

PROFESSOR
ANDREAS BÖRNER

DOCTOR HONORIS CAUSA
UNIVERSITATIS
STUDIORUM NATURALIUM
LUBLINENSIS

DIE XVI MENSIS MAII ANNO DOMINI MMXIX



PROFESSOR ANDREAS BÖRNER

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UNIVERSITATIS STUDIORUM NATURALIUM
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Q.F.F.



F.Q.S.

SUMMIS AUSPICIIS SERENISSIMAE REI PUBLICAE POLONORUM
ATQUE
IN NOMINE UNIVERSITATIS RERUM NATURALIUM LUBLINENSIS

NOS

SIGISMUNDUS LITWIŃCZUK

SCIENTIARUM AGRARIARUM PROFESSOR
IN UNIVERSITATE RERUM NATURALIUM LUBLINENSI PROFESSOR ORDINARIUS
ET EIUSDEM HOC TEMPORE RECTOR MAGNIFICUS

CHRISTOPHORUS KOWALCZYK

SCIENTIARUM AGRARIARUM PROFESSOR
IN UNIVERSITATE RERUM NATURALIUM LUBLINENSI PROFESSOR ORDINARIUS
FACULTATIS AGROBIOINGENIARIAE HOC TEMPORE DECANUS SPECTABILIS
PROMOTOR RITE CONSTITUTUS

IN REVERENDISSIMUM DOMINUM

ANDREAM BÖRNER

IN SCIENTIIS AGRARIIS VIRUM ERUDITISSIMUM
PRAECIPUE DE GENETICA DOCTRINA NANITATIS FRUMENTORUM
ET INVESTIGATIONIBUS MOLECULARIBUS BASIUM MUTABILITATIS EORUM QUAE PROPRIA SUNT
ET MECHANISMIS REACTIONIS PLANTARUM AD FACTORES SOLICITUDINEM EFFICIENTES
IN PLANO TRANSCRIPTOMATIS, PROTEOMATIS ET METABOLOMATIS BENE MERITUM
AD SCIENTIAM CONFIRMANDAM MODERATOREM EXCELLENTISSIMUM ET INDEFESSUM
CUM MULTIS SEDIBUS SCIENTIARUM IN STUDIIS TOTO IN ORBE TERRARUM VERSANTEM
EUCARPIA MODERATOREM DESIGNATUM
EWAC PRAESIDEM ET SOCIETATUM MULTARUM ET CONSTITUTIONUM SCIENTIARUM
TOTO IN MUNDO SOCIUM
QUI MERITA VALIDA AD DOCTRINAM EXCOLENDAM ET PROMOVENDAM
ATQUE AD CRESCENTIAM NUMERI HOMINUM STUDIIS DEDITORUM INTULIT
EXIMII INGENII HOMINEM
EXPERTE AUXILIO IN SOLVENDO RERUM INVESTIGANDARUM VENIENTEM
UNIVERSITATIS RERUM NATURALIUM LUBLINENSIS OPERIS SOCIUM ET AMICUM
E SENTENTIA CONCILII FACULTATIS AGROBIOINGENIARIAE
DECRETO SENATUS ACADEMICI CONFIRMATA

DOCTORIS HONORIS CAUSA

UNIVERSITATIS RERUM NATURALIUM LUBLINENSIS

NOMEN ET DIGNITATEM, IURA ET PRIVILEGIA CONTULIMUS
IN EIUSQUE REI FIDEM HOC DIPLOMA SIGILLO UNIVERSITATIS NOSTRAE
ET PROPRIIS NOSTRIS SUBSCRIPTIONIBUS SANCIENDUM CURAVIMUS

PROF. DR HAB. CHRISTOPHORUS KOWALCZYK

PROMOTOR

PROF. DR HAB. SIGISMUNDUS LITWIŃCZUK

RECTOR

LUBLINI, DIEI SEXTUS DECIMUS, MENSIS MAII ANNO DOMINI BIS MILLESIMO UNDEVIGESIMO

RECTORIS MAGNIFICI ORATIO

The ceremony of conferring the title of the doctor honoris causa is always a great celebration for the University, which in this way expresses the highest formal recognition for those of great merit for scientific, cultural, social or political life.

