

Alma Balestrazzi - Curriculum Vitae

Born in Pietra de' Giorgi (Pavia), 10 November 1961. Degree with honours in Biology at the University of Pavia in 1985. PhD Degree in Genetics and Molecular Biology at the University of Pavia in 1994.

Scientific activity

1991. Awarded by an EMBO Short-Term Fellowship for a stage at the Cambridge Laboratories ("John Innes" Centre for Plant Science Research, Norwich, UK), Department of Molecular Genetics (Multinational *Arabidopsis* Genome Research Project). Awarded by a contract of guest scientist from the European Community for a further 3-month stage in the same laboratories. **1994.** Awarded by a Long-Term fellowship from the National Research Council. **1996-1998.** Awarded by a Post-Doctor Long-Term Fellowship at the University of Pavia. **2000-2014.** Research position (Plant Physiology) at the Department of Biology and Biotechnology (DBB) - University of Pavia. **2014.** Associate Professor in Plant Physiology at the Department of Biology and Biotechnology (DBB) - University of Pavia. *Reviewer activity* for several international peer-review journals. *Membership:* International Association for Plant and Cell Tissue Culture & Biotechnology (IAPTC&B), Italian Society of Plant Biology, Federation of European Societies of Plant Biology (FESPB), International Society for Seed Science (ISSS), Italian Society of Horticulture. Co-author of 108 papers *in extenso*, published on international journals peer-reviewed, 15 chapters on books and more than 100 communications to International and National Congresses. ORCID CODE: orcid.org/0000-0003-2003-4120. SCOPUS AUTHOR ID: 7003717835. h INDEX (SCOPUS) = 25. TOTAL CITATIONS (SCOPUS) = 2163

Editorial Activity

Topic Editor: **2020.** International Journal of Molecular Sciences (MDPI) - Special Issue: *Metabolic Processes during Seed Germination*. Topic Editors: A. Balestrazzi, L. Wojtyla (Adam Mickiewicz University, Poland), A. Pagano (University of Pavia, Italy) (www.mdpi.com/journal/ijms/special_issues/Seed_Germination). Frontiers in Plant Science - Research Topic: *New Insights into seed metabolites: from research to application*. Topic Editors: A. Balestrazzi, M. Chen (Northwest A and F University, Yangling, China), C. Silva-Sanchez (National Council for Air and Stream Improvement, USA) (www.frontiersin.org/research-topics/12893). **2018.** Frontiers in Plant Science - Research Topic: *The maintenance of genome integrity in plants: novel challenges in basic and applied research*. Topic Editors: A Balestrazzi, KO Yoshiyama (Tohoku University, Giappone), AN Sakamoto (Japan Atomic Energy Agency) (www.frontiersin.org/research-topics/8851). **2017.** Genes - Special Issue "DNA Damage Responses in Plants", Section "Plant Genetics and Genomics". Topic Editors: A. Balestrazzi, M. Donà (Gregor Mendel Institute - Austrian Academy of Science, Vienna Biocenter), Susana Araujo (Instituto de Tecnologia Química e Biológica António Xavier - ITQB-NOVA, Oeiras, Portugal) (www.mdpi.com/journal/genes/special_issues/). **2014-2015.** Frontiers in Plant Science - Research Topic: *Maintenance of genome integrity: DNA damage sensing, signaling and repair and replication in plants*. Topic Editors: A Balestrazzi, VMM Achary (ICGEB, India), A. Macovei (IRRI, Filippine), KO Yoshiyama (Kyoto Sangyo University, Giappone), AN Sakamoto (Japan Atomic Energy Agency) (www.frontiersin.org/research-topics/1612).

Book Editor: **2021.** *E-book: New Insights into seed metabolites: from research to application* - A Balestrazzi, M Chen, C Silva-Sanchez (Eds), Lausanne: Frontiers Media SA. doi: 10.3389/fps.2021.726800. *E-book: Maintenance of Genome Integrity in Plants: Novel Challenges in Basic and Applied Research* - A. Balestrazzi, K.O. Yoshiyama, A.N. Sakamoto (Eds), Lausanne: Frontiers Media SA. doi: 10.3389/fpls.2020.00585, **2020.** *New Challenges in Seed Biology: Basic and Translational Research Driving Seed Technology* - A Balestrazzi & S. Araujo (Eds), **2016.** InTech (www.intechopen.com). ISBN 978-953-51-2659-1. *E-book: Maintenance of Genome Integrity: DNA Damage Sensing, Signaling, Repair, and Replication in Plants*. Editors: Balestrazzi

