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Decreto Rettore Università di Roma "La Sapienza" n. 142/2018 del 17/01/2018

LUISA MANNINA
Curriculum Vitae

Place Rome
Date 15-02-2018

Part I – General Information

Full Name	Luisa Mannina
Spoken Languages	Italian, English

Part II – Education

Type	**Year**	**Institution**	**Notes (Degree, Experience,…)**
University graduation	1992	University of Rome "La Sapienza"	Degree in Chemistry, 110/110
Fellowship	1993/1994	CNR, Area della Ricerca di Roma	Mediolanum farmaceutici S.p.A. fellowship: "Studi strutturali in soluzione via NMR di derivati inositolici"
Fellowship	1994/1995	CNR, Area della Ricerca di Roma	Biomedica Foscama S.p.A. fellowship: "Studi strutturali in soluzione via NMR di derivati fosforilati del fruttosio"
Fellowship	1995/1996	CNR, Area della Ricerca di Roma	CNR fellowship: "Caratterizzazione di materiale cartaceo mediante Risonanze Magnetiche"
Research activity	16-09-1998/ /15-11-1998	Laboratory of Biophysical Chemistry, National Institutes of Health (NIH), Bethesda (USA)	Short term mobility programs (CNR): "Nuove metodologie per l'indagine della struttura di feromoni di insetti, di insetticidi, di fungicidi ed antibiotici naturali o di sintesi, da utilizzare per la prevenzione del degrado biologico della carta"
Research activity	6-10-1995 /19-10-1995	NMR laboratory, Academy of Sciences, Prague	Short term mobility programs (CNR): "NMR delle sostanze naturali"

Part III – Appointments

IIIA – Academic Appointments

Start	End	Institution	Position
2009	present	Sapienza University of Rome, Department of Drug Chemistry and Technologies	Associate Professor SSD CHIM/10 (Professore II Fascia, SSD CHIM/10 Chimica degli Alimenti)
2014	2020	Ministero dell'Istruzione dell'Università e della Ricerca (MIUR)	National Scientific Qualification (ASN) as full professor, SC 03/D1, SSD CHIM/10) (Abilitazione Scientifica Nazionale Professore di I fascia, Settore Concorsuale 03/D1 Chimica e Tecnologie farmaceutiche, tossicologiche e nutraceutiche-alimentari, SSD CHIM/10 Chimica degli Alimenti)
2005	2009	University of Molise	Associate Professor SSD CHIM/03 (Professore di II Fascia, SSD CHIM/03 Chimica Generale e Inorganica)
1996	2005	University of Molise	Assistant professor (Ricercatore) SSD CHIM/03 Chimica Generale e Inorganica

IIIB – Other Academic Appointments

Start	End	Institution	Position
2017	present	Sapienza University of Rome	Member of University Committee for the recognition of 24 CFU (access to high schools)
2017	present	Sapienza University of Rome	Evaluator for the AVA system in Sapienza (Valutatori Disciplinari nell'ambito dell'attuazione del Sistema AVA in Ateneo)
2017	present	Sapienza University of Rome	Tutor of "Alternanza Scuola-Lavoro" activities.
2015	2016	Sapienza University of Rome Faculty of Pharmacy and Medicine	Director of II level Master in "Nutraceutica e Cosmeceutica di Prodotti di Origine Vegetale"
2013	present	Sapienza University of Rome Faculty of Pharmacy and Medicine	Responsible for the Metabolomics Unit: Foods, Nutraceuticals and Biological Fluids Research
2012	present	Sapienza University of Rome Faculty of Pharmacy and Medicine	President of Degree Course in Applied Pharmaceutical Sciences (Scienze Farmaceutiche Applicate)
2010	2014	University of Messina	Member of the Committee for PhD program in "Scienze Enogastronomiche"
2005	2010	University of Molise	Member of the Committee for PhD program in "Biotecnologie degli Alimenti"
1999	2005	University of Molise	Member of the Committee for PhD program in "Ambiente e Territorio"

IIIC – Other Appointments

Start	End	Institution	Position
2015	2016	ANVUR	Member of the Evaluation Expert Group (GEV), VQR 2011-2014
2015	present	Italian NMR Discussion Group (GIDRM)	Responsible for the Italian Group of Magnetic Resonance in Food Science within the Italian NMR Discussion Group (GIDRM).
2011	present	Istituto di Metodologie Chimiche, CNR of Rome	Professor associated at "Istituto di Metodologie Chimiche" with commission of research (associazione al CNR)
2003	2008	Istituto di Metodologie Chimiche, CNR of Rome	Appointment for a free of charge Research at Istituto di Metodologie Chimiche (Incarico di ricerca a titolo gratuito)
2001	2002	Istituto di Chimica Nucleare, CNR of Rome	Appointment for free of charge Research at Istituto di Chimica Nucleare (Incarico di ricerca a titolo gratuito)
1999	2000	Istituto di Strutturistica Chimica, CNR of Rome	Appointment for a free of charge Research at Istituto di Strutturistica Chimica (Incarico di ricerca a titolo gratuito)
7/11/ 2016		Sapienza University of Rome, Department of Drug Chemistry and Tecnologies	Member of the Committee for the assignment of research grants (assegni di ricerca di categoria B," bandi 18 ottobre 2016). Project: *e*-ALIERB)
2014		CNR of Rome	Member of the Committee for the selection of "Primo tecnologo II Livello" (Bando n. 364.146)
2015		Sapienza University of Rome, Department of Drug Chemistry and Tecnologies	Member of the Committee for the assignment of research grants (assegni di ricerca di categoria B, BANDI 4 novembre 2015). Project: e-ALIERB)
2012		Istituto di Metodologie Chimiche, CNR of Rome	Member of the Committee for the selection of Researchers of III level (Ricercatore di III livello, bando IMC n.4/. IMC n.0000301, 18-07-2012)
2008		Istituto di Metodologie Chimiche, CNR of Rome	Member of the Committee for the selection of Researchers of III level (Ricercatore di III livello, bando IMC/02/2008, Prot. IMC-CNR n. 0000342, 27-11-2008).
2007		Istituto di Metodologie Chimiche, CNR of Rome	Member of the Committee for the selection of collaborative grants and research activities (Assegni di collaborazione ed attività di Ricerca, bando n.61)

2006		Istituto di Metodologie Chimiche, CNR of Rome	Member of the Committee for the selection of research grants (Assegni di Ricerca, bando n. 54)
2006		Dipartimento STAAM, University of Molise	President of the Commitee for external collaboration appointments conferred by COVADIRAM
2005		Istituto di Metodologie Chimiche, CNR of Rome	Member of the Committee for the selection of a research grant (Assegno di Ricerca, bando n.49)
2001		Istituto di Metodologie Chimiche, CNR of Rome	Member of the Committee for the selection of a technical assistant. (Collaboratore tecnico a tempo indeterminato n. 310.2.95, Codice settore RM 131/1)
2000		Istituto di Metodologie Chimiche, CNR of Rome	Member of the Committee for the selection of research grants (Assegni di Ricerca, bando n. NMR1)