This prestigious title is mostly bestowed on the research workers closely cooperating with our University, thus including them into the community of the most prominent representatives of all sciences. The University of Life Sciences in Lublin in its 64-year history has rewarded 58 outstanding personages only, which makes the title a rarity. Hence, this award ennobles both the distinguished Doctor Honoris Causa and our University.

Professor Andreas Börner is a prominent figure in the field of crop genetics and genetics of other useful plants, great authority on the international scene. We honour a person whose scientific achievements serve not only scientists, but also contribute to maintaining crop safety as one of the main sources of food.

We confer the honorary doctor of honoris causa title to Professor Andreas Börner as the acknowledgement of his scientific achievements and extensive organisational activity on the international forum, but above all for close and long-term cooperation with Lublin Institute of Plant Genetics, Breeding and Biotechnology.

Rector of the University of Life Sciences in Lublin

Professor dr hab. dr h.c. multi Zygmunt Litwińczuk

CENSUS

Prof. dr hab. Halina Wiśniewska

Institute of Plant Genetics
Polish Academy of Sciences, Poznań

Review of the entirety of scientific, organizational and didactic record of Prof. Andreas Börner, Ph.D., D.Sc., in connection with the procedure for granting the distinction of doctor honoris causa

This review of the academic record of Prof. Andreas Börner was prepared in response to the resolution of the Council of the Faculty of Agrobioengineering at the University of Life Sciences in Lublin of September 19, 2018 in connection with the initiation of proceedings for granting the doctor honoris causa degree.

University of Life Sciences in Lublin is an institution integrating agricultural, biological, veterinary, technical and economic-social sciences. The University's tradition dates back to 1944. The University with great consequence awards the highest academic distinction of doctor honoris causa to scholars who contribute the most to the development of science and are distinguished by their cooperation with the University. The University of Life Sciences in Lublin has already honored 58 people from Poland and abroad, particularly meritorious, having great authority and social recognition. Professor Andreas Börner will be 12th foreign scientist among the group of honoris causa doctors of the University of Life Sciences in Lublin.

Professor Andreas Börner graduated from the Martin-Luther University in Halle-Wittenberg in 1985. He obtained the doctoral degree in Plant Genetics and Breeding in 1998 at the same University. In 1988–1992, he worked at the Leibniz Institute of Plant Genetics and Crop Plant Research (IPK) in Gaters-

leben. In 1990, he was on a scholarship (postdoctoral) at the Cereal Department, John Innes Center, Norwich in Great Britain. In 1992–1996, he was the head of the “Wheat Genetics” research group at that Institute, and from 1997 he took over the supervision of the “Genetics of resources and reproduction” research group. Since 2005 he has been supervising the “Management and Evaluation” program at the Leibniz Institute of Plant Genetics and Crop Plant Research in Gatersleben, which concerns the maintenance of the Gene Bank collections at IPK, where crop plant species and related species are collected. The Gene Bank is an important place in the global ex situ plant conservation, it contains numerous forms representing the majority of temperate climate species. Professor Andreas Börner, in addition to managing the collection, conducts an active research program aimed at testing seed durability, as well as genetically describing the collected materials related to the main crop cereals of temperate climate. He cooperates with many foreign partners in research related to the identification of genes responsible for important agronomic traits.

First research of Professor Andreas Börner concerned dwarfism genetics of cereals and led to the detection of the new Rht10 dwarfing gene derived from the Chinese cultivar ‘Ai-bian 1’, and a dwarfing gene derived from *Triticum aethiopicum* (RhtB1f). These genes are insensitive to gibberellic acid. Professor Andreas Börner was the first researcher to detect the ct1 and ct2 dwarfing genes insensitive to gibberellic acid, which he mapped on chromosomes 7R and 5R. Prof. Andreas Börner’s group also conducted research in the field of molecular mapping of rye loci, determining the ability to vernalization (Sp1), self-fertility (S, S5, Z), the restorer gene, restoring male fertility (Rfg1), hairy peduncle (Hp), waxless plant (wa), multiple pistils (mp) and waxy endosperm (Wx).