A, Achary VMM, Macovei A, Yoshiyama KO and Sakamoto AN. **2016**. Lausanne: Frontiers Media. doi: 10.3389/978-2-88919-820-7

Member of Editorial Board

BMC Plant Biology (IF₂₀₂₀ 4.215). 2019-present, Associate Editor, Section *Reproductive Biology* (www.bmcplantbiol.biomedcentral.com/about/editorial-board).

Frontiers in Plant Science (IF₂₀₂₀ 5.440). 2016-present. Associate Editor, Section *Plant Breeding* (www.frontiersin.org/journals/plant-science/sections/plant-breeding). 2021-presente. Review Editor per la Sezione *Plant Physiology* (<https://loop.frontiersin.org/people/80235/overview>).

Seeds. 2017-presente. Member of Editorial Board (www.mdpi.com/journal/seeds)

Congresses/Workshops organization

Session Chair - XIV FISV Congress. Rome, 20th-23th September 2016. *Member of the Scientific Committee* - 110th Congress of the Italian Society of Botany. Pavia, 14th -18th September 2015. *Session Chair*. Target Meeting "Genome instability and DNA repair" - Online Symposium, 25th April 2012 (<http://www.targetmeeting.com>). *Member of Executive Board* - Joint Meeting of Working Groups (Cellular and Molecular Biology, Biotechnology and Differentiation) of the Italian Society of Botany. Pavia, 14th -16th June 2000.

Invited Speaker

- ASA-CSSA-SSA International Annual Meeting, Salt Lake City, Utah (U.S.A.). Special Symposium "Basic and Translational Research on Postharvest Maintenance and Assessment of Seed Quality". 7-10 Novembre **2021**. Seminar: *The challenges of seed priming: from basic to translational research* • Tech Share Day 2021, Environmentally Sound Technologies, University of Pavia. 5 Maggio **2021**. Seminar: *Sustainable seed priming: a tool to address the EU Green Deal Challenges*
- Winter school "Seed Functional Ecology 2021", University of Pavia. 29 Gennaio **2021**. Seminar: *Seed priming: basics and challenges* • University of Innsbruck (Austria), Botanical Colloquium. 27 Gennaio **2021**. Seminar: *Seed quality examined through the lens of genome integrity* • Institute of Plant Science, Paris-Saclay, Parigi (Francia). 5 Aprile **2019**. Seminar: *Understanding how seeds cope with genotoxic stress: a case study in *Medicago truncatula** • Institute of Plant Genetics - Polish Academy of Science. *Integrative Plant Biology IPG PAS Conference*, Poznan (Polonia), 7-9 Novembre **2018**. Seminar: *The DNA damage response in the context of seed germination: lesson from the model legume *Medicago truncatula** • CEITEC - Central European Institute of Technology. Brno (Repubblica Ceca), 15 Novembre **2016**. Seminar: *Role of tyrosyl-DNA phosphodiesterases in DNA damage response and abiotic stress tolerance* • Academy of the Sciences of the Czech Republic, Institute of Experimental Botany. Praga (Repubblica Ceca), 14 Novembre **2016**. Seminar: *Role of tyrosyl-DNA phosphodiesterases in DNA damage response and abiotic stress tolerance*.

Research grants (PI)

- "Nakuru, Kenya: valorization of local seeds and their resilience", ID: Rif. 2021-3223 (**2021-2022**). Call for Innovators - Sustainable Food and Agriculture (Coopen Action) - Cariplo Foundation and Fondazione Compagnia di San Paolo. Role: Head of the Research Unit UNIPV-SEEDTEAM. Partner: SlowFood Foundation for Biodiversity.
- "Recover and valorization of the Lombardy ecotype "peperone di Voghera (RECUPEVO)" (**2021-2022**). Lombardy Region, FEASR Call. Role: Head of Research Unit-UNIPV. Partners: CREA, CNR-IBBA.
- "Understanding kinetin-mediated seed priming in *Medicago truncatula* to disclose novel hallmarks of seed vigour", ID: EPIC-XS-0000059 (**2019-2021**). Union Horizon 2020 Work programme, European Proteomics Infrastructure Consortium - Providing Access (EPIC-XS). Role: Principal Investigator. Partners: ITQB-Universidade Nova de Lisboa (Portugal).

