; Santos, J. V.; Patel, D. M.; Ahmad, A.; Mitrofanova, A.; Liu, X.; Mallela, S. K.; Ducasa, G. M.; Ge, M.; Sloan, A. J.; Al-Ali, H.; Boulina, M.; Mendez, A. J.; Contreras, G. N.; Prunotto, M.; Sohail, A.; Fridman, R.; Miner, J. H.; Merscher, S.; Fornoni, A., Discoidin domain receptor 1 activation links extracellular matrix to podocyte lipotoxicity in Alport syndrome. *EBioMedicine* **2021,** *63*, 103162. *8.143*

Matias-Garcia, P.; Wilson, R.; Guo, Q.; Zaghlool, S.; Eales, J.; Xu, X.; Charchar, F.; Dormer, J.; Maalmi, H.; Schlosser, P.; Elhadad, M.; Nano, J.; Sharma, S.; Peters, A.; Fornoni, A.; Mook-Kanamori, D.; Winkelmann, J.; Danesh, J.; Di Angelantonio, E.; Ouwehand, W.; Watkins, N.; Roberts, D.; Petrera, A.; Graumann, J.; Koenig, W.; Hveem, K.; Jonasson, C.; Kottgen, A.; Butterworth, A.; Prunotto, M.; Hauck, S.; Herder, C.; Suhre, K.; Gieger, C.; Tomaszewski, M.; Teumer, A.; Waldenberger, M., Plasma Proteomics of Renal Function: A Trans-ethnic Meta-analysis and Mendelian Randomization Study. *J Am Soc Nephrol* **2021**. *6.27*

Moll, S.; Angeletti, A.; Scapozza, L.; Cavalli, A.; Ghiggeri, G. M.; Prunotto, M., Glomerular Macrophages in Human Auto- and Allo-Immune Nephritis. *Cells* **2021,** *10* (3). *4.33*

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Preynat-Seauve, O.; Nguyen, E. B.; Westermaier, Y.; Heritier, M.; Tardy, S.; Cambet, Y.; Feyeux, M.; Caillon, A.; Scapozza, L.; Krause, K. H., Novel Mechanism for an Old Drug: Phenazopyridine is a Kinase Inhibitor Affecting Autophagy and Cellular Differentiation. *Front Pharmacol* **2021,** *12*, 664608. *5.81*

Quartier, J.; Lapteva, M.; Boulaguiem, Y.; Guerrier, S.; Kalia, Y. N., Polymeric micelle formulations for the cutaneous delivery of sirolimus: A new approach for the treatment of facial angiofibromas in tuberous sclerosis complex. *Int J Pharm* **2021**, 604, 120736. *5.875*

Quartier, J.; Rao, W.; Slade, S.; Metral, F.; Lapteva, M.; Kalia, Y. N., DESI-MS imaging to visualize spatial distribution of xenobiotics and endogenous lipids in the skin. *Int J Pharm* **2021**, 607, 120967. *5.875*

Ravani, P.; Colucci, M.; Bruschi, M.; Vivarelli, M.; Cioni, M.; DiDonato, A.; Cravedi, P.; Lugani, F.; Antonini, F.; Prunotto, M.; Emma, F.; Angeletti, A.; Ghiggeri, G. M., Human or Chimeric Monoclonal Anti-CD20 Antibodies for Children with Nephrotic Syndrome: A Superiority Randomized Trial. *J Am Soc Nephrol* **2021,** *32* (10), 2652-2663. *6.27*

Rosenbaum, P.; Tchitchek, N.; Joly, C.; Rodriguez Pozo, A.; Stimmer, L.; Langlois, S.; Hocini, H.; Gosse, L.; Pejoski, D.; Cosma, A.; Beignon, A. S.; Dereuddre-Bosquet, N.; Levy, Y.; Le Grand, R.; Martinon, F., Vaccine Inoculation Route Modulates Early Immunity and Consequently Antigen-Specific Immune Response. *Front Immunol* **2021,** *12*, 645210. *7.561*

Singhal, M.; Serna, C.; Kalaria, D.; Kalia, Y. N., Effect of continuous and multi-phasic current profiles on the iontophoretic transport of pramipexole, rasagiline and huperzine A: Depicting temporal variation and biodistribution in the skin. *Int J Pharm* **2021**, 599, 120445. *5.875*

Singhal, M.; Serna, C.; Merino, V.; Kalia, Y. N., Current profile controlled transdermal delivery of pramipexole from an iontophoretic patch system in vitro and in vivo. *Eur J Pharm Biopharm* **2021**, 166, 175-181. *5.71*

Sonaje, K.; Tyagi, V.; Chen, Y.; Kalia, Y. N., Iontosomes: Electroresponsive Liposomes for Topical Iontophoretic Delivery of Chemotherapeutics to the Buccal Mucosa. *Pharmaceutics* **2021**, 13 (1), 88. *6.321*

Thakur, N. S.; Mandal, N.; Patel, G.; Kirar, S.; Reddy, Y. N.; Kushwah, V.; Jain, S.; Kalia, Y. N.; Bhaumik, J.; Banerjee, U. C., Co-administration of zinc phthalocyanine and quercetin via hybrid nanoparticles for augmented photodynamic therapy. *Nanomedicine: Nanotechnology, Biology and Medicine* **2021**, 33, 102368. *6.458*

Tyagi, V.; Serna-Jimenez, C. E.; Kalia, Y. N., Controlled simultaneous iontophoresis of buflomedil hydrochloride and dexamethasone sodium phosphate to the mucosa for oral submucous fibrosis. *Int J Pharm* **2021**, 607, 121009. *5.875*

Wright, M. B.; Varona Santos, J.; Kemmer, C.; Maugeais, C.; Carralot, J. P.; Roever, S.; Molina, J.; Ducasa, G. M.; Mitrofanova, A.; Sloan, A.; Ahmad, A.; Pedigo, C.; Ge, M.; Pressly, J.; Barisoni, L.; Mendez, A.; Sgrignani, J.; Cavalli, A.; Merscher, S.; Prunotto, M.; Fornoni, A., Compounds targeting OSBPL7 increase ABCA1-dependent cholesterol efflux preserving kidney function in two models of kidney disease. *Nat Commun* **2021,** *12* (1), 4662. *14.919*

Patents

4 'invention-forms' submitted to UNITEC. UNITEC has decided to support the submission of these patents.

Congresses / conferences and Symposia

- Congresses / conferences organisation: 1 (XXVI EFMC-ISMC 2021, 26.8-2.9 2021, Basel)
- Posters presentations: 23
- Oral presentations: 7
- Invited oral presentations: 6

Ph.D. Theses presented in 2021

QUARTIER Julie
« Investigating the Cutaneous Spatial Biodistribution of Pharmaceutical Molecules after Topical Application: from the Design of Polymeric Micelle Formulations to the Development of Quantitative and Qualitative Techniques» - 20.01.21
Prof. Yogeshvar Kalia

SHATZ Whitney
« Adapting a Naturally Occurring Protein Cage to Modulate an Array of Therapeutic Delivery Properties in Various Disease Settings» - 14.01.21
Prof. Yogeshvar Kalia

RAUSCH Magdalena
« New Multidrug Cocktails for Treatment-Naive and -Resistant Clear Cell Renal Cell Carcinoma » - 03.06.21
Prof. Patrycja Nowak-Sliwinska, Prof. Leonardo Scapozza (co-director)

Public outreach activities (radio, television and other media, community service)

Intervention Radio CQFD (l'émission sciences et santé de La Première) sur le sujet « Stocker son insuline à des températures élevées: c'est possible » vendredi, 05.02.2021 (https://www.rts.ch/la-1ere/programmes/cqfd/11916245-stocker-son-insuline-a-des-temperatures-elevees-cest-possible-05-02-2021.html?mediaShare=1)

Communiqué de presse « Insulin can be stored out of refrigeration even in hot settings' UNIGE-MSF 3th February 2021.

Plusieurs interviews et articles dans la presse mondiale sur le sujet de la publication in Plos One en collaboration avec MSF « Heat-stability study of various insulin types in tropical temperature conditions: New insights towards improving diabetes care" https://medicalxpress.com/news/2021-02-vial-insulin-weeks-37c-efficacy.html; https://www.youtube.com/watch?v=Lb7Ant_I_5E&feature=youtu.be

PHARMACEUTICAL TECHNOLOGY

Professor Eric ALLEMANN
Professor Norbert LANGE
Doctor Florence DELIE-SALMON

General description of Unit

Research at the unit of Pharmaceutical Technology is focusing on the delivery of therapeutic agents for cancer, rheumatic, vascular applications and contrast agents for medical imaging at the right site at the right time. Eric Allémann has activities in nanomedicine, micro particles, and targeted contrast agents for medical imaging. Norbert Lange leads research in photodetection, photodynamic therapy and enzymatically activated prodrugs. Florence Delie leads research in nanomedicine and drug targeting. In 2021, various collaborations were continued with the University Hospital of Geneva, the University Hospital of Lausanne, and the Faculty of Medicine in Geneva. Collaboration projects with established companies continued.