As part of the International Triticeae Mapping Initiative (ITMI), this scientist obtained synthetic wheat from the crossing of ‘Opata 85’ tetraploid wheat with *Aegilops tauschii*. This synthetic wheat was widely studied and used for genetic mapping of quantitative traits, such as yield structure elements, grain quality, resistance to diseases and insects, as well as resistance to abiotic stresses. Synthetic wheat obtained by Prof. Andreas Börner was also the basis for the development of a unique set of *Triticum/Aegilops tauschii* introgression lines.

The next step in Professor’s career was taking the position of Gene Bank Manager in Gatersleben, where he initiated research on the genetic purity of the collection. Based on the DNA fingerprinting research, he showed that a high de-

gree of identity is maintained in self-pollinating species, such as wheat, while allele frequencies can change over time in cross-pollinated species, such as rye.

Prof. Andreas Börner and his team also initiated research on genetic variability. Materials from the Gene Bank collection obtained from trips to various geographical regions were used to assess changes in genetic variability. Changes were evaluated on the basis of the variability of selected microsatellite loci randomly distributed throughout the genome. The general stability of genetic diversity was found in all the geographic regions studied. It was demonstrated that the allele flow occurred during the evolution of traditional agriculture into modern production systems. The quantitative level of genetic diversity was rather stable. Recently, Professor Andreas Börner has begun intensive work in the field of seed material research. The importance of these studies is related to the fact that over 90% of world's collections are stored in the form of seeds, and therefore their durability is of particular importance for the preservation of gene resources. The research was carried out in barley, wheat, rape, chickpeas and tobacco.

Special emphasis should be put on Prof. Andreas Börner's activity in research and scientific associations and research groups. Professor Andreas Börner held several important functions at the European Association for Research on Plant Breeding (EUCARPIA): President Designate of EUCARPIA; German Country Representative of the European Association for Research on Plant Breeding; Chairman of Cereals Section of the European Association for Research on Plant Breeding. He is also the coordinator of the European Cereals Genetics Co-operative (EWAC); a German representative of the Working Group Wheat of the European Co-operative Program for Plant Genetic Resources (ECPGR) and a member of the Seed Storage Committee of the International Seed Testing Association (ISTA). Moreover, he was the chairman of the Working Group Seed Science and Certification, German Society of Plant Breeding and German Society of Plant Cultivation Research.

In addition, Prof. Andreas Börner is active in the field of publishing and is a member of many Editorial Committees of international journals, e.g.: Plant Genetic Resources – Characterization and Utilization, Cambridge, United Kingdom; Cereal Research Communications, Budapest, Hungary; Hereditas, Lund, Sweden; Field and Vegetable Crops Research, Novi Sad, Serbia; Agricul-

ture, Piestany, Slovakia; Vavilov Journal of Genetics and Breeding, Novosibirsk, Russia; Agrophysics, St. Petersburg, Russia.

However, the Professor is not only praised for his scientific achievements, but also for his ability to pass on knowledge. He can skillfully combine scientific and research work with staff education. He promoted 16 doctors, mentored 35 master students and 25 bachelor students. He was the chairman and member of many organizational and scientific committees of prestigious conferences.

Professor Andreas Börner has a very extensive, original and coherent publishing output that is the result of his scientific and research activity. It contributes to the development of agricultural sciences. He was the author or co-author more than 550 papers, of which 236 are original research papers published in renowned journals. The remaining are conference reports or other scientific papers. The Hirsch index of all the Professor's publications according to the Web of Science is 38. Professor's papers are appreciated by many scientists and they have been cited (without self-citations) over 3200 times so far. Part of the Professor's scientific achievements is the result of his cooperation with many scientific centers around the world. Professor Andreas Börner gained great recognition and respect for his knowledge and research experience – this is evidenced by his publications co-authored with scientists from different countries.