- “Seed wake-up with aptamers: a new technology for dormancy release and improved seed priming strategy (WAKE-APT)”, ID: Rif. 2016-0723 (www.wake-apt.it) (2017-2020). CARIPLO Foundation. Role: Head of Research Unit. Partners: CREA, University of Milan.
- Action 1 - “Advanced Seed Priming Technologies for the Lombardy Agro-Seed Industry (PRIMTECH)”, ID: 43448533 (2013-03939) (www.unipv.it/primtech) (2014-2015). Lombardy Region. Role: Coordinator. Partners: CREA, ATLAS srl Seed Technology, Apsovsementi SPA.
- Action 2 - “Advanced Seed Priming Technologies for the Lombardy Agro-Seed Industry (PRIMTECH)”, ID: 46547514 (www.unipv.it/primtech) (2014-2015). Lombardy Region. Role: Coordinator. Partners: CREA.
- Action 3 - “Advanced Seed Priming Technologies for the Lombardy Agro-Seed Industry (PRIMTECH)”, ID: Rif. 2013-1727 (www.unipv.it/primtech) (2014-2015). CARIPLO Foundation. Role: PI.
- “Conservation, characterization and induction of variability in rose in order to optimize breeding (MUTROS)” (2011-2012). MPAAF (Bando OIGA-Osservatorio per l’Imprenditorialità Giovanile in Agricoltura). Role: PI. Partners: CREA, University of Turin, NIRP International s.s..
- “Cross-talk between organelles in the oxidative stress defence and programmed cell death in plants” (2004-2006) PRIN-MIUR. Role: Head of Research Unit. Partners: University of Bari, University Padua, University of Molise.

Research grants (participant)

- “Exploring the diversity of soil microbes and their biomolecules in Victoria Land - MicroBiomaA-S” PNRA18_00015 - E (2019-2021), CNR. Role: Member of Research Unit.
- “Unraveling post-transcriptional regulation of seed development in common bean” (2016-2018) Fundação para a Ciência e Tecnologia. Post-Doctoral grant application (SFRH/BPD/108032/2015 - Principal Investigator Dott. Susana Araujo). Collaborative Project ITQB-NOVA (Portugal) and University of Pavia. Role: Co-supervision of research activity.
- “The Native Seed Science, Technology and Conservation Initial Training Network (NASSTEC)” (2013-2016) (www.nasstec.eu), Marie Curie Multi-Partner Initial Training Network-ITN. Role: Member of Research Unit/PhD management. Joint Supervision (Alma Balestrazzi, Hugh Pritchard) of Early Stage Researcher 6B-Seed longevity in storage.
- “Physical Mutagenesis for the Genetic Improvement of commercial varieties in ornamental species of geranium, gerbera and poinsettia (MUTAFLO)” (2009-2011) MIPAAF. Role: Member of Research Unit.
- “Innovative strategies for the phytoremediation of heavy-metals polluted areas” (2003-2005) PRIN-MIUR. Role: Member of Research Unit.

Networking

Member of **COST Action FA1306 - The Quest for Tolerant and Stable Varieties - Phenotyping at Plant and Cellular Level** (2013-2017) (www.cost.eu/COST_Actions/fa/FA1306), WG2-Phenotyping at cell level. Member of **COST Action CM1201 - Biomimetic Radical Chemistry** (2012-2016) (www.cost.eu/COST_Actions/cmst/CM1201), WG2-Models of DNA damage and consequences.

