• PERSONAL INFORMATION

Family name, First name: Moschou, Panagiotis Marital status: Married (2 children) Email: Panagiotis.moschou@slu.se

• CURRENT POSITIONS

2018-present: Associate Professor (Molecular Plant Physiology), Department of Biology, University of Crete, Greece

2016-present: Group Leader (Assoc. Prof.), Department of Plant Biology, Uppsala BioCentrum, Swedish University of Agricultural Sciences

• CAREER BREAKS

Total Leave of 19 months from active research **2009-2010:** Compulsory Military Service (Infantry Cyprus Unit, 9 months; 275 days) **2015-2017:** Parental Leave (10 months; 296 days)

• PREVIOUS POSITIONS AND EDUCATION

2016: Sabbatical leave, The Sainsbury Lab, UK England. Group of Prof. Jonathan Jones2013-2015: Researcher, Department of Plant Biology, Swedish University of Agricultural Sciences, Sweden. Group of Prof. Peter V. Bozhkov.

2010-2013: Postdoctoral Fellow, Department of Plant Biology, Swedish University of Agricultural Sciences, Sweden. Group of Prof. Peter V. Bozhkov.

2012: Visiting Scientist, Durham University, England UK. Group of Prof. Patrick Hussey.

2008: Visiting Student, Department of Plant Molecular Genetics, CSIC, Spain. Group of Prof. Sánchez-Serrano JJ.

2009: <u>PhD</u>/Biology/University of Crete, Greece

2006: MSc, Plant Biotechnology, University of Crete, Greece

2004: Diploma (with honours) in Biology, National and Kapodistrian University of Athens, Greece

• SCIENTIFIC RECOGNITION

2018 Distinction: Finalist of European Research Council StG 2018 and recipient of A-score "Fully meets the excellence criterion and should be funded if available funds are available"

2018 Distinction: Sole Nominee of the Department of Plant Biology, SLU, Sweden for "Excellence and Innovation" Medal (to young scientists)

2018 Distinction: Highlighted plant biologist from the journal "Developmental Biology"

2017 Distinction: Finalist of European Research Council StG 2017 and recipient of A-score "Fully meets the excellence criterion and should be funded if available funds are available"

2016 Prize: Newly appointed academic prize, Society of Experimental Biology (SEB)

2015 Distinction: Fellow of the Marie Curie (MCSA) Horizon2020

2014 Distinction: Scandinavian Society of Plant Physiology (SSPP Interview)

2014 Award: Federation of European Societies of Plant Biology (FESPB Award)-Top European young researcher (age below 35)

2013 Distinction: Scandinavian Society of Plant Physiology (SSPP), Scandinavian representative for FESPB

2011 Distinction: Thesis tribute from the Federation of European Societies of Plant Biology (bulletin) **2009 Distinction**: Selected as the representative for the Hellenic Society of Plant Biology (FESPB award)

2004-2006 Prize: top student (National Foundation of Scholarships, Greece)

2005 Award: for Master Thesis, Biology, University of Crete, Greece

• **GRANTS**

He has obtained grants from the Swedish Research Council VR and FORMAS, Carl Tryggers Foundation, Wallenberg Foundation, SLU, and EU (total of 5 million euro and share for the lab >1.5

million euro)

• **FELLOWSHIPS**

As promoter:

2018: Chinese Government (promoter for an Assistant Professor, Sabbatical Leave)

2018: HEC Program, Pakistanian Government (promoter for one visiting student)

2017: ERASMUS EU Hungary (promoter for one visiting student)

2017: ERASMUS+ (promoter for two visiting students)

2016-2017: STSM EU PROTEOSTASIS (promoter for two visiting students, received twice) <u>As recipient:</u>

2015: Individual Fellowship: Marie Curie (MCSA) Horizon2020. 183 k€

2011-2012: Postdoctoral Independent Fellowship: Swedish Research Council VR Postdoctoral Grant. 200 k€

2007: Short-Term Fellowship, EU COST Action. Department of Plant Molecular Genetics, CSIC, Spain. 3 k€

• SUPERVISION OF GRADUATE STUDENTS AND POSTDOCTORAL FELLOWS

He has supervised >30 *students or postdocs, as follows*

2017-present: Currently supervising 3 postdoctoral fellows as main supervisor, 2 PhD student as main supervisor, 3 PhD students as deputy supervisor, 1 visiting PhD, 1 master student as main supervisor and 2 as deputy supervisor