Worth emphasizing is Professor Andreas Börner's cooperation with Polish Research Units. Since 2010 Prof. Andreas Börner cooperated with the Institute of Plant Genetics of the Polish Academy of Sciences in the research on the chemical composition and mechanical properties of broad bean seeds, the composition and content of soluble carbohydrates in seeds, as well as on the variability of lipid and fatty acid contents in seeds of the Polish white lupine collection. The cooperation resulted in 3 publications in the journal from the ISI Master Journal List – Genetic Resources and Crop Evolution.

Since 2012, Professor Andreas Börner has also been working with the Institute of Soil Science and Plant Cultivation – the State Research Institute in Pulawy on the effects of seeds storage of different *Nicotiana* species on their viability and genetic basis of durability of tobacco seeds and wheat grains. Research and its results have been presented in 5 publications in recognized journals.

The Professor's cooperation with the Faculty of Biology and Biotechnology at the University of Warmia and Mazury in Olsztyn dates back to 2012.

Joint studies on changes in the proteome of barley roots under salinity stress and the mitigation of salinity stress in barley using BABA allowed to obtain results worth presenting to the scientific bodies by five renowned international journals.

The cooperation of Prof. Andreas Börner with the Institute of Plant Genetics, Breeding and Biotechnology of the University of Life Sciences in Lublin has started already in 2005. Conducted research focused on the identification of GA-sensitive semi-dwarfing genes in barley cultivars growing in Poland and the characterization of the quantitative traits of the ‘Steptoe’ x ‘Morex’ barley population. The research also concerned the analysis of selected quantitative traits in *T. aestivum*/*Ae. squarrosa* introgression lines. The results of the cooperation were presented at international prestigious conferences in Turkey, Serbia and Lublin. In 2017 Professor Börner participated in the Scientific Symposium organized by the Institute of Plant Genetics, Breeding and Biotechnology of the University of Life Sciences in Lublin titled “Gene resources of utility plants for breeding”, where as an invited guest, discussed the operation of the German Gene Bank in terms of preserving and using gene resources.

To sum up the review, Professor Andreas Börner is one of the prominent contemporary geneticist of cereals and utility plants. His publications are recognizable on an international scale and research output serve not only scientists, but above all contribute to maintaining the biosafety of cereals as one of the main food sources.

All analyzed aspects related to academic achievements, publishing activity and extensive cooperation with many scientific centers as well as education of young scientific staff and his activity in research and scientific associations clearly support the proceedings of the Council of the Faculty of Agrobioengineering at the University of Life Sciences, in awarding Professor Andreas Börner the doctor *honoris causa* degree.

At the same time, granting this honorable title to a scientist of world prestige, which undoubtedly Professor Andreas Börner is, will be for the University of Life Sciences in Lublin a confirmation of belonging to a group of universities involved in the exchange of knowledge, experiences and actively participating in international research.

Poznań, 30.10.2018

Prof. dr hab. Grażyna Podolska

Institute of Soil Science and Plant Cultivation
State Research Institute, Pulawy

Review
of the academic record, achievements and merits
of professor Andreas Börner in connection with the proceedings
for granting him the distinction of *doctor honoris causa*
of the University of Life Sciences in Lublin

Prof. Andreas Börner is a graduate of the Martin Luther University in Halle-Wittenberg, Germany. He graduated from this university in 1985. He obtained his doctoral degree in the field of Genetics and Plant Breeding in 1988. In 1995 he received the doctor habilitatus degree also in the field of Genetics and Plant Breeding.

Prof. Andreas Börner has closely tied his scientific career with one of the leading international research institutes in the field of genetics and plant cultivation: Leibniz Institute of Plant Genetics and Crop Plant Research (IPK Gatersleben). He worked as a researcher in the Institute in the years 1988–1992. After obtaining the doctoral degree (PhD), he completed a scientific internship at the Cereal Plant Department, John Innes Center, Norwich, in Great Britain. In the years 1992–1996, he headed the group working on wheat genetics (Research Group Wheat Genetics). From 1997 until 2005, he led the research group for genetic resources and reproduction (Research Group Wheat Genetics). Since 2005, he has been the head of the team working on the management and evaluation of genetic resources in the gene bank (Program Management and Evaluation, Genebank).