Part IV – Teaching experience

IVA Teaching experience in the CHIM/10 scientific sector

Year	Institution	Lecture/Course
2017-2018	Sapienza University of Rome	*Chimica degli Alimenti*, Degree course in "Chimica e Tecnologia Farmaceutiche" (8 CFU) *Chimica degli Alimenti e Prodotti dietetici*, Degree course in "Farmacia" (8 CFU, in mutuazione); *Nutraceutici e Prodotti dietetici*, Degree course in "Scienze Farmaceutiche Applicate" (6 CFU)
2016-2017	Sapienza University of Rome	*Chimica degli Alimenti*, Degree course in "Chimica e Tecnologia Farmaceutiche" (8 CFU) *Chimica degli Alimenti e Prodotti dietetici*, Degree course in "Farmacia" (8 CFU, in mutuazione) *Integratori e Alimenti Dietetici*, Degree course in "Informazione Scientifica sul Farmaco" (6 CFU) (modulo di Integratori e Alimenti dietetici-Marketing e Tecniche di accesso al mercato farmaceutico) *Chimica degli Alimenti*, Degree course in "Dietistica" (2 CFU) (modulo di Chimica degli Alimenti e Tecnologie alimentari)
2015-2016	Sapienza University of Rome	*Chimica degli Alimenti*, Degree course in "Chimica e Tecnologia Farmaceutiche" (8 CFU) *Chimica degli Alimenti e Prodotti dietetici* Degree course in Farmacia (8 CFU, in mutuazione) *Integratori e Alimenti Dietetici*, Degree course in "Scienze Farmaceutiche Applicate" (6 CFU) (modulo di Integratori e Alimenti dietetici-Marketing e Tecniche di accesso al mercato farmaceutico) *Chimica degli Alimenti*, Degree course in "Dietistica" (2 CFU) (modulo di Chimica degli Alimenti e Tecnologie alimentari)
2014-2015	Sapienza University of Rome	*Chimica degli Alimenti*, Degree course in "Chimica e

		Tecnologia Farmaceutiche" (8 CFU) *Chimica degli Alimenti e Prodotti dietetici* Corso di Laurea in Farmacia (8 CFU, in mutuazione) *Integratori e Alimenti Dietetici*, Degree Course in "Scienze Farmaceutiche Applicate" (6 CFU) (modulo di Integratori e Alimenti dietetici-Marketing e Tecniche di accesso al mercato farmaceutico)
2013-2014	Sapienza University of Rome	*Chimica degli Alimenti*, Degree course in "Chimica e Tecnologia Farmaceutiche" (8 CFU) *Integratori e Alimenti Dietetici*, Degree course in "Scienze Farmaceutiche Applicate" (6 CFU)
2012-2013	Sapienza University of Rome	*Chimica degli Alimenti*, Degree course in "Chimica e Tecnologia Farmaceutiche" (8 CFU) *Analisi Chimica degli Alimenti*, Degree course in "Chimica e Tecnologia Farmaceutiche" (8 CFU) *Integratori e Alimenti Dietetici*, Degree course in "Scienze Farmaceutiche Applicate" (6 CFU)
2011-2012	Sapienza University of Rome	*Analisi Chimica degli Alimenti*, Degree course in "Chimica e Tecnologia Farmaceutiche" (8 CFU) *Integratori e Alimenti Dietetici*, Degree course in "Scienze Farmaceutiche Applicate" (6 CFU)
2010-2011	Sapienza University of Rome	*Analisi Chimica degli Alimenti*, Degree course in "Chimica e Tecnologia Farmaceutiche" (8 CFU) *Prodotti Dietetici*, Degree course in "Informazione Scientifica sul Farmaco" (4 CFU) *Integratori alimentari*, Degree course in "Chimica e Tecnologia Farmaceutiche" (4 CFU)
2009-2010	Sapienza University of Rome	*Prodotti Dietetici*, Degree course in "Informazione Scientifica sul Farmaco" (4 CFU) *Integratori Alimentari*, Degree course in "Chimica e Tecnologia Farmaceutiche" (4 CFU)
2009-present	Sapienza University of Rome	Advisor of undegraduate students
2016-present	Sapienza University of Rome	Advisor of 1 PhD student
2004-2010	University of Molise	Advisor of 4 PhD students

Note: From 1996 to 2009, she held courses in General and Inorganic Chemistry as Researcher (1996-2005) and Associate Professor (2005-2009) in the CHIM/03 scientific sector.

IV B – Teaching experience in Master and PhD courses

Place and Date	**Institution**	**Lecture/Seminar Title**
Chieti, 17/05/2017	PhD in "Scienze Biomolecolari e Farmaceutiche", University of Chieti	La Risonanza Magnetica applicata alla Scienza degli Alimenti
Pavia, 14/06/2015	II Level Master "Prodotti nutraceutici: progettazione, sviluppo formulativo, controllo e commercializzazione", University of Pavia	La Risonanza Magnetica Nucleare nella Scienza degli Alimenti
Rome, 24/03/2017	II Level Master: "Metodologie Analitiche Forensi", Sapienza University of Rome	La Risonanza Magnetica nello studio degli Alimenti
Rome, 12-19/02/2016	II Level Master: "Metodologie Analitiche Forensi", Sapienza University of Rome	La Risonanza Magnetica nello studio degli Alimenti
Campobasso,	SAPERI Master: "Esperto dell'Innovazione e del	Nuove Metodologie nell'Analisi

12-26/07/2007	Rinnovamento Tecnologico nell'Agroalimentare e nell'Agroindustria", University of Molise	degli Alimenti
Teramo, 29 /09/2005	I Level Master: "Produzione, trasformazione e mercato dell'olio di oliva", University of Teramo	Produzione, trasformazione e mercato dell'olio di oliva

IV C – Other Teaching experiences

Date	**Institution**	**Lesson/Seminar title**
Frosinone, 32/10/2012	"Corso di formazione di assaggiatori per l'analisi sensoriale dell'olio di oliva extra-vergine" organized by A.S.P.OL.	La Risonanza Magnetica Nucleare sulla qualità, genuinità e origine geografica del prodotto
Frosinone, 10 /11/2009	"Corso di formazione di assaggiatori per l'analisi sensoriale dell'olio di oliva extra-vergine" organized by A.S.P.OL.	La Risonanza Magnetica Nucleare sulla qualità, genuinità e origine geografica del prodotto
Montelibretti, 22/02/2010 8/03/2010	1° e 2° School on "Moderne Metodologie Chimico-Fisiche per le nuove Frontiere della Chimica", organized by Istituto di Metodologie Chimiche, CNR of Rome	NMR in Chimica degli Alimenti
Latina, 23/06/2009	Degree course in "Biotecnologie Industriali e Agro-alimentari Sapienza University of Rome (polo di Latina)	La Risonanza Magnetica Nucleare nello Studio degli Alimenti
Frosinone, 12/02/2008, 6/11/2007	"Corso di formazione di assaggiatori per l'analisi sensoriale dell'olio di oliva extra-vergine" organized by A.S.P.OL.	La Risonanza Magnetica Nucleare sulla qualità, genuinità e origine geografica del prodotto
Frosinone, 1 /12/2008	"Corso di formazione di assaggiatori per l'analisi sensoriale dell'olio di oliva extra-vergine" organized by A.S.P.OL.	La Risonanza Magnetica Nucleare sulla qualità, genuinità e origine geografica del prodotto
Rome, 18/04/2008	Department of Drug Chemistry and Technologies. Sapienza University of Rome	La Risonanza Magnetica Nucleare nello Studio degli Alimenti
Frosinone, 12/02/2008, 6/11/2007	"Corso di formazione di assaggiatori per l'analisi sensoriale dell'olio di oliva extra-vergine" organized by A.S.P.OL.	La Risonanza Magnetica Nucleare sulla qualità, genuinità e origine geografica del prodotto
Latina, 11/05/2007	Degree course in "Biotecnologie Industriali e Agro-alimentari" Sapienza University of Rome	Gli Alimenti e la Risonanza Magnetica Nucleare
Latina, 20/06/2006	Degree Course in "Biotecnologie Industriali e Agro-alimentari" Sapienza University of Rome	La Risonanza Magnetica e l'olio di oliva
Campobasso, 6/03/2006	Training Project: "Nuovo sistema di trattamento-smaltimento–recupero di rifiuti solidi urbani e assimilati"	Nuove metodologie di indagine analitica: La Risonanza Magnetica
Marcianise (CE) 8/09/ 2005.	Training Course: "Innovazione Tecnologica della filiera Bufalina" presso la ditta Bellopede & Golino	La Risonanza Magnetica nello studio di prodotti caseari
Rome, January-May 2003	Training Course, Project DISIO-PARNASO	Principles of chemistry for cultural heritage
Vietri sul Mare (SA), 2/07/2003	Advanced Training Course for Experts in "Tecnologia dei Processi di Trasformazione della Filiera Bufalina Campana D.O.P." organized by MIUR	Tecniche tradizionali ed innovative di valutazione della qualità della Filiera Bufalina