Specific research fields

Modified nanoparticles for active targeting
Perivascular formulation for the prevention of restenosis
Development of drug formulations for intra articular delivery
Enzymatically activated prodrugs and supramolecular constructs
Development of new contrast agent for MRI
Formulation of microbiota
Polymer photosensitizers projects
Cancer targeted drug delivery systems
Synthesis of biopolymers

2021 at a glance

- Publications with impact factor: 14
- Publications without impact factor: 2
- Patents: 1
- Book and chapters: 0
- Congresses / conferences organisation: 0
- Posters presentations: 10
- Oral presentations: 4
- Invited oral presentations: 3
- Number of projects at FNRS and assimilated (Research funds): 5
- Service agreements and related activities: 1
- Ph.D. Theses presented in 2021: 2
- Awards and distinctions: 1
- Public outreach activities: 2

Research funds

HUG-CONFIRM
Category : Institutional
Molecular markers of intracranial aneurysms wall integrity and stability
Main applicant: Kwak Brenda, Bijlenga Philippe, Allémann Eric
Total funding of the project: CHF 600'000.-
Total duration of the project: 3 years
Allocation 2021: CHF 200'000.-
Starting date: 01.11.2019

FNRS – 205321-173027/ALA
Category: SNSF
Novel-Self Assembling 5-ALA Derivatives for Controlled Drug Delivery
Main applicant: Lange Norbert
Total funding of the project: 500'000.-
Total duration of the project: 4 years
Allocation 2021: CHF 73'692.-
Starting date: 01.02.2018

FNRS – 205321 – 192350
Category: SNSF
Synthesis of biopolymers and their application for glucose carriers for osteoarthritis stem cells therapy
Main applicant: Allémann Eric
Total funding of the project: 493'114.-
Total duration of the project: 4 years
Allocation 2021: CHF 133'440.-
Starting date: 01.09.2020

GALAPAGOS NV
Category: Industry
Main applicant: Allémann Eric
Total funding of the project: 435'000.-
Total duration of the project: 2 years
Allocation 2021: CHF 217'500.-
Starting date: 01.11.2020

NOVARTIS-ALLE
Category : Industry
Main applicant: Allémann Eric
Total funding of the project: 75'000.-
Total duration of the project: 3 years
Allocation 2021: 0.-
Starting date: 01.01.2021

Total amount for all research funds for 2021: CHF 624'632.-

Service agreements and related activities

Total amount (for all service agreements and related activities) for 2021: CHF 1323.-

Scientific publications (with impact factor)

Dzoyem JP, Nganteng DND, Melong R, Wafo P, Ngadjui B, Allemann E, et al. Bioguided identification of pentacyclic triterpenoids as anti-inflammatory bioactive constituents of Ocimum gratissimum extract. J Ethnopharmacol. 2021;268:113637. 4.36

Dupertuis Y.M, Boulens N, Angibaud E, Briod AS, Viglione A, Allemann E, et al. Antitumor Effect of 5-Fluorouracil-Loaded Liposomes Containing n-3 Polyunsaturated Fatty Acids in Two Different Colorectal Cancer Cell Lines. AAPS PharmSciTech. 2021;22(1):36 3.25

Melong R, Tamokoue Kengne PC, Dzoyem JP, Fusi AA, Allemann E, Delie F, et al. New cytotoxic obacunone-type limonoid and others constituents from the stem bark of Carapa procera DC (Meliaceae). Nat Prod Res. 2021:1-8 2.86

Dzoyem JP, Boulens N, Allémann E, Delie F. Thymol and Piperine-Loaded Poly(D,L-lactic-co-glycolic acid) Nanoparticles Modulate Inflammatory Mediators and Apoptosis in Murine Macrophages. Planta Med Int Open. 2021;8:e122-e30. 3.11

Leutcha BP, Sema DK, Dzoyem JP, Ayimele GA, Nyongbela KD, Delie F, et al. Cytotoxicity of a new tirucallane derivative isolated from Stereospermum acuminatissimum K. Schum stem bark. Nat Prod Res. 2021;35(22):4417-22 2.86

Bouilloux J., Kiening M., Yapi S., Lange N., Double-PEGylated Cyclopeptidics. Photosensitizer Prodrug improves Drug Uptake from in Vitro to Hen's Egg Chorioallantoic membrane model. Molecules, 2021 Oct. 15;26(20):6241 4.11

Vorobiev, V.; Adriouach, S.; Crowe, L. A.; Lenglet, S.; Thomas, A.; Chauvin, A. S.; Allemann, E., Vascular-targeted micelles as a specific MRI contrast agent for molecular imaging of fibrin clots and cancer cells. European Journal of Pharmaceutics and Biopharmaceutics 2021**,** 158, 347-358. 5.57

Thauvin, C.; Maudens, P.; Allemann, E., Microwave-assisted synthesis of self-assembling bi-functionalizable amphiphilic diblock copolymers. Journal of Drug Delivery Science and Technology 2021**,** 61. 3.92

Tegha, H. F., Jouda, J. B., Dzoyem, J.P., Sema, D. K., Leutcha, B. P., Allemann, E., Delie, F. Shiono, Y., Sewald, N., Lannang, A. M., A New Chromene Derivative and a New Polyalcohol Isolated From the Fungus Xylaria sp. 111A Associated With Garcinia polyantha Leaves. Natural Product Communications 2021, 16 (1). 4.36

Salgado, C., Jordan, O., Allemann, E., Osteoarthritis In Vitro Models: Applications and Implications in Development of Intra-Articular Drug Delivery Systems. Pharmaceutics 2021, 13 (1). 6.32

Laurent, A., Porcello , A., Fernandez, P. G., Jeannerat, A., Peneveyre, C., Abdel-Sayed, P., Scaletta, C., Hirt-Burri, N., Michetti, M., Roessingh, A. D., Raffoul, W., Allemann, E, Jordan, O., Applegate, L. A., Combination of Hyaluronan and Lyophilized Progenitor Cell Derivatives: Stabililization of Functional Hydrogel Products for Therapeutic Management of Tendinous Tissue Disorders. Pharmaceutics 2021, 13 (12) 6.32

Fouotsa, H., Dzoyem, J. P., Lannang, A. M., Stammler, H. G., Mbazoa, C. D., Luhmer, M., Nkengfack, A. E., Allemann E., Delie, F., Meyer, F., Sewald, N., Antiproliferative activity of a new xanthone derivative from leaves of Garcinia nobilisEngl. Natural Product Research 2021, 35 (24), 5604-5611. 2.86

Brillatz, T., Jacmin, M., Queiroz, E. F., Marcourt, L., Morin, H., Shahbazi, N., Boulens, N., Riva, A., Crawford, A. D., Allemann, E., Wolfender, J. L., Identification of Potential Antiseizure Agents in Boswellia sacra using In Vivo Zebrafish and Mouse Epilepsy Models. Acs Chemical Neuroscience 2021, 12 (10), 1791-1801. 4.42

Acosta, J. M., Cayron, A. F., Dupuy, N., Pelli, G., Foglia, B., Haemmerli, J., Allemann, E., Bijilenga, P., Kwak, B. R., Morel, S., Effect of Aneurysm and Patient Characteristics on Intracranial Aneurysm Wall Thickness. Frontiers in Cardiovascular Medicine 2021, 8. 4.79

Scientific publications (without impact factor)

Furrer P, Delie F. Pharmacocinétique oculaire. In : Pharmacologie oculaire et biothérapie. Société Française d'ophtalmologie éd. Elsevier 2021, in press

Hammel P., Lange N., RB217, RB218, and RB219 antibodies recognize Protoporphyrin IX by ELISA, 2021, Antibody reports vol. 4.

Patents

Sansaloni Pastor S., Varesio E., Lange N., Uses of 5-ALA or its derivatives-induced PpIX for targeting cell epitopes generated there 2021, European patent number P2620EP00

Congresses / conferences and Symposia

- Congresses / conferences organisation: 0
- Posters presentations: 10
- Oral presentations: 4
- Invited oral presentations: 3

Ph.D. Theses presented in 2021

Litvinenko Alexandra
A Novel Dual-imaging Probe for the Detection of Progressive Ovarian Cancer
Allémann Eric
Walter Martin

Salgado Carlota
Intra-articular sustained release carriers for osteoarthritis management: formulation and bioactivity evaluation studies
Allémann Eric
Jordan Olivier

Awards and distinction

Porcello A., Poster Award AKB Foundation, First Prize, Swiss Pharma Science Day 2021, 25 August 2021, Berne (Suisse)

Public outreach activities (radio, television and other media, community service)

P. Furrer, Journée « Futur en tous genres » accueil de 40 jeunes gens, prépartion de crèmes pour les mains

F. Delie, Accueil étudiants boussole, printemps 2021

PHARMACOGNOSY

Professor Muriel CUENDET

General description of the unit

The pharmacognosy research unit mainly focuses on the study of the pharmacological activity of bioactive natural products. Compounds with anticancer and antiparasitic activity are of particular interest. In these areas, the development of new and better drugs remains a principal need. A panel of in vitro bioassays indicative of inhibiting major stages of carcinogenesis (initiation, promotion and progression) is used. Mechanistic studies are then pursued with the most promising compounds. A particular interest is set on multiple myeloma and lung adenocarcinoma models. Also, most antiparasitic drugs available on the market (when available) have a limited efficacy and strong side effects. Some plant extracts and pure compounds showed good in vitro and in vivo activity. Therefore, derivatives (synthetized by collaborators) are currently being investigated to improve their physicochemical properties. The absorption and metabolism of those compounds are being evaluated in vitro and in vivo.