Prof. Andreas Börner is a well-known and recognized scientist specializing in the field of genetics and plant breeding, belonging to a group of researchers whose work has made a significant contribution to modern science in agrono-

my. I am fully convinced that the scientific record of the Professor directly contributes to the breeding of new improved cultivars of cereals. Primarily, due to the knowledge of the effects of pleiotropic dwarfing genes, molecular foundations of variability of phenotypic traits, mechanisms conditioning plant reactions to stress factors at the level of transcriptome, proteome and metabolome, and determination of markers for important agronomic traits.

The overall achievements of Professor Andreas Börner as a researcher are impressive in every field of his activity. He has a large, original and consistent publication record. He is the author or co-author upward of 550 papers, including 45% of original research papers published mostly in journals included in the Journal Citation Reports (JCR) database. His Hirsh *h*-Index is 44. The number of citations without self-citations is impressive and amounts to 4332. Prof. Andreas Börner published most of the publications in the following journals: *Euphytica* (16%), *Genetic Resources and Crop Evolution* (13%), *Theoretical and Applied Genetics* (12%), *Plant Breeding* (8%), *Cereal Research Communications* (7%) and *Plant Genetic Resources* (6%). The remaining papers have been published in many other journals, such as the *Journal of Applied Genetics*, *Russian Journal of Plant Physiology*, *Genetic Resources and Crop Evolution*, *Czech Journal of Genetics and Plant Breeding*, *Genome*; in total, in over 60 different scientific periodicals. This shows that the studies which the Professor authored or co-authored have a wide world range and reach a diverse group of recipients. Most of his original research papers is co-authored, which proves the Professor's great ability to establish cooperation and conduct interdisciplinary research. He actively participated in dissemination of his research results throughout the world. In this respect, presentation of his research results in international conferences should be particularly positively evaluated. In this field, the Professor's academic record is impressive. Publications in conference materials account for about 35% of academic record. Other papers have been published in journals that are not listed in the database of IF journals and they mainly include: *Annual Wheat Newsletter*, *Agriculture Biology*, *Journal of Genetics and Breeding*, *EWAC Newsletter* or in series of *European Wheat Aneuploid Co-Operative Newsletter*. Professor is also a co-author or author of chapters in textbooks and monographs, such as "Biotechnological Approaches to Barley Improvement".

Scientific papers published by Professor Andreas Börner are characterized by high substantive value, a clearly defined goal, very good interpretation of results, extensive discussion and logical reasoning. According to the assessment of the scientific achievements in terms of the subject, his research output can be divided into one concerning plant genetics, molecular mapping of cereal loci, genetic diversity and research on sowing material.

Research on plant genetics cover 22% of scientific record. The fundamental achievement of Prof. Andreas Börner in this area was the detection of rye, wheat and barley dwarfing genes insusceptible to gibberellic acid, proving the function of dwarfing genes and their relationship with the variability of some yielding traits. Research has shown that in addition to decreasing plant height, and thus increasing resistance to lodging, these genes show pleiotropic effects in relation to several other quantitative traits shaping the yield of cereal plants. Professor expanded the knowledge in this area by analyzing the effects of loci on the basis of morpho-anatomic, proteomic, molecular and biometric analyses. The research carried out by the Professor was related to the phenotyping of cereal species lines with a dwarfing gene and lines of a normal growth type in terms of morphological and yielding characteristics. The results of the studies showed the presence of semi-dwarf, complex phenotypic changes in plants, suggesting a pleiotropic gene interaction.