2016-2017: Supervised 5 pre-doctoral students, 1 project student

2012-2016: Main supervisor for 1 Bachelor and deputy supervisor for 5 PhD students and postdoctoral fellow

2008-2012: Advisor for 1 Bachelor, 4 Master students (one Thesis prize)

• TEACHING ACTIVITIES (2015 onwards)

2018 Lecturer: "Cell communication", Uppsala BioCentrum, Sweden

2018 Lecturer: "Cell differentiation", Uppsala BioCentrum, Sweden

2018 Lecturer: Master Courses in Plant Biotechnology, University of Crete, Greece

2017 Course Organizer and lecturer: "Genome editing by CRISPR in theory and practise", Uppsala BioCentrum, Sweden

2014-2015 Lecturer: "Confocal microscopy-In silico analyses", Swedish University of Agricultural Sciences, Sweden

• ORGANISATION OF SCIENTIFIC MEETINGS

2017: International Conference Session Organizer, Society of Experimental Biology (SEB), Plant Cell Biology Session, Gothenburg, Sweden
 2017: Organizer of seminar series "At the Forefront of CRISPR" Uppsala, Sweden

• COMMISSIONS OF TRUST

2018:	Invited panel member reviewer for VR Swedish Research Council (declined
	assignment in 2018 due to conflicting interest)
2018:	PhD education steering committee, Linnean Plant Science Center, Sweden
2018:	Opponent for 1 PhD student, Technological University of Cyprus
2016-present:	Reviewer for proposals/European Union-Horizon 2020, Biotechnology and
	Biological Sciences Research Council (BBSRC) of UK
	Expert Advisor/Research Misconduct/Journal of Experimental Botany
	Reviewer for proposals/
	Recruitment Board for Professors/Agricultural University of Athens/Greece
2015-2018:	Reviewer Panel [three-year tenure]/Journal of Experimental Botany
2014-present:	Review Editor/Frontiers in Cell and Developmental Biology

2013-present: Reviewer for proposals/Research Foundation-Flanders (FWO), Belgium 2010-present: Reviewer for international peer-reviewed journals: Plant Cell, Cell Death and Differentiation, New Phytologist, Plant Physiology, Plant Journal, Plant and Cell Physiology, Journal of Experimental Botany, Plos One, Frontiers in Cell and Developmental Biology, Frontiers in Plant Science, Frontiers in Ecology and Evolution, Environmental and Experimental Botany, BMC Plant Biology, International Journal of Molecular Sciences, Journal of Plant Physiology, Acta Physiologiae Plantarum, Plant Science, World Journal of Medicine and Medical Research, Functional Plant Biology, Gene, Molecules, Frontiers in Pharmacology, Microbes, PeerJ, Plant Cell and Tissue Culture

• MEMBERSHIP IN PROFESSIONAL SOCIETIES AND NETWORKS

Research Network "Linnean Centre of Plant Biology in Uppsala"; Research Network "COST Action BM1307-Plant Proteostasis; Scientific Society "European Plant Science Organisation (EPSO); Research Network "European Network for Plant Endomembrane Research (ENPER); Research Network "Plant Protease and Cell Death (PPCD); Elected Member, Scientific Society "Hellenic Society of Biochemistry and Molecular Biology (EEBMB); Scientific Society "Federation of European Biochemical Societies (FEBS), Scientific Society "Society of Experimental Biology (SEB), Scientific Society "The Swedish Developmental Biology Organization (SWEDBO); Scientific Society "Federation of European Societies of Plant Biology (FESPB); network "Linnean plant science centre in Uppsala".