Specific research fields

- To identify plant extracts and natural products capable of inhibiting one or several of the major stages of carcinogenesis (initiation, promotion and progression)
- To identify plant extracts and natural products with antiparasitic activity
- To characterize the mechanism of action of compounds that inhibit carcinogenesis by studying cellular pathways and cancer hallmarks, such as proliferation, angiogenesis, migration, and invasion
- To rationally optimize the molecules regarding their activity and selectivity

2021 at a glance

- Publications with impact factor: 3
- Publications without impact factor: 0
- Patents: 0
- Book and chapters: 0
- Congresses / conferences organisation: 1
- Poster presentations: 6
- Oral presentations: 1
- Invited oral presentations: 1
- Number of projects at FNRS and assimilated (research funds): 4
- Service agreements and related activities: 2
- Ph.d. Theses presented in 2021: 0
- Awards and distinctions: 2
- Public outreach activities: 0

Research funds

FNS
Grant No CRSII5_183536: From medicinal plant to mechanism: Target deconvolution of phytochemicals for *Trypanosoma cruzi*
Main applicant within the research unit: Muriel Cuendet
Total funding of the project: CHF 945'554.-
Total duration of the project: 42 months
Allocation 2021: CHF 280'312.-
Starting date: 01.02.2019

FNS
Grant No 310030-184790: HDAC6 ZnF-UBP domain inhibition in multiple myeloma
Main applicant within the research unit: Muriel Cuendet
Total funding of the project: CHF 530'880.-
Total duration of the project: 48 months
Allocation 2021: CHF 111'111.-
Starting date: 01.01.2020

Institutional
INNOSUISSE – Innovation Project
Grant No 33410.1 IP-LS: Development of waltherione F-based chemical entities for Chagas disease
Main applicant within the research unit: Muriel Cuendet
Total funding of the project: CHF 271'200.-
Total duration of the project: 30 months
Allocation 2021: 0.-
Starting date: 01.06.2019

Institutional
Leading House for the Latin American Region – Seed Money Grant
Grant No SMG1906
Main applicant within the research unit: Muriel Cuendet
Total funding of the project: CHF 10'050.-
Total duration of the project: 29 months
Allocation 2021: 0.-
Starting date: 01.02.2020

Total amount for all research funds for 2021: CHF 391'423.-

Service agreements and related activities

MEDIBIOTIX
Service
Total amount for 2021: CHF 2'000.-

Office de Promotion des Industries et des Technologies - OPI
Service
Total amount for 2021: CHF 5'000.-

Total amount for all service agreements and related activities for 2021: CHF 7'000.-

Scientific publications (with impact factor)

Berndt, S.; Carpentier, G.; Turzi, A.; Borlat, F.; Cuendet, M.; Bodaressi, A.; Angiogenesis is differentially modulated by platelet-derived products. Biomedicines 2021, 9, 251. *6.08*

Cretton, S.; Genta-Jouve, G.; Munoz, O.; Buergi, T.; Kaiser, M.; Mäser, P.; Cuendet, M.; Christen, P., Hygroline derivatives from *Schizanthus tricolor* and their anti-trypanosomatid and antiplasmodial activities. Phytochemistry 2020, 192, 112957. *4.07*

Freitas Misakyan, M.F.; Wijeratne, E.M.K.; Issa, M.E.; Xu, Y.; Monteillier, A.; Gunatilaka, A.A.L.; Cuendet, M., Structure-activity relationships of withanolides as anti-proliferative agents for multiple myeloma: comparison of activity in 2D models and a 3D co-culture model. Journal of Natural Products 2021, 84, 2321-2335. *4.05*

Congresses / conferences and symposia

- Congress / conference organisation: 1
- Posters presentations: 6
- Oral presentations: 1
- Invited oral presentations: 1

Awards

MT 180 2021, finale locale : Ozlem Sevik, 3ème prix « Étude phytochimique de plantes du Niger actives contre la maladie de Chagas »

MT 180 2021, finale suisse : Ozlem Sevik, prix du public « Étude phytochimique de plantes du Niger actives contre la maladie de Chagas »

PHYTOCHEMISTRY AND BIOACTIVE NATURAL PRODUCTS

Professor Jean-Luc WOLFENDER
Doctor Emerson FERREIRA-QUEIROZ

General description of Unit

The main research activities of the unit are related to the development of methodologies for the rapid isolation identification and bioactivity characterisation of natural products (NPs) at the microgram scale. State-of-the-art LC-MS and LC-MS/MS as well as microNMR techniques are used for dereplication purposes or de novo identification of NPs in crude extracts from different origins (plants, fungi, and microorganisms). Microfractionation methods in 96 well plates allow bioassays to be performed on LC peak in crude extracts, quantitative estimation of the well content and further structural determination by sensitive NMR. Rational large-scale isolation strategies are developed for the rapid obtention of pure NPs in the mg scale for further testing bioactivies and mode of action. The range of biological activities studied in house or in collaboration covers mainly antifungal, antiprotozoal, anti-inflammatory and antiepileptic activities. The interest of the group is also focused on plant metabolomics, in this respect the focus is on the investigation of bioactive NPs dynamically induced in various stress situations (fungi confrontation, biotic and abiotic stresses, metabolite elicitation...). With the idea to generate original sources of bioactive NPs, other strategies including biotransformation or chemical derivatisation of crude extracts from common sources are also investigated. Finally, the analytical and metabolomics methods are also used for studying the metabolisation of crude extracts in view of a better understanding of the mode of action (synergy, prodrugs) and the potential toxicity of phytopharmaceuticals or nutraceuticals.

Specific research fields

- Search for new lead compounds from natural sources
- On-line identification of natural products by LC-UV-NMR-MS (dereplication)
- Rapid microfractionation of crude extracts for chemical and bioactivity profiling
- Plant metabolomics
- Search for original bioactive stress-induced natural products of various origin
- Study of antifungal compounds from pathogen fungi in co-culture Qualitative quantitative analysis of phytotherapeuticals
- Study of the metabolisation of phytopreparation by metabolomics in relation with their mode of action
- Investigation of natural products involved in diseases associated with problems of ageing
- Search for new lead compounds for use against tropical parasitic diseases
- Investigation of methods for isolation of natural products using preparative chromatographic techniques
- Exploitation of microbial biotransformation for the search of new lead compounds

2021 at a glance

- Publications with impact factor: 23
- Publications without impact factor: 0
- Patent: 0
- Book and chapters: 0
- Congresses / conferences organisation: 1
- Posters presentations: 2
- Oral presentations: 2
- Invited oral presentations: 9

- Number of projects at FNRS and assimilated (Research funds): 3
- Service agreements and related activities: 7
- Ph.D. Theses presented in 2021: 1
- Awards and distinctions: 1
- Public outreach activities: 1

Research funds

FNS
Grant No 31003A-163424/1: Localisation and dynamics of free and bound 12- oxo-phytodienoic acid (OPDA) pools in Arabidopsis
Main applicant within the research unit: Jean-Luc Wolfender
Total funding of the project: CHF 451'030.-
Total duration of the project: 54 months
Allocation 2021: CHF 0.-
Starting date: 01.07.2016

FNS
Grant No 205321_182438: Improving natural products chemical biodiversity for drug discovery by fungal secretome assisted biotransformation
Main applicant within the research unit: Emerson Ferreira Queiroz
Total funding of the project: CHF 319'161.-
Total duration of the project: 48 months
Allocation 2021: CHF 75'149.-
Starting date: 01.04.2019

FNS
Grant No CRSII5-189921/1: An in silico and chemo-biological approach to identify anti-infective and pro-metabolic natural products
Main applicant within the research unit: Jean-Luc Wolfender
Total funding of the project: CHF 3'198'673.-
Total duration of the project: 48 months
Allocation 2021: CHF 784'153.- (pour tout le consortium mais reçu à l'UNIGE)
Starting date: 01.04.2020

Total amount for all research funds for 2021: CHF 859'302.-

Service agreements and related activities

Industry Partner, Lausanne (NIHS)
Total amount for 2021: CHF 0.-

Industry Partner, Geneva (NITM)
Total amount for 2021: CHF 0.-

Industry Partner, Geneva (ALICE)
Total amount for 2021: CHF 40'882.-

Industry Partner, Wenling, China (Bench Fees Hao)
Total amount for 2021: CHF 0.-

Industry Partner, Epalinges (Divers mandats)
Total amount for 2021: CHF 7'154.-

Industry Partner, LVMH, France
Total amount for 2021: CHF 22'198.-

Université de La Réunion, France
Total amount for 2021: CHF 13'094.-

Total amount (for all service agreements and related activities) for 2021: CHF 83'328.-

Scientific publications (with impact factor)

Agbadua, G. O.; Kusz, N.; Huber, R.; Marcourt, L.; Wolfender, J.; Queiroz, F. E.; Hunyadi, A., Insights into biomimetic oxidized resveratrol metabolite mixtures. Planta Medica 2021, 87 (15), 1253-1253. 3.35