Montelibretti, 16-20/06/2003	School on "Metodi Innovativi nell'Analisi delle Sostanze Grasse con Particolare Riferimento all'Olio di Oliva" organized by Istituto di Metodologie Chimiche, CNR of Rome	La Risonanza Magnetica Nucleare e l'olio di oliva
Marsiglia, 12-13/05/ 2003	Université D'Aix-Marseille III	Olive Oil: a ^{1}H and ^{13}C high resolution NMR characterization

Part V - Society memberberships, Awards and Honors

Year	Title
2010-2016	Board Member of the Italian NMR Discussion Group (GIDRM)
2016-present	Member of National Institute of Biostructures and Biosystems, Interuniversity Consortium (I.N.B.B)
2012-present	Member of the Italian Chemical Society (Analytical Chemistry Division, Magnetic Resonances Interdivisional Group, Food Chemistry Interdivisional Group)
2012-2013	Member of technical-scientific committee of "Circuito Intelaboratorio NMR Retelab" (Camere di Commercio Italiane, Università ed Industrie Produttrici di strumentazione)

Part VI – Other activities

Date	Activity
2008-present	Member of Referees Scientific Committee of La Rivista Italiane delle Sostanze Grasse
2012-present	Assistent Editor of Journal of Integrated –Omics
1995-present	Referee for food chemistry international journals including Food Chemistry, Electrophoresis, Nutrients, Foods, Journal of Agricultural and Food Chemistry and Magnetic Resonance in Chemistry
2000-present	Collaboration with international research groups: Prof. Stefano Caldarelli, Aix Marseille University, CNRS, Marseille, France Prof. Stephane Viel, Aix Marseille University, CNRS, Institut de Chimie Radicalaire, Marseille, France. He was visiting professor at Department of Drug Chemistry and Technologies. Dr. James Donarski, Fera Science Ltd, Sand Hutton, York , United Kingdom Dr. Freddy Thomas, Eurofins Analytics France, Nantes, France

VII - Funding Information

VII A Funding Information, Research projects [grants as PI-principal investigator]

Year	Title	Program	Grant (€)
2017	Studio multi-metodologico dei prodotti della filiera agroalimentare della canapa industriale	University Research (Grant: RM11715C77E550EB)	34750
2016	Multi-methodological approach for the characterization of exotic plant foods with high nutritional value	University Research (Grant: RG116154C8E02882)	48600
2015	Nuclear Magnetic Resonance-Based Metabolomics Approach in sarcopenic obese subjects: a focus on insulin resistance, inflammation, protein metabolism and muscle strength	University Research (Grant: C26A15CJ98)	8000
2014	Caratterizzazione e valorizzazione di prodotti alimentari di origine vegetale attraverso un "OPEN LAB".	University Research (Grant: C26A14XF5A)	10000
2013	Alimenti di origine vegetale a elevato valore nutrizionale-funzionale: analisi del profilo metabolico e studio degli effetti di trattamenti tecnologici di produzione e della digestione sul contenuto di nutrienti e nutraceutici	University Research (Grant: C26A13JNL5)	12000
2012	Studio di miscele alimentari ad elevato valore nutrizionale: il caso di mirtilli e carote	University Research (Grant: C26A12ZZE3)	34946.04
2011	Oli aromatizzati e oli di semi ad elevato valore nutrizionale: profilo analitico e valutazione della qualità mediante Risonanza Magnetica e Analisi Convenzionali	University Research (Grant: C26A114A73)	12000
2015	*e*-ALIERB: un OPEN LAB per caratterizzare e valorizzare i prodotti alimentari ed erboristici del territorio laziale	Regione Lazio, Università e Centri di Ricerca, (LR13/2008, FILAS-RU-2014-1157)	249999.20
2006	Caratterizzazione di componenti minoritari dell'olio di oliva Molisano mediante analisi NMR	Centro di Ricerca Applicata per l'Innovazione e Trasferimento Tecnologico nel Settore Agro-Industriale Finalizzato alla Difesa e alla Valorizzazione delle Produzioni di Eccellenza" (Programma pluriennale di interventi diretti a favorire la ripresa produttiva del Molise)	36000

VII B - Funding Information, Research Contracts [grants as PI-investigator].

Year	Title	Program	Grant (€)
2012	Caratterizzazione NMR di Oli di oliva	Contract between Dep. Of Drug Chemistry and Tecnologies (Sapienza University of Rome) and Fondazione Edmund Mach	20000
2009	Valorizzazione della frutta in guscio mediante l'introduzione e la costituzione di nuovo materiale genetico e l'applicazione di tecniche colturali innovative	Contract between Dep. STAAM (University of Molise) and CRA (Centro di Ricerca per la Frutticoltura)	10800
2006	Individuazione di un modello di tracciabilità per l'olio extravergine di oliva del Lazio	*Contract between Istituto di Metodologie Chimiche (CNR of Rome) and ARSIAL (Agenzia Regionale per lo Sviluppo e l'Innovazione dell'Agricoltura del Lazio)	50000
2006	Lo studio strutturale di campioni di polisaccaridi	*Contract between Istituto di Metodologie Chimiche (CNR of Rome) and Lamberti S.p.A. company	10000
2006	Determinazioni strutturali NMR in soluzione ad alto campo (600 MHz)	*Research agreement between Istituto di Metodologie Chimiche (CNR of Rome) and CHEMI SpA company	feasibility study
2004	Valutazione preliminare di compatibilità alimentare di manufatti prodotti dalla ditta Xilopack s.r.l	Contract between Dep STAAM (University of Molise) and Xilopack s.r.l. company	9200

* The candidate was responsible of the scientific research in the association field with the CNR

VII C - Funding Information, [grants as I-investigator, participant]

Year	Title	Program	Grant (€)
2013-20	Ensuring the Integrity of the European food chain	Seventh Frame work Program Theme [KBBE.2013.2.4-01, Assuring quality and authenticity in the food chain], Food Integrity, Grant agreement no: 613688, Role: Key person Partner n.38 in WP4	26365
2011	Individuazione di un nuovo modello di riconoscimento, con lo sviluppo di una nuova tecnica risultante dalla combinazione e integrazione delle analisi avanzate (profilo isotopico di	*Project Biolabel, Istituto di Metodologie Chimica, CNR of Rome (Progetti di Ricerca, Sviluppo e Innovazione delle PMI POR Lazio Asse 1-Azione 1.1 della Regione Lazio, CUP	60000

	origine della produzione e composizionale), per la certificazione di origine della produzione agroalimentare laziale – filiera dell'olio extravergine di oliva	F87I10000290007)	
2009	Tracciabilità NMR di oli extra-vergini di oliva	*Research project (Istituto di Metodologie Chimiche, Istituto di Biologia Agro Ambientale e Forestale e UNAPROL, n. 0000413 15/12/2009)	142500
2008	Studio del pathway di biodegradazione della micotossina patulina operata da un lievito basidiomicete"	Program funded by MIUR as part of the Italy-Spain integrated actions (prot. IT088MB951), University of Molise	10300
2006	Sistemi innovativi per la riduzione della contaminazione da patulina e fungicidi nella filiera pomacea	PRIN (Anno 2006 - prot. 2006072204_001) "Studio pilota di strategie innovative per abbattere la contaminazione da patulina". University of Molise	152386
2003	Qualificazione oli laziali	*Research Project: "Latii Olii Viae 2003", finanziato dalla società funded by IRSAM (Istituto Ricerca S. Alberto Magno). Istutito di Metodologie Chimiche, CNR of Rome.	41650
2003	TRACE (Tracing Food Commodities in Europe)	* European project. FP6-2003-Food-2-A, contract number: 0060942). Istutito di Metodologie Chimiche, CNR of Rome.	145663
2002	Trattamento di prodotti freschi altamente deperibili per garantirne qualità, sicurezza e salubrità PROFSICURI	* Research Program- agri-food sector funded by Ministero dell'Università e della Ricerca Scientifica e Tecnologica, Istutito di Metodologie Chimiche, CNR of Rome.	77000
2001	Development and Assessment for the Detection of Adulteration of Olive Oil with Hazelnut Oil	* European project.Project MEDEO (GRD1-2000-25011).	55232