• INVITED PRESENTATIONS AT CONFERENCES, WORKSHOPS AND INSTITUTES (RECENT)

>35 contributions, including 15 oral talks of which 14 were upon invitation

Moschou PN. 2018. New Phytologist Trust-Proteases. Durham UK (only 20 group leaders invited). **Moschou PN.** 2018. PhD symposium in CRAG, Barcelona, Spain. **Moschou PN.** 2016. Size regulation of plant organs. SBF1011, Tubingen, Germany; **Moschou PN.** 2016. ENPER meeting, Bordeaux, France (Chair); **Moschou PN.** 2015. Organ size regulation in plants. JIC, England UK; **Moschou PN.** 2014. Separase promotes microtubule rescue and vesicle trafficking by activating CENP-E kinesins; **Moschou PN.** 2014. Engineering plant tolerance through catabolic processes ENPER network meeting, Lecce, Italy; **Moschou PN.** 2014. FESPB award winner talk. FESPB conference. Dublin, Ireland; **Moschou PN.** 2014. Finding the missing links between cell division and cell expansion. Linnean Centre workshop, Uppsala, Sweden; **Moschou PN.** 2014. Proteases: Natural born killers or healers? ETH, Zurich, Switzerland; **Moschou PN.** 2013. Shaping Organisms. Leicester University, UK

• TOTAL NUMBER OF PUBLICATIONS IN JOURNALS

45 of which **39** in international journals (13 as 1^{st} author and 5 as last author-publication history 2008-2018 with two long-term leaves from active research). He has also contributed six book chapters of which three as first author and >40 abstracts in conferences. Total citations: **1,789**

https://scholar.google.se/citations?user=3Bhex0wAAAAJ&hl=en

H-index: **20** (15 corresponding authorships). Pubmed link

The five most representative [Star (*): Corresponding author]:

1. Minina EA, Reza SH, Gutierrez-Beltran E, Elander PH, Bozhkov PV, <u>Moschou PN</u>* (2017). The Arabidopsis homolog of Scc4/MAU2 is essential for embryogenesis. *Journal of Cell Science*, 15: 1051-1063. [Times Cited 2]

Highlighted as a paper of high interest: Minina EA,..., <u>Moschou PN</u> (2017). **Development**, 144:e1.2-e1.2.

2. *<u>Moschou PN</u>, Gutiérrez Beltrán E, Bozhkov PV, Smertenko A (2016). Separase Promotes

Microtubule Polymerization by Activating CENP-E-Related Kinesin Kin7. *Developmental Cell*, 37:350 [Times Cited 15]

Highlighted in: Muller S (2017). Linking Separase to Microtubule Dynamics. Developmental Cell, 37: 295-296, and by a press release from Scandinavian Society of Plant Physiology (SPPS)

3. Gutierrez-Beltran E, *<u>Moschou PN</u>, Smertenko AP, Bozhkov PV (2015). Tudor Staphylococcal Nuclease Links Formation of Stress Granules and Processing Bodies with mRNA Catabolism in Arabidopsis. *Plant Cell*, 27:927. [Times Cited 31]

4. *<u>Moschou PN</u>, Smertenko AP, Minina EA, Fukada K, Savenkov EI, Robert S, Hussey PJ, Bozhkov PV (2013). The Caspase-Related Protease Separase (ESP) Controls Cell Polarity and Cytokinesis in Arabidopsis. *Plant Cell*, 25:217. [Times Cited 28]

5. <u>Moschou PN</u>, Paschalidis KA, Delis ID, Andriopoulou AH, Lagiotis GD, Roubelakis-Angelakis KA (2008). Spermidine Exodus and Oxidation in the Apoplast Induced by Abiotic Stress is Responsible for H2O2 Signatures that Direct Tolerance Responses in Tobacco. *Plant Cell*, 20:1708 [Times Cited 201]

When corresponding indicated by §

<u>2018</u>

1. Ma Y., Guo H., Hu L., Pons Martinez P., **Moschou P.N.**, Cevik V., Ding P., Duxbury Z., Sarris P.F., Jones J.D.G. 2018 Distinct modes of derepression of an Arabidopsis immune receptor complex by two different bacterial effectors. *Proceedings of the National Academy of Sciences doi.org/10.1073/pnas.1811858115*

2. §Liu C., Moschou P.N. Cutting in the middleman: hidden substrates at the interface between proteases and plant development. *New Phytologist 10.1111/nph.14501*

3. §Liu C., **Moschou P.N.** Phenotypic novelty by CRISPR in plants. *Developmental Biology* 10.1016/j.ydbio.2018.01.015

4. Minina E.A., **Moschou P.N.**, Vetukuri R.R., Sanchez-Vera V., Cardoso C., Liu Q., Elander P.H., Dalman K., Beganovic M., Lindberg Yilmaz J., Marmon S., Shabala L., Suarez M.F., Ljung K., Novák O., Shabala S., Stymne S., Hofius D., Bozhkov P.V. Transcriptional stimulation of ratelimiting components of the autophagic pathway improves plant fitness. *Journal of Experimental Botany* 10.1093/jxb/ery010