Al-Anbaki, M.; Cavin, A. L.; Nogueira, R. C.; Taslimi, J.; Ali, H.; Najem, M.; Mahmood, M. S.; Khaleel, I. A.; Mohammed, A. S.; Hasan, H. R.; Marcourt, L.; Felix, F.; Low-Ders, N. V. T.; Queiroz, E.F.; Wolfender, J.-L.; Watissee, M.; Graz, B.; Hibiscus sabdariffa, a treatment for uncontrolled hypertension. Pilot Comparative Intervention. Plants-Basel, 2021, 10 (5). 3.93

Alfattani, A.; Marcourt, L.; Hofstetter, V.; Queiroz, E.F.; Allard, P.M.; Gindro, K.; Stien, D.; Wolfender, J.-L., Combination of pseudo-LC-NMR and HRMS/MS-based molecular networking for the rapid identification of antimicrobial metabolites from *Fusarium petroliphilum.* Frontiers in molecular biosciences. 2021, 8. 5.24

Brillatz, T.; Jacmin, M.; Queiroz, EF.; Marcourt, L.; Morin, H.; Shahbazi, N.; Boulens, N.; Riva, A.; Crawford, A.D.; Allémann, E.; Wolfender, J.-L., Identification of potential antiseizure agents in *Boswellia sacra* using *in vivo* Zebrafish and mouse epilepsy models. ACS Chemical Neuroscience, 2021, 30;12(10):1791-801. 4.41

Conserva, G. A.; Costa-Silva, T. A.; Quirós-Guerrero, L. M.; Marcourt, L.; Wolfender, J.-L.; Queiroz, E. F.; Tempone, A. G.; & Lago, J. H. G., Kaempferol-3-O-α-(3,4-di-E-p-coumaroyl)-rhamnopyranoside from Nectandra oppositifolia releases Ca2+ from intracellular pools of *Trypanosoma cruzi* affecting the bioenergetics system. Chemico-Biological Interactions, 2021, 349, 109661. 5.19

Conserva, G. A.; Quirós-Guerrero, L. M.; Costa-Silva, T. A.; Marcourt, L.; Pinto, E. G.; Tempone, A. G.; Fernandes, J. P. S.; Wolfender, J.-L.; Queiroz, E. F.; Lago, J. H. G., Metabolite profile of *Nectandra oppositifolia* Nees & Mart. and assessment of antitrypanosomal activity of bioactive compounds through efficiency analyses. PloS One, 2021, 16(2), e0247334. 3.24

Defossez, E.; Pitteloud, C.; Descombes, P.; Glauser, G.; Allard, P.-M.; Walker, T.N.; Wolfender, J.-L.; Rasmann, S., Spatial and evolutionary predictability of phytochemical diversity. Proceedings of the National Academy of Sciences of the United States of America, 2021, 118 (3). 11.20

Gaweł-Bęben, K., Strzępek-Gomółka, M.; Xiao, J.; Marcourt, L.; Wolfender, J.-L.; Skalicka-Woźniak, K., Liquid-liquid chromatography separation of guaiane-type sesquiterpene lactones from *Ferula penninervis* Regel & Schmalh. and evaluation of their *in vitro* cytotoxic and melanin inhibitory potential. International Journal of Molecular Sciences, 2021, 22 (19). 5.92

Gomes, P.; Quirós-Guerrero, L.; Muribeca, A.; Reis, J.; Pamplona, S.; Lima, A. H.; Trindade, M.; Silva, C.; Souza, J. N. S.; Boutin, J.; Wolfender, J.-L.; Silva, M., Constituents of *Chamaecrista diphylla (L.)* greene leaves with potent antioxidant capacity: a feature-based molecular network dereplication approach. Pharmaceutics, 2021, 13(5), 681. 6.32

Gomes, P.; Quirós-Guerrero, L.; Silva, C.; Pamplona, S.; Boutin, J. A.; Eberlin, M.; Wolfender, J.-L.; Silva, M., Feature-based molecular network-guided dereplication of natural bioactive products from leaves of *Stryphnodendron pulcherrimum* (Willd.) Hochr. Metabolites, 2021, 11(5), 281. 4.93

Hammerle, F.; Quirós-Guerrero, L.; Rutz, A.; Wolfender, J.-L.; Schöbel, H.; Peintner, U.; Siewert, B., Feature-based molecular networking - an exciting tool to spot species of the *Genus Cortinarius* with hidden photosensitizers. Metabolites, 2021, 11(11): 791. 4.93

Houriet, J.; Pellissier, L.; Kalia, Y.N.; Wolfender, J.-L., Using Porcine Jejunum *ex vivo* to study absorption and biotransformation of natural products in plant extracts: *Pueraria lobata* as a case study. Metabolites, 2021, 11 (8). 4.93

Klimenko, A.; Huber, R.; Marcourt, L.; Chardonnens, E.; Koval, A.; Khotimchenko, Y.S.; Queiroz, E.F.; Wolfender, J.L.; Katanaev, V.L. A cytotoxic porphyrin from North Pacific brittle star Ophiura sarsii. Marine drugs, 2021, 19 (1), 11. 4.76

Magliocco, G.; Desmeules, J.; Matthey, A.; Quirós-Guerrero, L. M.; Bararpour, N.; Joye, T.; Marcourt, L.; Queiroz, E. F.; Wolfender, J.-L.; Gloor, Y.; Thomas, A.; Daali, Y., Metabolomics reveals biomarkers in human urine and plasma to predict cytochrome P450 2D6 (CYP2D6) activity. British Journal of Pharmacology, 2021, 178 (23), 4708-4725. 4.34

Massana-Codina, J.; Schnee, S.; Wolfender, J.-L.; Gindro, K., Influence of abiotic factors, inoculum source, and cultivar susceptibility on the potato tuber blemish diseases black dot (*Colletotrichum coccodes*) and silver scurf (*Helminthosporium solani*). Plant Pathology, 2021, 70 (4), 885-897. 2.59

Michalet, S.; Allard, P. M.; Commun, C.; Ngoc, V. N.; Nouwade, K.; Gioia, B.; Dijoux-Franca, M. G.; Wolfender, J. L.; Doleans-Jordheim, A., Alkyl-Quinolones derivatives as potential biomarkers for *Pseudomonas aeruginosa* infection chronicity in Cystic fibrosis. Scientific Reports 2021, 11 (1). 4.38

Pellissier, L.; Koval, A.; Marcourt, L.; Ferreira Queiroz, E.; Lecoultre, N.; Leoni, S.; Quiros-Guerrero, L.-M.; Barthélémy, M.; Duivelshof, B. L.; Guillarme, D.; Tardy, S.; Eparvier, V.; Perron, K.; Chave, J.; Stien, D.; Gindro, K.; Katanaev, V.; Wolfender, J.-L., Isolation and identification of isocoumarin derivatives with specific inhibitory activity against Wnt pathway and metabolome characterization of *Lasiodiplodia venezuelensis*. Frontiers in Chemistry, 2021, 9, 584. 5.22

Pellissier, L.; Leoni, S.; Marcourt, L.; Ferreira Queiroz, E.; Lecoultre, N.; Quiros-Guerrero, L. M.; Barthélémy, M.; Eparvier, V.; Chave, J.; Stien, D.; Gindro, K.; Perron, K.; Wolfender, J.-L., Characterization of *Pseudomonas aeruginosa* Quorum Sensing inhibitors from the endophyte *Lasiodiplodia venezuelensis* and evaluation of their antivirulence effects by metabolomics. Microorganisms, 2021; 9(9), 1807. 4.12

Queiroz, E.F., Editorial for the Special Issue on “Brazilian Biodiversity”. Planta Medica, 2021, 87 (01/02), 4-5. 3.35

Rausch, M.; Rutz, A.; Allard, P.-M.; Delucinge-Vivier, C.; Docquier, M.; Dormond, O.; Dyson, P.J.; Wolfender, J.-L.; Nowak-Sliwinska, P., Drug Repurposing to identify a synergistic high-order drug combination to treat sunitinib-resistant renal cell carcinoma. Cancers, 2021, 13(16):3978. 6.63

Rausch, M.; Rutz, A.; Allard, P.-M.; Delucinge-Vivier, C.; Docquier, M.; Dormond, O.; Wolfender, J.-L.; Nowak-Sliwinska, P., Molecular and functional analysis of sunitinib-resistance induction in human renal cell carcinoma cells. Int J Mol Sci., 2021, 22(12):6467. 5.92

Saldanha, L.L; Camaforte, N.A.P.; Vareda, P.M.P.; Marcourt, L.; Ebrahimi, D.M.; Vilegas, W.; Dokkedal, A.L.; Queiroz, E.F.; Wolfender, J.L.; Bosqueiro, J.R. Hypoglycemic active principles from the leaves of *Bauhinia holophylla*: comprehensive phytochemical characterization and in vivo activity profile. PLOS One, 2021, 16 (9). 3.24

Widelski, J.; Luca, S. V.; Skiba, A.; Maciag, M.; Budzynska, B.; Marcourt, L.; Wolfender, J.-L.; Skalicka-Woźniak, K., Coumarins from seseli devenyense Simonk.: isolation by liquid–liquid chromatography and potential anxiolytic activity using an *in vivo* Zebrafish Larvae Model. International Journal of Molecular Sciences, 2021, 22 (4). 5.92

Congresses / conferences and symposia

- Congresses / conferences organisation: 1
- Posters presentations: 2
- Oral presentations: 2
- Invited oral presentations: 9
- Workshops: 2

Ph.D. Theses presented in 2021

Abdulelah Alfattani
"Efficient Strategies for Metabolites Profiling and Isolation of Antimicrobial Secondary Metabolites from the Fungal Endophyte Community of the Seagrass *Posidonia oceanica*"
Director: Prof. Jean-Luc Wolfender

Awards and distinctions

MT180 2021, finale locale : Léonie Pellissier, 2ème prix « Etude compréhensive de champignons endophytes isolés des feuilles d'un palmier de la forêt amazonienne : un modèle pour déchiffrer les interactions plante-microbe et explorer leur diversité chimique et potentiel bio-actif ».