* The candidate participated in these projects within the association with the CNR

VIII Conference organization and Invited lectures and plenaries

VIII A Conference organization

Place, Date	Conference	Position
Cesena, 10-12/01/2018	5th International Conference on Foodomics	Organizing Commitee Member
Rome, 11/12/2017	NMR Day: NMR Aspects of Colloids Science	Organizing Commitee Member

Rome, 17/03/ 2017	La Canapa Industriale	Scientific Committee Member
Lecce, 19/04/2017	NMR Day Fish and SeaFood Applications	Scientific Committee Member
Rome, 26-27/05/2016	V workshop: "Applicazioni della Risonanza Magnetica nella Scienza degli Alimenti"	Scientific Committee Co-Chair
Rome, 19-20/06/2014	IV workshop: "Applicazioni della Risonanza Magnetica nella Scienza degli Alimenti"	Scientific Committee Co-Chair
Rome, 28-29/05/2012	III workshop: "Applicazioni della Risonanza Magnetica nella Scienza degli Alimenti	Scientific Committee Co-Chair
Rome, 27-28/05/2010	II workshop: "Applicazioni della Risonanza Magnetica nella Scienza degli Alimenti	Scientific Committee Co-Chair
Campobasso, 22-23/05/2008	Workshop: "Applicazioni della Risonanza Magnetica nella Scienza degli Alimenti	Scientific Committee Co-Chair
Pavia, 17-19/09/2012	XLI National Congress on Magnetic Resonance	Scientific Committee Member
Parma, 26-28/09/2011	XL National Congress on Magnetic Resonance	Scientific Committee Member
Cesena, 22-24/06/2011	2nd International Conference on FoodOmics	Scientific Committee Member
Rome, 30/10/ 2009	Workshop: "La Risonanza Magnetica Nucleare: dal sito archeologico alla struttura molecolare"	Scientific Committee Member
Cesena, 28-29/05/2009	International Conference on FoodOmics	Scientific Committee Member
Rome, 9/05/1996	II Congress on "Applicazione della Risonanza Magnetica nell'Industria Alimentare"	Organizing Commitee Member

VIII B Invited lectures, plenaries

Place and Date	Conference	Position
Padova, 14-17/11/ 2017	Conference: Advances in NMR-based and MS-based Metabolomics	Keynote lecture: "NMR-based metabolomics in food Science: outcomes and critical points"
Turin, 10-11/11/2017 2017	First National Conference: I Metodi di Controllo-il Controllo dei Metodi dalla Tecnica alla norma: gli Oli come sistema Modello	Keynote lecture: "La Risonanza Magnetica nello studio degli oli di oliva: risultati e prospettive"
Rome, 13-15/11/2017	International Conference on Food Science & Tecnology	Keynote lecture: "NMR methodologies in Food Science"
Lecce, 19/04/2017	NMR Day Fish and SeaFood Applications organized by GIDRM	Plenary lecture: "Profilo metabolico tramite NMR delle spigole di allevamento e spigole di mare aperto"
Rome, 24/02/2017	6 Edition "Giornate di Carlo Cannella" Micronutrienti & Composti Bioattivi	Plenary lecture: "La Risonanza Magnetica nella determinazioni degli indicatori"
Rome, 14/02/2017	Workshop (BUCHI) Natural Products: Tecniche analitiche e nuove tendenze nel	Lecture: "La Risonanza Magnetica nello studio di miscele

	mondo dei prodotti naturali	complesse
Cagliari, 4-7/10/2016	XI Congresso Italiano di Chimica degli Alimenti	Plenary lecture: "Nuclear Magnetic Resonance: from molecular structure to food origin"
Lisbon, 4/07/ 2016	Food Integrity workshop on Geographic Origin and Authenticity of Food Products, from Tools to Legislation	Lecture: "NMR-based metabolomic approach in the foodstuff investigation"
Turin, 3/03/2016	Giornata sulle Nuove Frontiere nella spettroscopia NMR: dalla biochimica ai materiali	Lecture: "La Risonanza Magnetica e gli Alimenti: una lunga storia d'amore"
Ischia, 3-7/06/2012	IX Italian Congress of Food Chemistry	Plenary lecture: "NMR-Metabolomics in food analysis"
Wageningen, 26-29/06/2012	International Conference on the applications of Magnetic Resonance in Food	Plenary lecture: "NMR Approach to the study of Food Metabolites: Practical Applications"
Avellino, 3-5/09/2009	Convegno MICAS	Plenary lecture: "Spectroscopic methods for cheese quality and authenticity"
Rome, 12/05/2009	Corso di Laurea in Scienze dell'Alimentazione e della Nutrizione Umana Facoltà di Medicina e Chirurgia, Università Università Campus Biomedico di Roma	Lecture: "La Risonanza Magnetica Nucleare nello Studio degli Alimenti"
Bari, 11/07/ 2008	Scientific conference on Foods	Plenary lecture: "NMR-statistical protocol for the characterization of olive oils"
Campobasso, 3-5/10/ 2007	7° Convegno AISTEC. Cereali tra tradizione e innovazione: il contributo della Scienza.	Plenary lecture: "La Risonanza Magnetica Nucleare nello studio delle farine" nell'ambito Università degli Studi del Molise
Campobasso, 9/03/ 2006	Congresso Arpa	Lecture: "L'olio di oliva e la Risonanza Magnetica Nucleare: uno studio dell'origine geografica, delle varietà e della qualità"
Campobasso, 25/09/2009	Workshop organized by the Accademia Nazionale dell'Olivo e dell'Olio	Lecture: "Caratterizzazione geografica degli oli di oliva"
Porto Conte, 21-24/09/2004	XXXIV National Congress on Magnetic Resonance	Plenary lecture: "Characterization of olive oils by high resolution NMR

Part IX – Research Activities

***Keywords*:** Foodstuffs, NMR methodologies, Metabolomics

Brief Description

The research activity of prof. Luisa Mannina is focused on the study of food matrices carried out using Nuclear Magnetic Resonance (NMR) methodologies. This activity is significantly represented by the 16 selected papers published in Scientific Journals relevant in the field of food chemistry.

A description of her main research topics is reported here with particular reference to the 16 selected publications (reported as **Selected Publication**) and, in some cases, to the publications (reported as *Publication*) listed in the "Allegato E_Elenchi Prodotti Attività Scientifica" attachment. High-field NMR spectroscopy is recognized as one of the main analytical methodologies in food metabolomics since it allows to obtain in a single experiment a comprehensive characterization of an entire food matrix as a mixture of components without their separation.

Prof. Mannina, together with her research group, has developed an analytical protocol that provides for the determination of the foodstuffs metabolic profile by high-field NMR spectroscopy and, according to the specific problem, the elaboration of NMR data through appropriate multivariate statistical analyses (*Publications n. 107, 126, Chapters of Book n. 4,5,6*). A detailed description of the NMR protocol used in food analysis is reported in the **Selected Publication n. 8**. In this paper, the different experimental phases of the NMR protocol together with many applications are described highlighting how NMR methodology is also helpful for the identification of secondary metabolites. Molecular identification is quite easy and straightforward and can be obtained from the NMR spectrum of the mixture itself or, after purification, by means of 1D and 2D experiments, standard additions and by comparison with a database of standard compounds. In this paper, for the first time, all the metabolites identified in foods by means of NMR methodology are reported together in a single table. This table can be considered the first step towards the creation of a food NMR database.