5. §Moschou P.N.Determination of di–/polyamine oxidase activity in plants by an in-gel spermidine oxidation assay. Methods in Molecular Biology 10.1007/978-1-4939-7398-9_14

6. Dolfors F., Holmquist L., **Moschou P.N.**, Dixelius C., Tzelepis G. The Rhizoctonia solani LysM and RlpA-like effector proteins contribute to virulence suppressing chitin-triggered immunity and hypersensitive response. *Biorxiv* 10.1101/395582

<u>2017</u>

7. §Minina E.A., Moschou P.N., Bozhkov P.V. Limited and digestive proteolysis: crosstalk between evolutionary conserved pathways. *New Phytologist 10.1111/nph.14627*

8. §Minina E.A., Reza S.H., Gutierrez-Beltran E., Elander P.H., Bozhkov P.V., **Moschou P.N.** The Arabidopsis homolog of Scc4/MAU2 is essential for embryogenesis. *Journal of Cell Science* 10.1242/jcs.196865

9. Highlight in Development: The Arabidopsis homolog of Scc4/MAU2 is essential for embryogenesis. Minina E.A., Reza S.H., Gutierrez-Beltran E., Elander P.H., Bozhkov P.V., **Moschou P.N.** *Development*, *144:e1.2-e1.2*

10. §Liu C., Stael S., Gevaert K., Van Breusegem F., Bozhkov P.V., **Moschou P.N.** The Proteolytic Landscape of an Arabidopsis Separase-Deficient Mutant Reveals Novel Substrates Associated With Plant Development. *Biorxiv* 10.1101/140962

<u>2016</u>

11. §Gémes K., Kim Y.J., Park K.Y., **Moschou P.N.,** Andronis E., Valassaki C., Roussis A., Roubelakis-Angelakis K.A. An NADPH-oxidase/polyamine oxidase feedback loop controls oxidative burst under salinity. *Plant Physiology 10.1104/pp.16.01118*

12. §Moschou P.N., Savenkov E.I., Minina E.A., Fukada K., Reza S.H., Gutierrez-Beltran E., Sanchez-Vera V., Suarez M.F., Hussey P.J., Smertenko A.P., Bozhkov P.V. EXTRA SPINDLE POLES (Separase) controls anisotropic cell expansion in Norway spruce (Picea abies) embryos independently of its role in anaphase progression. *New phytologist* 10.1111/nph.14012

13. **§Moschou P.N.,** Gutierrez-Beltran E., Bozhkov P.V., Smertenko A. Separase Promotes Microtubule Polymerization by Activating CENP-E-Related Kinesin Kin7. *Developmental Cell* 10.1016/j.devcel.2016.04.015

14. Mellidou I., Moschou P.N., Ioannidis N.E., Pankou C., Gemes K., Valassakis C., Andronis E.A., Beris D., Haralampidis K., Roussis A., Karamanoli A., Matsi T., Kotzabasis K., Constantinidou H.-I., Roubelakis-Angelakis K.A. Silencing S-adenosyl-L-methionine decarboxylase (SAMDC) in Nicotiana tabacum points at a polyamine-dependent trade-off between growth and tolerance responses. *Frontiers in Plant Science 10.3389/fpls.2016.00379*

15. Zhu T., **Moschou P.N.**, Alvarez J.M., Sohlberg J.J., Arnold S. WUSCHEL-RELATED HOMEOBOX 2 is important for protoderm and suspensor development in the gymnosperm Norway spruce. *BMC Plant Biology 10.1186/s12870-016-0706-7*

16. Smertenko A., **Moschou P.N.,** Zhang L., Fahy D., Bozhkov P. Characterization of cytokinetic mutants using small fluorescent probes. *Methods in Molecular Biology* 10.1007/978-1-4939-3142-2_15

<u>2015</u>

17. §Gutierrez-Beltran E., **Moschou P.N.**, Smertenko A.P., Bozhkov P.V. Tudor staphylococcal nuclease links formation of stress granules and processing bodies with mRNA catabolism in arabidopsis. *Plant Cell* 10.1105/tpc.114.134494