Public outreach activities

Queiroz EF. Participation on the program Fantastico, Rede Globo Brazil. The program was broadcast on the Brazilian open TV 17th of October 2021. The documentary informs about the importance of Brazilian biodiversity as a source of new medicines at the same time that it highlights the pivotal role played by universities in this process. The documentary is available on the follow link:
https://globoplay.globo.com/v/9956824

MEDICATION ADHERENCE AND INTERPROFESSIONALITY

Professor Marie-Paule SCHNEIDER VOIROL

General description of Unit

The adjunct professorship (0.5 FTP) in medication adherence and interprofessionality, and its research and teaching unit was launched in August 2018. Medication adherence is the core research area of the unit. Medication adherence is a key determinant of the ambulatory care system of the 21st century. It is defined as the process by which patients take their medications as prescribed. It is characterized by three components: treatment initiation, implementation and discontinuation (Vrijens et al. 2012). As described by the World Health Organization (WHO) in 2003, around 50% of chronic patients are nonadherent to their treatment worldwide. This creates an endemic, medical and economic threat on the healthcare systems, which needs to be addressed. Research is needed to better document the issue and its contributing factors as well as assess cost-effective, interprofessional adherence-enhancing programs to implement in clinical practice and envision new models of care. Therefore, the research plan of the unit aims at achieving a comprehensive understanding of patient adherence and self-management across several chronic disease models. This research is at the interface between pharmaceutical and medical sciences.

The head of the unit is also the director of pharma24 (0.4 FTE), an outpatient pharmacy located in the Geneva University Hospitals (HUG). The team consists of 13 EFT pharmacists, including two PhDs, and 10 EFT pharmacy technicians. Pharma24 is an academic outpatient pharmacy, where research on medication adherence and interprofessionality has been launched in 2019. Pharma24, as research partner, supports a steady collection of routine-based adherence and patient data. In 2021, pharma24 was responsible for educating all committed community pharmacists and their teams to perform the SAS-CoV-2 rapid testing in the Canton of Geneva, in collaboration with the HUG. Pharma24 also provided a 7-day-a-week screening service for the population. Since the outbreak of SAS-CoV-2, community pharmacists and physicians confirmed that they are instrumental front-line healthcare providers for our society.

In terms of teaching, the unit is in charge of the interprofessional curriculum of the School of Pharmaceutical Sciences since 2019 in close collaboration with the Interprofessional Simulation Center (CIS) of the University of Geneva, especially with Dr Th. Fassier, Faculty of Medicine, head of the center, and P. Picchiottino, University of Applied Sciences Western Switzerland, deputy head. Since September 2018, the medication adherence unit is actively involved in the reform of the teaching curriculum of the school of pharmacy (Bachelor and Master levels), with a focus in harnessing the teaching of communication in health to ensure medication cost-effectiveness, patient security and to decrease the pressure of pharmaceuticals on the environment.

Specific research fields

- To evaluate medication adherence support programs in chronic diseases, such as oral oncology, diabetes and renal failure, or HIV.
- To develop robust medication adherence measurement and data analysis, in particular electronic monitoring in routine care.
- To analyse the epidemiology of contradictory information on prescribed medications as perceived by chronic patients, and its impact on patient medication self-management.
- To investigate how interprofessional collaborations could support a more efficient and secure medication use, especially at the interface between the hospital and the community.

2021 at a glance

- Publications with impact factor: 8
- Publications without impact factor: 0
- Patents: 0
- Book and chapters: 0
- Congresses / conferences organisation: 2
- Posters presentations: 3
- Oral presentations: 6
- Invited oral presentations: 9
- Number of projects at FNRS and assimilated (Research funds): 3
- Service agreements and related activities: 0
- Ph.D. Theses presented in 2021: 0
- Awards and distinctions: 0
- Public outreach activities: 3

Research funds

Swiss Cancer Research Foundation
Category: Institutional
Title of the research project: Optimizing targeted anti-cancer therapies: from better medication adherence to individualized treatments.
Main applicant: Marie Paule Schneider Voirol
Total funding of the project: CHF 248'200.-
Total duration of the project 4 years
Allocation 2021: CHF 0.-
Starting date: 01.10.2018

Qualité et Recherche Santésuisse Curafutura et Pharmasuisse
Category: Institutional
Title of the research project: Medication adherence, diabetes and renal failure
Main applicant: Marie Paule Schneider Voirol
Total funding of the project: CHF 110'000.-
Total duration of the project: 5 years
Allocation 2021: CHF 0.-
Starting date: 01.07.2017

SNF
Category: SNF
Title of the research project: Implementation of a new model of care for supporting adherence in people starting a new medication for a long-term condition (myCare Start project) - An implementation-effectiveness science study
Main applicant : Marie Paule Schneider Voirol
Total funding of the project: CHF 319'683.-
Total duration of the project: 4 years
Allocation 2021: CHF 0.-
Starting date: 01.06.2022

Total amount for all research funds for 2021: CHF 0.-

Scientific publications (with impact factor)

Backes C; Moyano C; Rimaud C ; Bienvenu C; Schneider M.P: *5.09*
Digital Medication Adherence Support: Could Healthcare Providers Recommend Mobile Health
Apps? Frontiers in Medical Technology 2021

https://doi.org/10.3389/fmedt.2020.616242

Bandiera, C.; Dotta-Celio, J.; Locatelli, I.; Nobre, D.; Wuerzner, G.; Pruijm, M.; Lamine, F. ; Burnier, M.; Zanchi, A.; Schneider, M.P. *5.18*
Optimizing Oral Targeted Anticancer Therapies Study for Patients With Solid Cancer: Protocol for a Randomized Controlled Medication Adherence Program Along With Systematic Collection and Modeling of Pharmacokinetic and Pharmacodynamic Data.
JMIR Res Protoc 2021, 10 (6), e30090

Bandiera C; Dotta-Celio J; Locatelli I; Nobre D; Wuerzner G; Pruijm M; Lamine F; Burnier M; Zanchi A; Schneider M.P. *5.18*
Interprofessional Medication Adherence Program for Patients With Diabetic Kidney Disease: Protocol for a Randomized Controlled and Qualitative Study (PANDIA-IRIS)
JMIR Res Protoc 2021, 10 (3), e25966

Bourdin, A., Schneider M.P., Locatelli I.; Schluep, M.; Bugnon O.; Berger, J. *4.38*
Longitudinal analysis of safety and medication adherence of patients in the Fingolimod patient support program: a real-world observational study.
Scientific Reports 2021, 11 (1), 4107

Castillo-Mancilla J.R.; Cavassini M.; Schneider M.P.; Furrer H.; Calmy A.; Battegay M.; Scanferla G. *3.85*
Association of Incomplete Adherence to Antiretroviral Therapy With Cardiovascular Events and Mortality in Virologically Suppressed Persons With HIV: The Swiss HIV Cohort Study.
Open Forum Infect Diseases Oxford Academic 2021, 8 (2) ofab032

Parienti, J-J.; Fournier, A.L.; Cotte, L.; Schneider, M.P.; Etienne, M.; Unal, G.; Perré, P.; Dutheil, J-J.; Morilland-Lecoq, E.; Chaillot, F.; Bangsberg, D.R.; Gagneux-Brunon, A.; Prazuck, T.; Cavassini, M.; Verdon, R.; Hocqueloux, L. *3.85*
Forgiveness of Dolutegravir-Based Triple Therapy Compared With Older Antiretroviral Regimens: A Prospective Multicenter Cohort of Adherence Patterns and HIV-RNA Replication.
Open Forum Infect Diseases Oxford Academic 2021, 8 (7) ofab316

Dotta-Celio, J.; Alatri, A.; Salvi, M.; Mazzolai, L.; Schneider, M.P. *1.36*
Rivaroxaban and medication adherence – A cohort study (RIVA): Qualitative results.
Thrombosis Update 2021 (4) 100057
https://doi.org/10.1016/j.tru.2021.100057

Boden, L.; Castellsague, M. Perrnoud, L.; Cimarelli, G.; Schneider, M.P. *0.13*
Hospital to home transition of care: challenges for patients with type 2 diabetes.
Revue Médicale Suisse 2021, 17 (741), 1087-1090

Congresses / conferences and Symposia

- Congresses / conferences organisation: 2
- Posters presentations: 3
- Oral presentations: 6
- Invited oral presentations: 9

Public outreach activities (radio, television and other media, community service)

M.P. Schneider and P. Bonnabry. Je trie et ramène mes médicaments. Bon à Savoir, no2, Mars/Avril 2021

M.P. Schneider. Tests rapides gratuits
https://www.rts.ch/play/tv/19h30/video/19h30?urn=urn:rts:video:12063264 21.03.2021

HUG@home, au-delà de l'écran
https://www.hug.ch/video/hughome-au-dela-lecran ou
https://www.youtube.com/watch?v=EOvCz_Jepvo

DATA ANALYTICS LAB

Professor Stéphane GUERRIER

General description

The Data Analytics Lab aims at contributing to the development of new methodologies for data analysis and decision-making that allow to respond to the ever-increasing data size and model complexity while achieving desirable statistical properties and performance. These fundamental developments make use of the latest advances in (applied) computer sciences, in particular machine learning. We also aim at making these developments broadly available through open-source statistical packages (e.g. the R platform) and scientific publications and/or reports in applied statistics. To ensure added-value and tangible impact of our work, we aim at confirming and expanding our interdisciplinary approach to research. Therefore, our work includes not only collaborations with established researchers in computer and mathematical sciences but also in areas such as experimental and behavioural sciences for whom data analysis has become an important and very demanding challenge, as is also the case for disciplines such as life sciences (medical and pharmaceutical), population health, engineering (signal processing, navigation), economics, management and others. We also aim at collaborating with (semi-)private institutions that face the challenges of analysing the data they collect in order to improve their products and/or services as well as their strategic decision-making.