As documented by the *Publications* listed in "Allegato E_Elenco Prodotti Attività Scientifica", using NMR-based metabolomics approach, it was possible:

- to have a comprehensive information regarding compounds present in the sample. This information may be also useful for industries interested in specific nutrients for the formulation of new products;

- to monitor the foodstuff metabolic profiles over time. This aspect may have an important role in the determination of the most suitable time for harvesting of products;

- to classify samples according to geographical origin, variety and type of production and farming;

- to detect possible frauds;

- to study production processes;

- to study the effect of specific sample treatments;

-to compare the metabolite profiles of Genetically Modified and control foodstuff samples

The most interesting results obtained on several specific food matrices are reported below.

- **Olive Oils**

Prof. Luisa Mannina, together with her research group, developed a protocol considered as reference in the olive oil NMR analyses (*Publications n. 40, 102, Book Chapters n. 2, 3*). The protocol provides for the ^{1}H NMR analysis, the measurement of selected signals intensity due to minor and major compounds and the data processing through suitable multivariate statistical analyses (*Publication n.3 in National Journal, Publication n. 8,*). Information regarding the distribution of fatty chains on glycerol, which are important to reveal possible esterification processes, is instead provided by ^{13}C NMR spectroscopy (*Publications n.23, 26*). Based on the collected data, a conspicuous NMR database of olive oils from different geographical areas, varieties and harvesting years was obtained.

The application of the NMR protocol allowed to gather information on:

- olive oils geographical origin. The capability of NMR methodology to distinguish olive oils on the basis of their geographical origin seems unique, whereas the conventional analyses suitable for the determination of quality and genuineness seem to be not appropriate for this type of discrimination. Olive oils from different areas of the same Italian regions (*Publications in National Journal n.2, 4, 5 and Publication n.71*), different Italian regions (*Publications n.17, 29*) and different countries were investigated and classified according to their geographical origin. Within the European TRACE project, a relevant number of samples (896 olive oils, three harvesting years) representative of the Mediterranean production were analyzed and Ligurian olive oils were chosen as a study case. Using discriminant and modeling analyses (PLS-DA and SIMCA), it was possible not only to discriminate Ligurian from not-Ligurian olive oils but also to define the Ligurian olive oil class which turned out to be characterized by specific sensory and quality markers. These results suggest that NMR-chemometric methodology can give an important contribution in the actual debated problem of PDO characterization and confirmation (**Selected Publication n. 4**)

A very important objective is also the development of tools capable to protect the Italian olive oil from mislabelling.

In **Selected Publication n. 14**, a multi-methodological approach, based on chemical analyses provided for by the European law, stable isotope ratios (IRMS), ^{1}H NMR profile and a robust chemometric approach, allowed to assess the quality of olive oil imported from Tunisia and to distinguish Italian olive oils from imported Tunisian olive oils potentially exported and mislabeled as Italian olive oils. The developed statistical model was able to discriminate olive oil from Italy and those imported from Tunisia with a differentiation ability arriving at about 98%.

- olive oils varieties. NMR analysis can also be useful to characterize monovarietal olive oils that according their sensorial and chemical characteristics are consumed as they are or are combined to produce suitable blends. Information regarding the olive oil varieties were obtained using both ^{1}H and ^{13}C NMR methodologies. For instance, monovarietal olive oils from the same geographical area of Sicily were classified according to their variety using ^{13}C NMR approach (*Publication n. 38*), having different fatty acids composition and distribution on glycerol moiety. On the other hand, olive oils of the same Mediterranean varieties, grown in experimental fields located in different countries (Italy and Argentina), were classified according to the country of origin showing a prevailing strong effect of the pedoclimatic condition on the chemical composition of olive oil (*Publication n. 28*). A multi methodological approach including NMR analysis was also applied to study monovarietal olive oils from Algeria, showing the potential of these olive oils to produce blends that may compete with other Mediterranean products (*Publication n. 140*).

- possible adulterations. Adulteration of high-cost virgin olive oils with less expensive vegetable oils or low-quality olive oils is one of the most common types of frauds. Adulteration of olive oil with bad quality hazelnut oils is a particular case of fraud. The main analytical challenge is that hazelnut and olive oils have a very similar chemical composition Within the European MEDEO project, an NMR-statistical protocol was developed, according to the ISO format and for operators with basic NMR knowledge, to detect the presence of refined hazelnut oil in refined olive oil. The protocol, tested by peer laboratories using spectrometers operating at different magnetic fields (600, 500 and 400 MHz), allowed additions of refined hazelnut oils in refined olive oils below 10% to be detected (**Selected Publication n.3**). Artificial neural networks used to process ^{1}H and ^{13}C NMR data allowed to detect additions of hazelnut oils to olive oils above to 8% (*Publication n.54*).

- *harvesting period and method, and agronomic and ecological factors*. The quality and uniqueness of extra virgin olive oils are primarily determined by genetic and pedoclimatic factors that can be considered "principal" factors but are also influenced by other "secondary" factors such as agronomic practices (irrigation, fertilization, and harvest method and period) and technological procedures (processing and storage). In the **Selected Publication n. 7**, the NMR protocol, together with a new integrated statistical methodology, was applied to olive oils harvested in two different periods ("green and "ripe" stages) and harvested using two types of hand-held tools, namely, combs and shakers. Some minor compounds responsible for quality, nutritional and sensorial aspects such as hexanal, trans-2-hexenal, sn-1,3-diglycerides, and squalene significantly decreased during ripening whereas unsaturated fatty chains turned out to be present at a higher amount in olive oils when the comb hand-held machines were used.

The effect of irrigation as well as of olive trees altitudes were investigated (*Publication n. 71*) applying the NMR-statistical protocol to olive oils from olive trees subjected to different irrigation regimes and grown at different altitudes. The major effect of the irrigation procedure was to increase the amount of oleic acid and to decrease the amount of saturated fatty acids, that is an important qualitative and nutritional aspect,

whereas the altitude of the olive trees influenced the content of minor compounds as squalene that turned out to be in high amount in olive oils from hill-top cultivations.

Flavored olive oils

Flavored olive oils, labeled as condiments are not subjected to the quality controls required for olive oils, even though they tend to be very expensive. In order to determine the quality of these products, different flavoured oils were analyzed obtaining specific flavoured oils NMR fingerprintings, which are particularly useful for the food industry to check the quality and reproducibility of products (*Publication n.103*).

- **Fruits**

Fruits are a complex mixture containing many metabolites, widely ranging in concentration and biological activities, which have to be analyzed to obtain a comprehensive chemical picture. In this context, an NMR analytical protocol based on complementary high and low field measurements has been applied to obtain information regarding the fruits chemical composition and the water status of fruits. The knowledge of fruits nutritional profile can be extremely important for the industries which extract specific compounds from the fruit to obtain additives for other foodstuffs.

The water status of fruits was monitored directly on the intact fruit by means of a portable unilateral NMR instrument, which is fully non invasive, and can provide interesting information on the fruit freshness, shelf-life, food texture, and ripening status (*Publication n. 145*). The results reported hereafter in the case of blueberries and kiwifruits suggest that high-resolution NMR methodology can be proposed to monitor comprehensively nutritional/nutraceutical properties of different fruits varieties useful to industrial applications whereas low field NMR standard protocols based on fast measurements of the water status of the intact fruit can be easily transferred to quality control applications. Furthermore, NMR relaxometric methodology allowed to study the draught stress in plants (*Publication n. 85*).