Among significant achievements of Prof. Andreas Börner is his research on genetic mapping and genotyping. Genotyping based on microsatellite markers allowed to identify loci conditioning quantitative and qualitative traits. He identified rye QTL determining the vernalization ability (Sp1), self-fertility (S, S5, Z), restorer gene, restoring male fertility (Rfg1), hairy peduncle (Hp), waxless plant (wa), multiple pistils (mp) and waxy endosperm (Wx). As part of the International Triticeae Mapping Initiative (ITMI), he obtained and studied the synthetic wheat (derived from 'Opata 85' cultivar and *Aegilops squarrosa*). This synthetic, hexaploid wheat has been widely used for genetic mapping of quantitative traits: yield, yield components, grain quality, disease and insect resistance and resistance to abiotic stress – mainly drought and salinity stress. Synthetic wheat was also the basis for developing the introgression of wheat genes from *Aegilops squarrosa*. These lines have been intensively studied in terms of agronomic traits in cooperation with many partners, including the Institute of Plant Genetics,

Breeding and Biotechnology of the University of Life Sciences in Lublin. It should be emphasized that the research group of Prof. Andreas Börner was one of the first mapping multicenter associations in hexaploid wheat. Research in this area constitute about 20% of the Professor's scientific output.

Prof. Andreas Börner has shown in DNA tests of seed materials of individual plant species that a high degree of identity is maintained in self-pollinating species, such as wheat, while allele frequencies can change over time in cross-pollinated species, such as rye. Prof. Andreas Börner also initiated research on genetic diversity using materials from the gene bank. He evaluated changes on the basis of the variability of selected microsatellite loci randomly distributed throughout the genome. He found changes in qualitative and stability in the quantitative level of genetic diversity. The Professor's significant achievements also include research on the sowing material of crop plants: barley, wheat, rapeseed, chickpeas and tobacco. Work on tobacco was carried out in cooperation with the Institute for Soil Science and Plant Cultivation, the State Research Institute in Pulawy. The studies included physiological and biochemical genetic analysis related to seed aging. Professor and his team have demonstrated that glycerol and glycerol phosphate are highly negatively correlated with germination, thus indicating lipid hydrolysis in aging seeds. They proved that lipid degradation occurs during seed aging, causing damage to the cell membrane and, consequently, loss of cell viability.

The didactic activity of Professor Andreas Börner is impressive. He was the supervisor of 16 doctoral theses, 35 master theses and 25 bachelor theses. From the beginning of his work, Professor has actively participated and continues to participate in activities promoting science. He is the Designated President of the European Association for Research on Plant Breeding (EUCARPIA); Representative of Germany in the European Association for Research on Plant Breeding; Chairman of the Cereals Section of the European Association for Research on Plant Breeding, Coordinator of the European Cereals Genetics Co-operative (EWAC); a German representative of the Working Group Wheat of the European Cooperative Program for Plant Genetic Resources (ECPGR) and a member of the Seed Storage Committee of the International Seed Testing Association (ISTA). He was also the chairman of the Working Group Seed Science and Certification, German Society of Plant

Breeding and German Society of Plant Cultivation Research. Professor Andreas Börner is also a member of many editorial boards of international journals: Plant Genetic Resources – Characterization and Utilization, Cereal Research Communications, Hereditas, Field and Vegetable Crops Research, Agriculture, Journal of Genetics and Breeding, Agrophysics.

Fully approving the idea of awarding the title of doctor *honoris causa* of the University of Life Sciences in Lublin to Professor Andreas Börner, his close relationship with the University should also be pointed out. One can not ignore important facts regarding his collaboration with the Lublin's community and the University of Life Sciences in Lublin. Cooperation between the Professor and the Institute of Plant Genetics, Breeding and Biotechnology of University of Life Sciences in Lublin and close collaboration with Professor Krzysztof Kowalczyk and his team has begun in 2005 and continues to this day. An example of this cooperation is the research on wheat genome, numerous publications and joint editing of European Cereals Genetics Co-operative Newsletter 2016 (Proceedings of the 16th International EWAC Conference 24–29 May 2015, Lublin). In addition to cooperation with the University of Life Sciences in Lublin, the Professor's long-term cooperation with Professor Teresa Doroszevska and the Institute of Soil Science and Plant Cultivation – State Research Institute in Pulawy should be emphasized. Moreover, Prof. Andreas Börner has collaborated with Institute of Plant Genetics in Poznań and Department of Biology and Biotechnology of University of Warmia and Mazury in Olsztyn. The entirety of Professor Andreas Börner's scientific achievements bringing many innovative solutions of highly substantive value, his great recognition on the international arena, international cooperation, as well as activity in science bodies make him a worthy candidate for the doctor *honoris causa* degree of the University of Life Sciences in Lublin.