Specific research fields

- Computational statistics and simulation methods
- Life sciences analytics
- Signal processing and time series analysis
- Machine learning
- Data analytics in engineering
- Applied statistics

2021 at a glance

- Publications with impact factor: 5
- Publications without impact factor: 1
- Patents: 0
- Book and chapters: 0
- Congresses / conferences organisation: 0
- Posters presentations: 0
- Oral presentations: 3
- Invited oral presentations: 2
- Number of projects at FNRS and assimilated (Research funds): 3
- Service agreements and related activities: 0
- Ph.D. Theses presented in 2021: 2
- Awards and distinctions: 1
- Public outreach activities: 2

Research funds

SNSF Professorships
New Challenges for Statistical Methods in Large and Complex Data Settings: Analysis of Dependent Data and Model Selection
Main applicant: Stéphane Guerrier
Main discipline: Mathematics
Total funding of the project: CHF 1'649'910.-
Total duration of the project: 4 years
Allocation 2021: CHF 385'131.75
Starting date: 01.01.2019
Link: http://p3.snf.ch/project-176843#

InnoSuisse
Title: Stochastic Modelling of Inertial Sensors for Precise GNSS-based Positioning
Main applicants: Stéphane Guerrier, Jan Skaloud (EPFL) and Markus Wenk (Hexagon)
Main discipline: Engineering
Total funding of the project: CHF 917'280.- (CHF 246'355 allocated to the University of Geneva)
Total duration of the project: 2 years
Allocation 2021: CHF 111'695.80
Starting date: 01.01.2020

InnoSuisse (obtained in 2021, starting in 2022)
Title: Multi-Sensor Adjustment of Raw LiDAR, Visual and Inertial Measurements in Kinematic Laser Scanning Devices
Main applicants: Stéphane Guerrier, Jan Skaloud (EPFL) and Elmar van der Zwan (Hexagon)
Main discipline: Engineering
Total funding of the project: CHF 815'265.40 (CHF 257'690.20 allocated to the University of Geneva)
Total duration of the project: 2 years
Allocation 2021: CHF 0.-
Starting date: 01.01.2022

Total amount for all research funds for 2021: CHF 496'827.55

Scientific publications (with impact factor)

Heerah, S.; Molinari, R.; Guerrier, S.; Marshall-Colon, A., Granger-Causal Testing for Irregularly Sampled Time Series with Application to Nitrogen Signaling in Arabidopsis, Bioinformatics, 2021, 7 (16), 2450-2460.	*6.937*
Quartier, J.; Lapteva, M.; Boulaguiem, Y.; Guerrier, S.; Kalia, Y., Polymeric Micelle Formulations for the Cutaneous Delivery of Sirolimus: A New Approach for the Treatment of Facial Angiofibromas in Tuberous Sclerosis Complex, International Journal of Pharmaceutics, 2021, 604.	5.875
Guerrier, S.; Molinari, R.; Victoria-Feser, M.-P; Xu, H., Robust Two-Step Wavelet-Based Inference for Time Series Models, Journal of the American Statistical Association (Theory & Methods), 2021, in press.	5.033
Wang, Y.; Gardoni, P.; Murphy, C.; Guerrier, S., Empirical Predictive Modeling Approach to Quantifying Social Vulnerability to Natural Hazards, Annals of the American Association of Geographers, 2021, 111 (5), 1559-1583.	4.683
Jammalamadaka, S. R.; Guerrier, S.; Mangalam, V., Exact Distributions and Performance of some Two-sample Nonparametric Tests for Circular Data, Sankhya B, 2021, 83, 140-166.	0.569

Scientific publications (without impact factor)

Parisi, N.; Janier-Dubry, A.; Ponzetto, E.; Pavlopoulos, C.; Bakalli, G.; Molinari, R.; Guerrier, S.; Mili, N., Non Applicability of Validated Predictive Models for Intensive Care Admission and Death of COVID-19 Patients in a Secondary Care Hospital in Belgium, Journal of Emergency and Critical Care Medicine, 2021, 5 (22).

Selected statistical software (R packages):

Maintainer and author for the R package "simts", which provides easy-to-use tools for time series analysis. Source code: https://github.com/SMAC-Group/simts
Website: https://smac-group.github.io/simts/index.html. Downloads: 8'000 per year.

Maintainer and author for the R package "wv", which provides various tools to perform standard and robust wavelet variance analysis for time series.
Source code: https://github.com/SMAC-Group/wv
Website: https://smac-group.github.io/wv/. Downloads: 6'000 per year.

Maintainer and author for the R package "avar", which provides a computationally efficient implementation of the Allan variance and of other related quantities.
Source code: https://github.com/SMAC-Group/avar
Website: https://smac-group.github.io/avar/. Downloads: 6'000 per year.

Congresses / conferences and symposia:

- Congresses / conferences organisation: 0
- Posters presentations: 0
- Oral presentations: 3
- Invited oral presentations: 2

Ph.D. Theses presented in 2021:

Haotian Xu, Ph.D. in Statistics, University of Geneva, 2021
Title: Contributions to Time Series Analysis
Advisors: Prof. Maria-Pia Victoria-Feser and Prof. Stéphane Guerrier

Gaetan Bakalli, Ph.D. in Statistics, University of Geneva, 2021
Title: Domain-Tailored Approaches to Statistical Learning
Advisors: Prof. Olivier Scaillet and Prof. Stéphane Guerrier

Awards and distinction:

Yuming Zhang (PhD student in Statistics) received the Subside Tremplin award in 2021, which supports female researchers in pursing an academic career. This award frees up the time of the laureates in order to enrich their research portfolio, write articles, finalize or publish their thesis, or go abroad. Thanks to the Subside Tremplin award, Ms. Zhang was able to spend one semester abroad visiting the Department of Statistics of Penn State University in Spring 2022. Awarded amount: CHF 31'349.50.

Public outreach activities:

Participation to "*Comprendre le Numérique*", Fall 2021, Bachelor level course (open to all bachelors students of the University of Geneva, cours transversal), responsible for the module on statistical literacy.

Advisor for MindEarth, a Swiss non-profit start-up that combines Earth Observation, Complex Networks and Artificial Intelligence to solve complex spatial problems related to urbanization, human mobility and socio-economic challenges. More information: https://www.mindearth.org.

Center for Research and Innovation in clinical pharmaceutical sciences (CRISP)

General Description

The Center for Research and Innovation in Clinical Pharmaceutical Sciences (CRISP) is the Lausanne entity of the Institute of Pharmaceutical Sciences of Western Switzerland. It is the result of a collaboration agreement between the University of Geneva and the University of Lausanne for Pharmacy.

CRISP networks academic groups from the CHUV, Unisanté and the School of Pharmaceutical Sciences of the University of Geneva around three areas of expertise: "Real-Life Medicines" that focus on the optimization of therapies under real-life conditions in target populations, "Innovative Biological and Cellular Therapies" that focus on translational research of new types of cellular or biological drugs and "Digital Pharmacy" that aims at developing research and education at the interface of pharmacy and technologies. The three poles of competence work in synergy to improve the coherence and efficiency of research and the translation of results into care, and to perpetuate and reinforce the teaching of clinical pharmaceutical sciences related to usual therapies or those from the biological and cellular world.

The vision of the CRISP is to promote training, clinical research and care related to drugs of chemical, cellular or biological origin. The missions of the 3 poles of expertise are :

- To work to support the implementation of innovative therapeutic strategies and care delivery in the clinic.
- To develop coordinated research to address public health challenges related to the safety, efficacy, efficiency and cost effectiveness of conventional and innovative medicines.
- To consolidate the training of students, health professionals and scientists in the field of clinical pharmaceutical sciences, opening it to cellular and biological therapies.