Blueberries

Blueberries are very popular fruits due to their peculiar sensorial, nutritional and healthy properties. In order to have a comprehensive metabolite identification, untargeted and targeted NMR methodologies were applied. Untargeted NMR analysis of blueberries aqueous and organic extracts allowed the identification of water-soluble metabolites belonging to different classes such as sugars, amino acids, organic acids, and phenolic compounds, as well as metabolites soluble in organic solvent such as triglycerides, sterols, and fatty acids. On the other hand, targeted NMR analysis allowed the identification, in solid phase extract, of five anthocyanins (malvidin-3-glucoside, malvidin-3-galactoside, delphinidin-3-glucoside, delphinidin-3-galactoside, and petunidin-3-glucoside) and also 3-O-α-L-rhamnopyranosyl quercetin. The water status of fresh and withered blueberries was monitored by portable NMR and fast-field cycling NMR showing a clear sensitivity to the blueberries withering of some NMR parameters (^{1}H depth profiles, T_2 transverse relaxation times and dispersion profiles) (**Selected publication n. 12**).

Kiwifruits

In recent years the kiwifruit became an important horticultural crop both for sensorial and nutritional characteristic. The NMR methodologies allowed to obtain a comprehensive metabolic profile of aqueous kiwifruits extracts (*Actinidia deliciosa*, Hayward cultivar) in terms of sugars, amino acids, organic acids, and other compounds and to monitor the metabolite profile and the water content of the whole fruit over the season. Specific temporal trends of aminoacids, sugars, organic acids and other metabolites were observed giving, therefore, useful information for the industries which use kiwifruit nutrients in the food production. The water status of kiwifruit was monitored over the season directly from the intact fruit measuring the spin-spin relaxation time (T_2) by means of a portable unilateral NMR instrument, which allows a fully non invasive analysis. Specific trends were observed as a function of time, giving important useful information on food texture and ripening status (**Selected Publication n. 6**).

In a second paper, the same NMR analytical protocol, based on complementary high and low field measurements previously applied on kiwifruits from commonly marked Hayward cultivar, was extended to Zespri Gold and CI.GI cultivars. The CI.GI cultivar is a crossbreed from different species of *A. deliciosa*, characterized by an earlier ripening than that of Hayward kiwifruits, thus promoting the kiwifruits marketing in a different period. Among other Actinidia species, Zespri Gold kiwifruits from *Actinidia chinensis*, have assumed a certain commercial relevance being characterized by a yellow flesh, a flavor sweeter than that of Hayward kiwifruit and an early ripening. In this context, the NMR based metabolite profiling of the three cultivars monitored over the season allowed to obtain indications on nutritional properties, on the development of the fruit, and on the appropriate harvesting time. The metabolic profiling of the three kiwifruits have shown common features, but also important differences in the metabolite behaviour during the growth and development of fruits conforming, for instance, Zespri's earlier maturation compared with the two other varieties (**Selected Publication n.10**).

Peaches

Among fruit-producing rosaceous crops, peach is the second most important fruit crop in Europe after apple. Unfortunately, the Mediterranean fly (*Ceratitis capitata*) attacks result in a peach disease, causing economically important losses. In order to limit the chance of attacks one of the most promising approaches is the realization of varieties naturally resistant to insect attacks. In this context, the metabolic profiling of peaches from two varieties, Flaminia (FP) and Percoca Romagnola 7, with a different susceptibility to fly attacks was investigated to have indication regarding the compounds related to the resistance to *C. capitata* attacks. Flamina variety, used for fresh market and characterized by good sensorial properties, is easily attacked by *C. capitata*, whereas Percoca Romagnola, with its greater firmness and aroma, is known to be able to resist such attacks. The analysis of ^{1}H metabolite profiling showed that the level of glucose, xylose, myo-inositol, choline, isoleucine and valine was higher in Flaminia peaches compared to Percoca Romagnola7 whereas the level of fumaric acid, alanine, quinic acid, sucrose, fucose, chlorogenic acid and neochlorogenic acid was higher in Percoca Romagnola7 peaches. The resistances of the Percoca variety

towards the attack of the *Ceratitis capitata* may be due to the presence of some volatile substances whose precursors, such as alanine, are present in high concentration in this variety (**Selected Publication n. 9**).

- **Honey**

Honey is a complex mixture that contains nutrients and bioactive compounds responsible for its sensorial and biological properties. Among the different types of honey, Sicilian honey produced entirely by the black honeybees (*Apis mellifera* L. ssp *sicula*), unfortunately in risk of extinction, is of particular interest as a local product which deserves to be valued. A combined methodology that includes HPLC-PAD-ESI-MSn and NMR spectroscopy allowed to obtain, for the first time, a comprehensive chemical characterization of sulla and dill honeys and of other three unifloral honeys identifying many compounds that were found in these products for the first time. Some quantitative aspects such as the high amount of kojibiose, turanose, and nigerose, especially in dill honey, suggest that this product may exert prebiotic effects. This in-depth knowledge of honey chemical composition can be an important starting point for the enhancement and preservation of local products (**Selected Publication n.13**).

Another noteworthy honey is Manuka honey derived from the manuka tree (*Leptospermum scoparium* L.), native to Australia and New Zealand. In order to study in depth the properties of this honey, a multidisciplinary study providing for the antistaphylococcal activity against methicillin-susceptible and -resistant *Staphylococcus aureus* and the metabolite profiling before and after *in vitro* simulated gastric and gastroduodenal digestions was proposed. It is notheworthy that undigested manuka honey showed antibacterial activity against all the tested strains whereas gastric digestion samples showed no activity against *S. aureus*. Finally, honey samples after the gastroduodenal digestion showed again an antistaphylococcal activity. In this case the metabolite analysis, carried out using an explorative untargeted NMR-based approach and a targeted RP-HPLC-PAD-ESI-MSn analysis, was useful to highlight the chemical modifications occurring during digestion and to explain, at least partially, the results of the antibacterial activity. Methylglyoxal, to which most of the antibacterial activity is ascribed, decreases, whereas leptosin, a marker of manuka honey remains stable. An increase of acetic acid and lactic acid was registered suggesting that the organic acids have an important role in the bacterial growth inhibition after the gastroduodenal digestion (**Selected Publication n. 15**)

- **Tea**

Tea is one of the most popular beverages in the world. The chemical composition of tea beverage is very complex and not yet completely elucidated since it depends on many factors such as plant growth conditions, manufacturing processes and preparation methods. Several epidemiological studies suggested that tea consumption is inversely associated with the risk of developing some chronic diseases and diabetes. Thus, increasing interest in the health properties of tea resulted in a significant rise in scientific investigation on tea chemical composition. In **Selected Paper n. 11,** the recent results obtained in the tea beverage characterization using targeted chromatographic and NMR techniques are highlighted reporting significant

applications of the different analytical approaches. Among the different applications, an interesting application, described in more details in *Pubblicazione n. 116*, was reported regarding the study of the antistaphylococcal activity as well as the metabolic profiling and polyphenol content of green tea before and after in vitro simulated gastric, duodenal and gastroduodenal digestions. Metabolite analysis, carried out using an explorative untargeted NMR-based approach and a RP-HPLC–PAD–ESI-MSn method, showed that gastroduodenal digestion results in degradation of polyphenols explaining the loss of activity of gastroduodenal digested samples and why in vivo green tea has neither protective nor therapeutic effects against intestinal and systemic bacterial infections.

- **Beer**

Beer is the world's most widely consumed alcoholic beverage. Among the large number of beer brands available worldwide, an important role is played by Trappist beers, which are peculiar products brewed under the control of Trappist monks, and known for their extremely high quality. In order to propose a model for the authentication of beer products, within the European TRACE project, an NMR and chemometric analytical approach to classify Rochefort 8 (initially called "Spéciale" for its yellowish-brown color and a peculiar pronounced fruity aroma) and other Trappist beers with respect to non-Trappist beers was developed. Discriminant (PLS-DA) and a modeling (SIMCA) approaches led to a very high classification accuracy in beers classification as evaluated by external validation. Moreover, by inspecting the model parameters, it was possible to identify a certain number of metabolites, which could be considered as tentative markers for the categories of interest. Rochefort beers showed a higher content of propanol, pyruvic acid and isopentanol with respect to non-Rochefort samples. This result is associated with the use of selected old yeast strains (*Saccaromices Cerevisiae*), which have a specific metabolism characterized by a low activity of the lactate dehydrogenase enzyme.