Main Research Topics

1.Pre-germinative metabolism: impact of DDR (DNA Damage Response) on seed quality.
The pre-germinative metabolism, one of the most fascinating aspects of seed biology, is triggered during early germination. At this stage, specific molecular events not only allow the transition from quiescence to active proliferation but also contribute to define seed quality. In this context, the seed antioxidant response prevents accumulation of the cytotoxic reactive oxygen specie. In parallel, complex molecular networks (DNA Damage Response) are able to monitor the level of DNA damage as well as to activate dedicated repair pathways. This research activity, carried using the model legume *Medicago truncatula*, has brought to the isolation and characterization, for the first time in the plant kingdom, of the *Tdp* genes encoding the different isoforms of tyrosyl-DNA

phosphodiesterases 1 and 2, actors in the BER (base excision repair) and NER (nucleotide excision repair) pathways essential for the removal of DNA lesions caused by the enzymes DNA topoisomerases I and II. The *Tdp* genes are involved in the pre-germinative metabolism and, more in general, the plant response to genotoxic stress accumulated under adverse environmental conditions (osmotic stress, heavy metal pollution). The characterization of *M. truncatula* transgenic lines with altered *Tdp1* and *Tdp2* gene function has highlighted the crucial role of nucleolus as stress sensor *in planta*. This research is based on the use of integrated approaches such as gene silencing, RNA Seq/qRT-PCT, genotoxicity test (Comet assay), metabolomics and proteomics.

2. Seed priming: basic and applied research for the development of molecular indicators.

The study of DNA repair in the context of pre-germinative metabolism have been expanded to experimental systems (model and crop species) to monitor the seed response to pre-sown or vigorization treatments ("seed priming"). A typical priming protocol is made of two distinct phases: *i*) seed imbibition under controlled conditions, in order to delay water entry end to expand the temporal window in which DNA repair is active; *ii*) dehydration (dry-back), in order to reach the original water content of the dry seed, after dry-back the primed seeds can be stored or used immediately. The seed industry currently relies on the use of empirical priming protocols, with low reproducibility since the observed responses are strictly genotype- and lot-dependent. The expression profiles of DDR and antioxidant genes are monitored during different types of priming treatments (hydropriming, osmopriming, hormopriming) and subsequently during dry-back. Metabolomics applied to both seeds treated with priming or seeds challenged with genotoxic stress has allowed to develop innovative protocols for assessing genome stability. Molecular indicators have been identified to be used for the early diagnosis of seed quality and the optimization of priming protocols.

Collaborations with International Institutions: • Susana De Sousa Araújo, Pedro Salema Fevreiro - Instituto de Tecnologia Química e Biológica António Xavier - Universidade Nova de Lisboa (ITQB-NOVA), Oeiras, Portugal. • Alexandros G. Georgakilas - DNA Damage Laboratory, Department of Physics, School of Applied Mathematical and Physical Sciences, National Technical University of Athens (NTUA), Athens, Greece. • Ayako N. Sakamoto - Department of Radiation-Applied Biology Research, National Institutes for Quantum and Radiological Science and Technology, Takasaki, Gunma, Japan. • Moussa Benhamed, Cécile Reynaud - Equipe Chromosome Dynamics, Institute of Plant Sciences Paris-Saclay, IPS2, CNRS-INRA-University of Paris Sud, Paris-Diderot and Evry, University of Paris-Saclay, Gif-sur-Yvette, France. • Jorge Paiva - Institute of Plant Genetics, Department of Integrative Plant Biology, Polish Academy of Sciences, Poznan, Poland

Companies: ISI Sementi S.p.a. Tokita Seeds. Bio Basic Europe S.r.l., BCL3-Campus of Technology & Innovation (Portugal)

Teaching activity

Bachelor and Master Degrees. 1997/1998. Plant Biotechnology, University of Ferrara. 2001/2004. Plant Biotechnology, University of Pavia. 2005/2007. Plant Biotechnology and Plant Physiology, University of Pavia. Plant Molecular Physiology, University of Modena and Reggio Emilia. 2019. Plant Physiology, University of Pavia. 2009/2019. Molecular Techniques for the Conservation of Biodiversity, University of Pavia. 2014/2019. Plant Molecular Biology and Biotechnology, University of Pavia. 2015/2017 Applied Plant Molecular Techniques and Laboratory, University of Pavia.

PhD. Doctorate program in Genetics, Molecular and Cellular Biology, University of Pavia - Member of the Proponents Board, PhD thesis supervision. External Reviewer for PhD thesis (University of Innsbruck, Austria; CSIR-Institute of Himalayan Bioresource Technology, Palamopur, India; Guru Nanak Dev University, Amritsar-Punjab, India). External Advisor, International PhD Plants for Life ITQB-Nuova Università di Lisbona (Oeiras-Portogallo), project PD/BD/13474/2015.