2021 Highlights

The CRISP deployed during 2021 its two clusters of expertise, " Innovative Biological and Cellular Therapies " and "Real-Life Drugs," with the following highlights:

Innovative Biological and Cellular Therapies

The goal for 2021 of the pole of expertise was to elaborate a structured institutional program at the University Hospital of Lausanne (CHUV) to promotes the development of new cellular and biological therapies, improved research collaboration and pre- and post-graduate training for these new types of drugs. Two steps have been defined to fulfil this mission. The first step consists in establishing an inventory of the structures, projects, mechanisms and transversal competences available at the CHUV with a vision of future needs. The results of the working groups (production, regulations and certifications, patients/clinics, pricing, pharmacovigilance, training and organization) will be presented during 2022. The second and following step will be to define the development strategy for these new types of medicines and the means and resources required to achieve the implementation of such therapeutic strategies at the CHUV.

Optional courses in the field of phagotherapy, transfusion medicine and cellular therapies as well as Master theses in these areas are now active in the program of the Master in Pharmacy. A CAS in 'Biological and advanced therapies : product manufacturing and clinical use' will open current 2023 within the framework of the UNIL/EPFL and UNIGE post-graduate program. In addition, the phage therapy laboratory has been implemented at the CRISP and is developing the production of bacteriophages in good manufacturing practices in close collaboration with the cell production center of the pharmacy of the CHUV; the accreditation by Swissmedic is in process.

Research projects within the framework of the NCRR Microbiome of the UNILhttps://nccr-microbiomes.ch) have also been initiated. It should be noted that this approach is interdisciplinary and includes collaborators from different departments of the CHUV and the UNIGE.

Real-Life Medicines

The objective of this pole is to promote exchanges between the research groups affiliated with CRISP for the sharing of expertise for clinical research and the training of master and doctoral students in particular. Regular shared group meeting between the different academic group for doctoral students and Master students have been initiated, which allows gain of expertise for the students and identification of expertise among the senior scientists.

To broaden the collaboration in the field of clinical pharmaceutical sciences between the different partners in Western Switzerland, the “Réseau universitaire romand de pharmacie pratique » (R2P2) has been created in 2021. It brings together pharmacists from the CHUV, the HUG, Unisanté, Pharma24, the Valais Hospitals and the Riviera Chablais Hospitals to promote scientific exchanges. Within this framework, structured scientific seminars presented by each group have been organised and a first scientific 1 day conference is being prepared for 2022 at the CHUV.

PhD PROGRAM

Professor Yogeshvar KALIA, Director
Doctor Béatrice KAUFMANN, Coordinator
Ms Florence VON OW, Secretary

Introduction – general description

The PhD Program in Pharmaceutical Sciences promotes a solid theoretical and practical training in all aspects of the Pharmaceutical Sciences, fosters interdisciplinary research and provides opportunities for scientific exchange via lectures, symposia and networking activities. The PhD Program also aims to increase awareness of career opportunities outside academia for graduates from the School of Pharmaceutical Sciences.

Our doctoral programme continues to consolidate its integration into the new inter-faculty Doctoral School in Life Sciences created by the Faculty of Science and the Faculty of Medicine in June 2018 (PSLS), of which the Section of Pharmaceutical Sciences is a founding member. An administrative management platform has been set up, which allows doctoral students to manage their administrative files, and also to validate the various key stages of their thesis, such as the TAC or obtaining credits.

This doctoral school has 302 doctoral students (figures as from 21.12.2021), 164 of whom are from the Faculty of Science. The 79 doctoral students in pharmaceutical sciences who are enrolled in this school therefore represent 26% of the PSLS doctoral students (and 48% of the PSLS doctoral students from the Faculty of Science). There are still a few doctoral students who complete their thesis under the "old regime" of the Doctoral School in Pharmaceutical Sciences, but it is planned in the near future to have only one thesis stream, the one linked to the PSLS.

This doctoral program, a pioneer since 2004, is in fact a special case. Indeed, there is only one pharmaceutical sciences program in French-speaking Switzerland. These are generally done in Geneva or Lausanne, with a few exceptions for extramural theses. For any doctoral student doing a thesis with a specialization in "pharmaceutical sciences", registration and participation in the doctoral program is mandatory in order to be able to defend the thesis and a minimum number of ECTS credits is required. These measures are clearly detailed in the regulations for the doctoral program in pharmaceutical sciences.

The program covers all aspects of pharmaceutical sciences, from basic research at the molecular level through to clinical pharmaceutical sciences and the patient. Five types of activities make up the program: courses, specialized conferences, symposia, networking activities and extramural seminars.

The activities of our doctoral programme are primarily organised for doctoral students enrolled in the Pharmaceutical Sciences doctoral programme, but we accept enrolments from other doctoral programs from the Life Sciences doctoral school, or from other CUSO doctoral programs, as long as there is space available.

Registration to our program is mandatory for PhD Students in pharmaceutical sciences, and all of the doctoral students enrolled in the PhD program of the School of Pharmaceutical Sciences are subject to the regulation that stipulates the acquisition of at least 30 credits before the thesis defense can take place. The Program's Direction tries to promote participation of PhD Students in the activities proposed either by the program or by the CUSO, but also recognizes some external activities, which are also granted credits. This is especially useful for "extramural" PhD students who are sometimes far from Geneva and cannot participate in the "local" courses and events.

The credits granted vary but as a general rule 1 credit is awarded for 6 hours of activity (internal activities) or 1 credit for 10 hours of participation (external activities). It should be noted that most of the PhD students acquire more than the minimum 30 credits indicating their active participation in the PhD program. Despite the fact the Unige does not allow the award of credits twice for different formations, completion of a CAS or MAS is recognized with the award of 3 credits (in the "course" part of the credits table). The minimum number of credits to be obtained by attending courses is now 20 (previously 18), in order to align with the other PSLS programs.

The introduction of the TAC, which takes place 12-15 months after the start of the doctorate, by the PhD Program commission, enables an evaluation of the progress of the PhD thesis. This is organized with the objective of harmonizing levels of excellence of the PhD candidates from the different component disciplines in the School of Pharmaceutical Sciences and indeed the Doctoral School in Life Sciences . This is done with respect to: (i) efficient time-planning and organization of the thesis project, (ii) enthusiasm and ability to perform interesting projects and (iii) optimization of thesis project progression. The TAC system is valid for all PhD candidates beginning their thesis as of 15 September 2015.

Courses and symposia

One of the main objectives of this year was to maintain a varied and dynamic offer of activities, despite the sanitary situation requiring most courses to be held at a distance. The fact that the CILS did not take place in 2021 also forced us to make choices in terms of which activities to prioritise, as the budget granted by the Faculty of Science for these joint activities was reduced to zero, and the CUSO envelope was not sufficient to pay for all the external speakers.

The form of the activities was adapted during the year according to the public health guidance at the time and the instructions issued by the Rectorat (face-to-face, distance learning, etc.). From the initially scheduled 49 activities, we were able to maintain 27 of them, either as face-to-face meetings (when possible), or in a remote form. All our teachers were very reactive, and a majority of the planned activities took place. This was made possible by the great responsiveness, availability and dynamism of our external teachers, whom we cannot thank enough. However, some courses had to be postponed, especially those that involved a lot of interactivity.

A total of 444 hours could however be maintained within the 2021 PhD program (including all activities; see Tables 1-3 below for detailed information).

Extra-muros seminar

Our usual extramural seminar had to be postponed from 2020 (see annual report 2020), and there was a great deal of uncertainty as to whether it would continue. However, the health situation in the summer of 2021 allowed us to keep it in Leysin at the Alpine Classic Hotel. This change of location brought a new dynamic to the organisation of the seminar and a renewal. Various appropriate measures were applied by the selected hotel in terms of adapting the accommodation conditions, and some speakers gave their talks remotely.

The objectives of this 34th seminar in pharmaceutical sciences were to present a program centred on natural products with the aim to cover various aspects of drug discovery, to give participants the opportunity to network with guest speakers coming from academia and the industry, and to help them improve their communication skills.

The scientific sessions organized included presentations on the use of natural products as well as phytopreparations for therapy, on various *in silico*, *in vitro* and *in vivo models* for the identification of active compounds, and on drug delivery models. In addition, a Maverick presentation was given by Prof. K. Altwegg on the Rosetta mission to open the participants' minds to other aspects of high-level scientific research in Switzerland.

The PhD students were also required to present their own project in the format of 'My Thesis in 180 seconds' during three late afternoon sessions; all sessions were chaired by a PhD student. For this, two coaches, Mrs A. Perrin (La Voix de la Détente) and Mr S. Lagier (Sam Speaks Science) were invited to prepare the

PhD students for their presentation through stress management exercises and to give them specific feedback after each session.

Finally, there was a round table including people from medium sized and start-up companies. Since most speakers were present for at least two days at the congress venue, this gave rise to networking opportunities to participants alongside the official program. The relaxed ambiance due to the warm atmosphere of the place favoured many exchanges between the participants.

The evaluation from the participants noted the excellence of the speakers and the networking opportunities. The possibility to present the PhD project in the form of 'My Thesis in 180 seconds' was generally appreciated, but some students would have preferred to use another format. Some lectures lasted 45 minutes and this could be shortened to 30 minutes; however, it was noted that it is important to keep sufficient time for discussion after the lectures. Overall, the seminar was very successful and welcome after the lack of face-to-face meetings due to the pandemic.

The PhD day had again to be postponed to 2022, but the PSLS annual symposium could take place in June, with an active participation of two of our PhD students, who gave talks, as did one ISPSO PO and one PD.