The proposed approach can be used by beers producers to verify that the product has the same metabolite fingerprint over the time and to monitor the functionality of production cycle. The definition of the metabolic profiling can be also useful when frauds such as the replacement with less valuable products are suspected (**Selected Publication n. 16**).

- **Sea bass**

Sea bass (Dicentrarchus labrax) is a very popular ocean-going fish with peculiar sensory and nutritional qualities. Due to the increased demand for this fish, in the last decade the aquaculture production has significantly increased and sea bass became one of the most important commercial fish farmed in the Mediterranean area. Therefore, the intensive sea bass production has raised concerns over the quality of farmed fish in comparison with that of wild ones. The NMR methodology allowed to determine the complete metabolic profiling of sea bass aqueous and organic extracts of farmed and wild seabass: water-soluble metabolites belonging to different classes such as sugars, amino acids, dipeptides and organic acids as well as metabolites soluble in organic solvent such as lipids, sterols and fatty acids were identified. The NMR metabolite profilings analyzed by a statistical approach, highlighted that these two types of seabass have not

only a different fatty acid composition but also different levels of cholesterol and phosphatidylethanolamine and some water-soluble metabolites such as choline, trimethylamine oxide, glutamine, fumaric and malic acids. The high content of DUFA in farmed samples as well as the low amount of in PUFA, DHA and EPA fatty acids can be attributed to the terrestrial not expensive dietary of farmed fish (**Selected Publication n. 1**).

- **Genetically modified foods**

Genetically modified (GM) foods are foods in which modifications in the DNA sequences have been introduced to give the product new properties and abilities. However, the genetic modification can lead to different effects on the plant and induce changes on its metabolism. It is therefore important to develop methodologies able to detect possible undesirable effects due to genetic modifications. In the case of GM products, an NMR protocol was developed that provides a comparison between the metabolic profiles of GM and non-GM products (*Publication n. 92*) showing the degree of metabolic impact induced by plant genetic breeding and bioengineering. NMR-based surveys, coupled with multivariate analyses, allow to observe metabolic changes in the transgenic lines monitoring metabolic profiles.

Following this protocol, GM maize and GM lettuce were investigated.

- GM maize samples. The investigated GM variety carries a functional *Cry1A(b)* gene, which confers to the plant the ability to produce Bt insect toxin. The ^{1}H spectra of transgenic and non transgenic samples extracts, assigned by means of 2D experiments, turned out to be conservative, showing the same signals and therefore the same metabolites. However, a higher concentration of ethanol, citric acid, glycine-betaine, trehalose, as well as of another compound not yet completely identified, was observed in the transgenic extracts than in non transgenic ones (**Selected Publication n. 2**)

- genetically modified lettuces. The ^{1}H NMR metabolic profiles of three transgenic lettuce lines (*Lactuca sativa* L.) that over-express the E. coli *asparagine synthetase* gene and are characterized by a better agronomical performance with respect to control samples were compared with those of the wild type at 24, 56, and 64 days after sowing. Statistical analyses based on hydro-soluble compound profiles significantly and maximally discriminated the wild type from GM-lines at 56 days after sowing, that is considered the optimal harvest time. The results show that GM samples contain the same metabolites as non-GM samples but in different concentrations. Compared to control samples, two GM line plants showed higher amino acid content and protein levels, and a lower nitrate contents, accompanied by a modest sink of organic acids, sucrose, fructose, and inulins whereas the other GM line, at early stages of development, showed a remarkable inulin accumulation, a trait of industrial interest (**Selected Publication n. 5**).

The scientific activity of prof. Luisa Mannina has also regarded the NMR study of other foodstuffs such as Argan oils (*Publication 77*), truffles (*Publication n.56, 57*), hazelnuts (*Publication n.117*) , Royal Jelly (*Publication n.115*), saffron (*Publication n.124, 141*), Neem leaves (*Publication n.132*), pears (*Publication*

n.130), and other products such as maize and sorghum ensilings (*Publication n. 73*) and fermentation products (*Publication n.55*)

Other papers were focalized on the NMR study of the molecular structure of:

- natural polysaccharides (*Publications n.37, 47, 49, 62, 63, 90, 114*). Specifically, NMR methodologies have been optimized for characterizing chemically modified polysaccharides aimed at obtaining chemical gels with pharmacological application (*Publications 36, 41, 42, 64, 65, 70, 79, 86, 95*). A versatile tool for the molecular determination of uncharged polysaccharides using Diffusion- Ordered NMR spectroscopy was also developed (*Publication n. 43*).
- peptides (*Publication n.35, 52, 53, 58, 69, 78*)
- micelles and liposomes (*Publications n.31, 46, 48, 66, 67*)
- compounds isolated from vegetable matrices (*Publication n.2, 5, 6, 7, 10, 101, 111*)

Finally, recently within the University Project (Grant: C26A15CJ98), in collaboration with Researchers of Sciencc of Nutrition of Sapienza University of Rome, the NMR based metabolomics approach was applied to the study of the biological fluids of obese subjects in order to investigate the effect of suitable diet regimes.

Part X– Summary of Scientific Achievements

Product type	**Number**	**Data Base**	**Start**	**End**
Papers [International Journals]	**146** **149**	Scopus Scopus	1993 1993	2017 2018
Papers [National Journal]	**5**	Scopus	1993	2017
Book Chapters	**6**	Scopus	1993	2017
Publications in the last ten years 2008-2017				
Papers [international]	**73**	Scopus	2008	2017
Papers [national]	**2**	Scopus	2008	2017
Book Chapters	**5**	Scopus	2008	2017

Index	**Value**	**Data Base**	**Start**	**End**
Total Impact Factor °	**391.617**	InCites Journal Citations Report	1993	2017
	400.709	InCites Journal Citations Report	1993	2018
Impact Factor° Last ten years	**214.892**	InCites Journal Citations Report	2008	2017

Average Impact Factor° per Product calculated in relation to the year of publication	**2.593**	InCites Journal Citations Report	1993	2017
	2.602	InCites Journal Citations Report	1993	2018
Total Citations (papers and book chapters)	**4382**	Scopus	1993	2017
	4382	Scopus	1993	2018
Average Citations per Product (papers and book)	**27.91**	Scopus	1993	2017
	27.39	Scopus	1993	2018
Hirsch (H) index	**41**	Scopus		
Normalized H index*	**1.64** **1.57**	Scopus Scopus	1993 1993	2017 2018

°calculated on the basis of the publication year
*H index divided by the academic seniority.

Part XI– Selected Publications (16)

List of the16 publications selected for the evaluation (2008-2017).
8 out of 16 publications have been published in the 2013-2017 period.
For each publication, authors, title, reference data, journal IF (InCites JCR) and number of citations (Scopus) are reported. IF is relative to the year of publication or, if not available, to the year closest to the year of publication. The role of the candidate as corresponding author is highlighted by reporting "*Corresponding author*". For each publication , the filename of the pdf format is also reported.