18. Gutiérrez-Beltran E., Bozhkov P.V., **Moschou P.N.** Tudor staphylococcal nuclease plays two antagonistic roles in RNA metabolism under stress. *Plant Signaling and Behavior 10.1080/15592324.2015.1071005*

19. Alvarez J.M., Sohlberg J., Engström P., Zhu T., Englund M., **Moschou P.N.**, von Arnold S. The WUSCHEL-RELATED HOMEOBOX 3 gene PaWOX3 regulates lateral organ formation in Norway spruce. *New Phytologist 10.1111/nph.13536*

<u>2014</u>

20. Andronis E.A., **Moschou P.N.**, Toumi I., Roubelakis-Angelakis K.A. Peroxisomal polyamine oxidase and NADPH-oxidase cross-talk for ROS homeostasis which affects respiration rate in Arabidopsis thaliana. *Frontiers in Plant Science* 10.3389/fpls.2014.00132

21. §Moschou P.N., Roubelakis-Angelakis K.A. Polyamines and programmed cell death. *Journal of Experimental Botany 10.1093/jxb/ert373*

22. Zhu T., **Moschou P.N.**, Alvarez J.M., Sohlberg J.J., Von Arnold S. WUSCHEL-RELATED HOMEOBOX 8/9 is important for proper embryo patterning in the gymnosperm Norway spruce. *Journal of Experimental Botany 10.1093/jxb/eru371*

<u>2013</u>

23. §Moschou P.N., Smertenko A.P., Minina E.A., Fukada K., Savenkov E.I., Robert S., Hussey P.J., Bozhkov P.V. The caspase-related protease separase (EXTRA SPINDLE POLES) regulates cell polarity and cytokinesis in arabidopsis. *Plant Cell 10.1105/tpc.113.113043*

24. Minina E.A., Sanchez-Vera V., Moschou P.N., Suarez M.F., Sundberg E., Weih M., Bozhkov P.V. Autophagy mediates caloric restriction-induced lifespan extension in Arabidopsis. *Aging Cell 10.1111/acel.12048*

<u>2012</u>

25. Moschou P.N., Wu J., Cona A., Tavladoraki P., Angelini R., Roubelakis-Angelakis K.A. The polyamines and their catabolic products are significant players in the turnover of nitrogenous molecules in plants. *Journal of Experimental Botany 10.1093/jxb/ers202*

26. Moschou P.N., Bozhkov P.V. Separases: Biochemistry and function. *Physiologia Plantarum* 10.1111/j.1399-3054.2011.01550.x

27. *Fincato P., ***Moschou P.N.**, *Ahou A., Angelini R., Roubelakis-Angelakis K.A., Federico R., Tavladoraki P. The members of Arabidopsis thaliana PAO gene family exhibit distinct tissue- and organ-specific expression pattern during seedling growth and flower development. *Amino Acids 10.1007/s00726-011-0999-7 (*equal contributors)*

<u>2011</u>

28. Tisi A., Federico R., Moreno S., Lucretti S., **Moschou P.N.,** Roubelakis-Angelakis K.A., Angelini R., Cona A. Perturbation of polyamine catabolism can strongly affect root development and xylem differentiation. *Plant Physiology 10.1104/pp.111.173153*

29. §Moschou P.N., Roubelakis-Angelakis K.A. Characterization, assay, and substrate specificity of plant polyamine oxidases. *Methods in molecular biology (Clifton, N.J.)* 10.1007/978-1-61779-034-8_11

30. Fincato P., **Moschou P.N.**, Spedaletti V., Tavazza R., Angelini R., Federico R., Roubelakis-Angelakis K.A., Tavladoraki P. Functional diversity inside the Arabidopsis polyamine oxidase gene family. *Journal of Experimental Botany* 10.1093/jxb/erq341

<u>2010</u>

31. Paschalidis K.A., Toumi I., **Moschou P.N.**, Roubelakis-Angelakis K.A. ABA-dependent amine oxidases-derived H2O2 affects stomata conductance. *Plant Signaling and Behavior* 10.4161/psb.5.9.12679

32. Wu J., Shang Z., Wu J., Jiang X., **Moschou P.N.,** Sun W., Roubelakis-Angelakis K.A., Zhang S. Spermidine oxidase-derived H2O2 regulates pollen plasma membrane hyperpolarization-activated Ca2+-permeable channels and pollen tube growth. *Plant Journal 10.1111/j.1365-313X.2010.04301.x*