A new way of participating financially in the organisation of hospital and community pharmacy courses (MAS seminars) was negotiated, so that the organisers could benefit from an amount to cover the costs related to the participation of PhD students. This made it possible to include another MAS seminar on management topics.

All our doctoral students (as well as all doctoral students affiliated to the PSLS) must follow and validate an awareness-raising module on ethics in scientific research, which is a prerequisite for the validation of their thesis credits. The module chosen is the "Research Integrity Training (EPIGEUM)", but equivalences are accepted for other courses, in particular our "Ethics in research" module, including the e-learning modules TRREE (TRAINING AND RESOURCES IN RESEARCH ETHICS EVALUATION).

The rule of a minimum of 6 doctoral students enrolled for a CUSO-funded course to take place (valid as from 01.01.2020) was communicated to all our external speakers, and all of them were willing to postpone their course if necessary in order to reach this quota.

The PhD students also attended the specialized seminars ("conférences spécialisées") proposed within the PhD program; 3 seminars were given remotely by international researchers from academia and industry, for a total of 6 teaching hours. A total of 29 participants attended these lectures including 12 PhD students.

The Doctoral Program Commission held a meeting on December 21st 2021.

Table 1
List of courses organized within the PhD Program in Pharmaceutical Sciences 2021 and number of participants

Name of course 2021	Course No.	Course Organizer	Total no. of hours	Credits	No. of PhD students (total no. of attendees)
Pharmacie hospitalière et communautaire 1	19H003	P. Bonnabry	18	3	5(43)
Pharmacie hospitalière et communautaire 2	19H012	F. Sadeghipour	18	3	0
Pharmacie hospitalière et communautaire 4		R. Pichon, F. Sadeghipour	18	3	10 (41)
Design drugs with a computer	19H053	A. Daina, V. Zoete	16	2	16
Introduction to pharmaceutical industry: History, structures and Challenges	19H017	B. Baumeister	30	5	POSTPONED TO 2022
Formulation of protein biopharmaceuticals and drug delivery	19H013	T. Arvinte	20	5	2
Drug discovery: an industrial perspective	19H063	M. Prunotto	18	3	8
Biostatistics in drug development and clinical trials design	19H055	D. Warne, F. Curtin	24	4	CANCELLED
Use of fluorescence spectroscopy in the study of drugs, protein and membrane	19H032	T. Arvinte	16	3	4 (35)
Therapeutic Drug Monitoring and its Application in Diagnostics and Clinical Research	19H045	L. Decosterd	6	1	CANCELLED
Initiation aux méthodes d'analyse multivariées en sciences pharmaceutiques	19H046	S. Rudaz, J. Boccard	12	3	CANCELLED
Techniques de chromatographie préparative : isolement de produits naturels et de composés synthétiques	19H037	E. Ferreira-Queiroz	20	3	CANCELLED

Caractérisation structurale de produits naturels	19H006	J.-L. Wolfender	12	2	CANCELLED
Microscopy and imaging course	14B063 P	C. Bauer	32	3	3
Library PhD Camp: from Research to Publication	19H064	A.Bellier, V. Huber	8	1	0
Drug development: regulatory aspects and clinical trials	19H009	S. Latour, A. Mc Allister, A. Naik	24	4	8
Ethics in research	19H092	D. Sprumont	24	2.5	CANCELLED
Biotechnology development	19H070	Various speakers from NovImmune	20	3	CANCELLED
Personal genomics & predictive genetics	19H069	D. Kraus, G. Tanackovic; T. Abbas-Terki	10	1.5	4
Aperçu de la pharmacovigilance pré et post-marketing	19H068	V. Rollason	16	1.5	CANCELLED
Suivi thérapeutique des médicaments en pratique clinique	19H059	N. Widmer	8	1.5	CANCELLED
Les agents anticancéreux : manipulation et aspects analytiques	19H061	S. Fleury-Souverain, D. Guillarme	10	1.5	CANCELLED
Pharmaceutical regulatory affairs : an introduction	19H088	G. Sbihi-Bouvier, P. Humbert-Droz	20	3	12
Spectrométrie de masse + exercices	1506BCR + 1506BEX	G. Hopfgartner	20	4	0
Electrophorèse capillaire	19H016	S. Rudaz	12	2	CANCELLED
Biobusiness	19H085	P. Nowak-Sliwinska	12	2	CANCELLED
Hot topics in immunology and immunopharmacology	19H077	C. Bourquin, O. Hartley	28	1.5 credit for 5 conf. followed	9
Immunology from A to Z Part 1: basic immunology	19H083	C. Bourquin, V. Puddinu	26	4	13 (16 total)
Immunology from A to Z Part 2: advanced immunology	19H084	C. Bourquin, V. Puddinu	18	3	POSTPONED to 2022, due to sanitary situation

Combination therapies for cancer and personalized medicine	19H080	P. Nowak-Sliwinska	6	1	11 (12 total)
Theory into practice: creating a successful business in Life Sciences	19H072	J. Camblong	10	1.5	POSTPONED TO 2022, due to sanitary situation
Quality in pharmaceuticals	19H065	F.-X. Abellan, J. Boccadoro, A. Stroemberg	20	3	16
Pharmaceutical project and portfolio management	19H075	A. Poulet	6	1	11
Patenting procedures in life sciences and intellectual property	19H018	K. Houchangpour, D. Kraus, L. Miéville, P. Weibel	24	4	CANCELLED
Challenges in clinical oncology	19H094	C. Bourquin, P. Nowak-Sliwinska, I. Labidi-Galy	12	2	15
Validation de méthodes analytiques	19H034	S. Rudaz, J. Boccard, J.-M. Roussel	28	4	13
Métabolisme des médicaments et interactions médicamenteuses : extrapolation in vitro-in vivo	19H060	Y. Daali	12	1.5	CANCELLED
Drug Discovery: DNA Encoded Libraries and Their Role	19H095	A. Satz	6	1	7
Protein Biochemistry: Data Analysis and Associated Literature Research	19H096	O. Vadas	14	2	5
Production stérile: méthodes et environnement	19H044	F. Sadeghipour	9	1.5	CANCELLED
TOTAL	40		681		172 PhD 74 others

Table 2
List of symposia organized within the PhD Program in Pharmaceutical Sciences 2021 and number of participants.

Name of course 2021	# Course no.	Course organizer	Total no. of hours	Credits	# No. of participants
PhD Day	19H020	Y. Kalia	8	1 or 2	Postponed to 2022, due to sanitary situation
Conférences sur sujets spécialisés		Y. Kalia	3 days (6 hrs)	1,5 for 5 conf.	12 PhD students (29 total)
34th « extra-muros » meeting, ("New paradigms in natural product drug discovery: Bedside to bench to bedside") – report from 2020	19H025	M. Cuendet, J.-L. Wolfender, E. Ferreira-Queiroz, P. Christen	4 days (24 hrs)	1 or 2	33 (45 total)
7e Symposium annuel de recherche d'Unisanté: Chercheuses et chercheurs dans un monde en transition: en quête de performance et de sens		Unisanté, Lausanne	4	0.5	25

Table 3
List of networking activities organized within the PhD Program in Pharmaceutical Sciences 2021 and number of participants.

Name of course 2021	Course no.	Course organizer	Total no. of hours	Credits	No. of PhD students
Boost your career! How to network at a scientific meeting	19H078	C. Bourquin	4	0.5	CANCELLED
Votre programme doctoral se présente : general information session on the PhD in pharmaceutical sciences	19H093	Y. Kalia, B. Kaufmann, F. von Ow, D. Billotte, C. Neyen	2	N/A	POSTPONED TO 2022
3rd Forum of the PhD School of Life Sciences		PSLS	8		For ISPSO: 6 PhD students (+ 3 prof./others)
L'industrie pharmaceutique se présente	19H050	Y. Kalia	6	1	CANCELLED
Career day *	19H007	Y. Kalia	7	1	Postponed to 2022, due to sanitary situation

*the career day of the Faculté des Sciences was proposed to the PhD students, but the University of Geneva cancelled it, due to sanitary situation.

Public research funds (CUSO)

Conférence Universitaire de Suisse Occidentale (CUSO)

The CUSO announced a 2021 budget similar to the 2020 budget, but without the “frais généraux” position (i.e. the budget for coordination salary). The program and the budget for 2021 were submitted to the CUSO in Sep 2020 and they were duly accepted. The total budget in 2021 for the five activities (Seminar Extra-Muros, Conférences spécialisées, Cours, Symposia as well as Networking activities) was 37’155.- CHF. Some activities were rescheduled in 2021, including the extramural seminar. Therefore, the total amount of money virtually offered by the CUSO was 53’510.-b CHF.

The CILS did not take place in 2021, which reduced the budget accordingly, and choices had to be made in terms of selecting expensive activities to offer our PhD students.

The COVID-19 sanitary situation did not allow us to hold all scheduled activities, and some of them, involving networking interactions had to be postponed to 2022.

At the end, the effective costs for 2021 for all the activities were 28’791.95.- CHF.

We would like to thank all our external lecturers for their flexibility and their willingness to find solutions to keep almost all the essential courses given remotely, and hope that this sanitary emergency will give place to more normal days.

We also take the opportunity in this report to thank the CUSO for the past and future financial support allowing us to offer an outstanding program to the PhD students in Pharmaceutical Sciences.