First name: n. 7 papers
(*) Corresponding author: n. 10 papers
Last name: 6 papers

1. **L. Mannina**, A.P. Sobolev, D. Capitani, N. Iaffaldano, M.P. Rosato, P. Ragni, A. Reale, E. Sorrentino, I. D'Amico, R. Coppola
"NMR Metabolic profiling of organic and aqueous sea bass extracts: Implications in the discrimination of wild and cultured sea Bass"
Talanta, Vol. 77, Issue 1, pp. 433-444, 2008
DOI: 10.1016/j.talanta.2008.07.006
Impact factor (2008): 3.206
Citations (Scopus): 49
Filename (pdf): 1.Talanta_77_433_2008

2. F. Piccioni, D. Capitani, L. Zolla, **L. Mannina**
"NMR Metabolic Profiling of Transgenic Maize with the *Cry1A(b)* Gene"
Journal of Agricultural and Food Chemistry, Vol. 57, Issue 14, pp. 6041-6049, 2009
DOI: 10.1021/jf900811u
Impact Factor (2009): 2.469
Citations (Scopus): 35
Corresponding author
Filename (pdf): 2.JAFC_57_6041_2009

3. **L. Mannina**, M. D'Imperio, D. Capitani, S. Rezzi, C. Guillou, T. Mavromoustakos, M.D.M. Vilchez, A.H. Fernández, F. Thomas, R. Aparicio
"^{1}H NMR-Based Protocol for the Detection of Adulterations of Refined Olive Oils with Refined Hazelnut Oil"
Journal of Agricultural and Food Chemistry, Vol. 57, Issue 24, pp. 11550 -11556, 2009
DOI: 10.1021/jf902426b
Impact Factor (2009): 2.469
Citations (Scopus): 42
Corresponding author
File name (pdf): 3.JAFC_57_11550_2009

4. **L. Mannina**, F. Marini, M. Gobbino, A.P. Sobolev, D. Capitani
"NMR and chemometrics in tracing European olive oils: The case study of Ligurian samples"
Talanta, Vol. 80, Issue 5, pp. 2141-2148, 2010
DOI: 10.1016/j.talanta.2009.11.021
Impact Factor (2010): 3.722
Citations (Scopus): 58
Corresponding author
Filename (pdf): Talanta_80_2141_2010

5. A.P. Sobolev, G. Testone, F. Santoro, C. Nicolodi, M. Iannelli, M.E. Amato, A. Iannello, E. Brosio, D. Giannino, **L. Mannina**
"Quality Traits of Conventional and Transgenic Lettuce (*Lactuca sativa* L.) at Harvesting by NMR Metabolic Profiling"
Journal of Agriculture and Food Chemistry, Vol. 58, Issue 11, pp. 6928-6936, 2010
DOI:10.1021/jf904439y
Impact Factor (2010): 2.816
Citations (Scopus): 20
Corresponding author
File name (pdf): 5. JAFC_58_6928_2010

6. D. Capitani, **L. Mannina**, N. Proietti , A.P. Sobolev, A. Tomassini, A. Miccheli, M.E. Di Cocco, G. Capuani, R. De Salvador, M. Delfini
"Monitoring of metabolic profiling and water status of Hayward kiwifruits by nuclear magnetic resonance"
Talanta, Vol. 82, pp. 1826-1838, 2010
DOI:10.1016/j.talanta.2010.07.080
Impact Factor (2010): 3.722
Citations (Scopus): 30
Corresponding author
Filename (pdf): 6. Talanta_82_1826_2010

7. M. D'Imperio, M. Gobbino, A. Picanza, S. Costanzo, A. Della Corte, **L. Mannina**
"Influence of Harvest Method and Period on Olive Oil Composition: an NMR and Statistical Study"
Journal of Agricultural and Food Chemistry, Vol. 58, pp.11043-11051, 2010
DOI:10.1021/jf1026982
Impact Factor (2010): 2.816
Citations (Scopus): 23
Filename (pdf):7. JAFC_58_11043

8. **L. Mannina**, A.P. Sobolev, S. Viel
"Liquid state ^{1}H high field NMR in food analysis"
Progress in Nuclear Magnetic Resonance Spectroscopy, Vol.66, pp. 1-39, 2012
DOI: 10.1016/j.pnmrs.2012.02.001
Impact Factor (2012): 6.022
Citations (Scopus): 89

Corresponding author
Filename (pdf): 8.Prog.Nucl.Magn.Res_66_1_2012

9. D. Capitani, A. P. Sobolev, A. Tomassini, F. Sciubba, F. R. De Salvador, **L. Mannina**, M. Delfini
"Peach Fruit: Metabolic Comparative Analysis of Two Varieties with Different Resistances to Insect Attacks by NMR spectroscopy"
Journal of Agricultural and Food Chemistry, Vol. 61, pp. 1718-1726, 2013
DOI: 10.1021/jf303248z
Impact Factor (2013): 3.107
Citations (Scopus): 27
Corresponding author
Filename (pdf): 9.JAFC_61_1718_2013

10. D. Capitani, **L. Mannina**, N. Proietti, A. P. Sobolev, A. Tomassini, A. Miccheli, M. E. Di Cocco, G. Capuani, F. R. De Salvador, M. Delfini
"Metabolic Profiling and Outer Pericarp Water State in Zespri, CI.GI and Hayward Kiwifruits"
Journal of Agricultural and Food Chemistry, Vol. 61, pp. 1727-1740, 2013
DOI: 10.1021/jf3028864
Impact Factor (2013): 3.107
Citations (Scopus): 20
Corresponding Author
Filename (pdf): 10. JAFC_61_1727_2013

11. M. Daglia, R. Antiochia, A.P. Sobolev, **L. Mannina**
"Untargeted and targeted methodologies in the study of tea (*Camellia sinensis* L.)"
Food Research International, Vol. 63, pp. 275-289, 2014,
DOI: 10.1016/j.foodres.2014.03.070
Impact Factor (2014): 2.818
Citations (Scopus): 20
Corresponding Author
Filename (pdf): 11. Food Res. Int._63_275_2014

12. D. Capitani, A.P. Sobolev, M. Delfini, S. Vista, R. Antiochia, N. Proietti, S. Bubici, G. Ferrante, S. Carradori, F.R. De Salvador, **L. Mannina**
"NMR methodologies in the analysis of blueberries"
Electrophoresis, Vol. 35, Issue 11, pp. 1615-1626, 2014
DOI: 10.1002/elps.201300629
Impact Factor (2014): 3.028
Citations (Scopus): 17
Corresponding author
Filename (pdf): Electrophoresis_35_1615_2014

13. **L. Mannina**, A. P. Sobolev, A. Di Lorenzo, S. Vista, G.C. Tenore, M. Daglia
"Chemical Composition of Different Botanical Origin Honeys Produced by Sicilian Black Honeybees (*Apis mellifera* ssp. *sicula*)
Journal of Agricultural and Food Chemistry, Vol. 63, pp. 5864-5874, 2015
DOI: 10.1021/jf506192s
Impact Factor (2015): 2.857
Citations (Scopus):10
Filename (pdf): 13. JAFC_63_5864_2015

14. F. Camin, A. Pavone, L. Bontempo, R. Wehrens, M. Paolini, A. Faberi, R.M. Marianella, D. Capitani, S. Vista, **L. Mannina**
"The use of IRMS, ^{1}H NMR and chemical analysis to characterise Italian and imported Tunisian olive oils"
Food Chemistry, Vol. 196, pp. 98–105, 2016
DOI: 10.1016/j.foodchem.2015.08.132
Impact Factor (2016): 4.529
Citations (Scopus): 9
Filename (pdf):14. Food Chemistry_196_98_2016

15. **L. Mannina**, A. P. Sobolev, E. Coppo, A. Di Lorenzo, S. M. Nabavi, A. Marchese, M. Daglia
"Antistaphylococcal activity and metabolite profiling of manuka honey (*Leptospermum scoparium* L.) after *in vitro* simulated digestion"
Food & Function, Vol. 7, pp. 1664-1670, 2016
DOI:10.1039/c5fo01409c
Impact Factor (2016): 3.247
Citations (Scopus): 4
Filename (pdf): 15. Food & Function_7_1664_2016

16. **L. Mannina**, F. Marini, R. Antiochia, S. Cesa, A. Magrì, D. Capitani, A. P. Sobolev
"Tracing the origin of beer samples by NMR and chemometrics: Trappist beers as a case study"
Electrophoresis, Vol. 37, pp. 2710-2719, 2016
DOI: 10.1002/elps.201600082
Impact Factor (2016): 2.744
Citations (Scopus): 2
Fil name (pdf): Electrophoresis_37_2710_2016

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