33. §Toumi I., **Moschou P.N.**, Paschalidis K.A., Bouamama B., Ben Salem-fnayou A., Ghorbel A.W., Mliki A., Roubelakis-Angelakis K.A. Abscisic acid signals reorientation of polyamine metabolism to orchestrate stress responses via the polyamine exodus pathway in grapevine. *Journal of Plant Physiology 10.1016/j.jplph.2009.10.022*

34. §Moschou P.N., Roubelakis-Angelakis K.A. Polyamines in grapevine research. *Methodologies and Results in Grapevine Research 10.1007/978-90-481-9283-0_13*

<u>2009</u>

35. Paschalidis K.A., **Moschou P.N.**, Aziz A., Toumi I., Roubelakis-Angelakis K.A. Polyamines in grapevine: An update. *Grapevine Molecular Physiology and Biotechnology: Second Edition* 10.1007/978-90-481-2305-6_8

36. Loulakakis K.A., Morot-Gaudry J.F., Velanis C.N., Skopelitis D.S., **Moschou P.N.,** Hirel B., Roubelakis-Angelakis K.A. *Advancements in nitrogen metabolism in grapevine Grapevine Molecular Physiology and Biotechnology: Second Edition 10.1007/978-90-481-2305-6_7*

37. Labboun S., Tercé-Laforgue T., Roscher A., Bedu M., Restivo F.M., Velanis C.N., Skopelitis D.S., **Moschou P.N.**, Roubelakis-Angelakis K.A., Suzuki A., Hirel B. Resolving the role of plant glutamate dehydrogenase. I. In vivo real time nuclear magnetic resonance spectroscopy experiments. *Plant and Cell Physiology 10.1093/pcp/pcp155*

38. Paschalidis K.A., **Moschou P.N.**, Toumi I., Roubelakis-Angelakis K.A. Polyamine anabolic/catabolic regulation along the woody grapevine plant axis. *Journal of Plant Physiology* 10.1016/j.jplph.2009.03.013

39. Moschou P.N., Sarris P.F., Skandalis N., Andriopoulou A.H., Paschalidis K.A., Panopoulos N.J., Roubelakis-Angelakis K.A. Engineered polyamine catabolism preinduces tolerance of tobacco to bacteria and oomycetes. *Plant Physiology 10.1104/pp.108.134932*

<u>2008</u>

40. Moschou P.N., Sanmartin M., Andriopoulou A.H., Rojo E., Sanchez-Serrano J.J., Roubelakis-Angelakis K.A. Bridging the gap between plant and mammalian polyamine catabolism: A novel peroxisomal polyamine oxidase responsible for a full back-conversion pathway in Arabidopsis. *Plant Physiology 10.1104/pp.108.123802*

41. Moschou P.N., Delis I.D., Paschalidis K.A., Roubelakis-Angelakis K.A. Transgenic tobacco plants overexpressing polyamine oxidase are not able to cope with oxidative burst generated by abiotic factors. *Physiologia Plantarum 10.1111/j.1399-3054.2008.01049.x*

42. Moschou P.N., Paschalidis K.A., Delis I.D., Andriopoulou A.H., Lagiotis G.D., Yakoumakis D.I., Roubelakis-Angelakis K.A. Spermidine exodus and oxidation in the apoplast induced by abiotic stress is responsible for H2O2 signatures that direct tolerance responses in tobacco. *Plant Cell* 10.1105/tpc.108.059733

43. Toumi I., Gargouri M., Nouairi I., **Moschou P.N.**, Salem-Fnayou A.B., Mliki A., Zarrouk M., Ghorbel A. Water stress induced changes in the leaf lipid composition of four grapevine genotypes with different drought tolerance. *Biologia Plantarum 10.1007/s10535-008-0035-2*

44. Moschou P.N., Paschalidis K.A., Roubelakis-Angelakis K.A. Plant polyamine catabolism: The state of the art. *Plant Signaling and Behavior.* 10.4161/psb.3.12.7172

• PATENTS

P41503887SE00. Bozhkov P, Minina A, Stymne S, <u>Moschou PN</u>, Hofius D; "Improving plant fitness through autophagy".