I have a great honor to support the motion of the Council of the Faculty of Agrobioengineering at the University of Life Sciences in Lublin to honor Prof. Andreas Börner with the distinction of doctor *honoris causa*.

Pulawy, 9.11.2018

Prof. dr hab. Barbara Kołodziej

Faculty of Agrobioengineering
University of Life Sciences in Lublin

Review
of scientific and didactic record, achievements in staff education
and organizational work of Professor Andreas Börner
in connection with the resolution of the Council of the Faculty of
Agrobioengineering at the University of Life Sciences in Lublin
on the initiation of proceedings for granting Professor the title
of doctor honoris causa

Prof. Andreas Börner is a well-known figure in the international environment of geneticists, especially cereal breeders. Over 30 years of professional work at various positions, mainly at the IPK Gatersleben in Germany, brought him recognition and authority not only in the scientific community but also among a wide range of agricultural practitioners in his country and abroad.

Evaluation of scientific activity

Professor's scientific interests focus on issues related to the cultivation of various cereal species, mainly wheat, a species of primary importance among crops in the world. In 2017, global wheat production reached almost 740 million tonnes. There has been an annual increase in the production of this grain recorded. Its production in a 10-year period increased by over 202 million tonnes (FAO 2015). In addition, wheat is characterized by the widest geographical and climatic range, because it is grown from Scandinavia to Argentina, also in the tropical and subtropical zones. This became possible due to the

breeding studies performed on this species, aimed at obtaining cultivars with increased adaptation to different environmental conditions. Wheat is mainly used in human nutrition (about 65%), and about 21% in feed production. Professors research and publishing output and its implementation contributed to obtaining short-stemmed, high yielding wheat cultivars. A characteristic feature of the Professor's academic work is the ability to combine elements decisive in solving a specific problem. Undoubtedly, the formation of such an attitude, that could be a model for other academic employees, was influenced by lively contacts with leading foreign scientists, numerous internships in European scientific centers and cooperation with agricultural practice.

Contribution of Prof. A. Börner to the development of cereal breeding is enormous and concerns the most important issues. The guiding principle of the research was the development of new cultivars with improved qualitative features and simultaneously resistant to adverse environmental conditions.

Of particular importance are the results of research on cereal dwarfism genetics. Prof. Andreas Börner identified and described the *Rht10* dwarfing gene derived from the Chinese wheat cultivar "Ai-bian 1", which shortened its height by approximately 40%. In addition, he detected another dwarfing gene in *Triticum aethiopicum* (*RhtB1f*). Moreover, Prof. Börner was the first to detect gibberellic acid insensitive genes in rye (*ct1* and *ct2*) that have been mapped on chromosomes 7R and 5R. The comparative mappings carried out later allowed to identify homoeological groups 4 (wheat and barley) and 5 (wheat and rye) on which dwarfing genes insensitive to gibberellic acid are located. Research in the field of molecular mapping of rye loci determining the ability to vernalization (Sp1), self-fertility (S, S5, Z), the restorer gene, restoring male fertility (Rfg1), hairy peduncle (Hp), waxless plant (wa), multiple pistils (mp) and waxy endosperm (Wx) are also extremely important.

Research that contributed to the elucidation of genetic integrity of cereal sowing material deserve particular attention. Pilot studies of the genetic DNA fingerprinting proved that a high degree of similarity is retained in self-pollinating species (e.g. wheat), while in the case of cross-pollinated species (e.g. rye), the frequency of alleles changes in time. Prof. Andreas Börner and his team also initiated research on genetic variability. He studied the sowing

material of Genebank resources derived from different geographic regions collected over the past 40–50 years by analyzing microsatellite loci distributed randomly throughout the genome. He found a general stability in genetic diversity in all geographic regions studied. However, qualitative changes appeared in them, because the flow of alleles takes place during the evolution of traditional agriculture to modern production systems, while the quantitative level of genetic diversity is rather stable. These studies have shown that only existing allelic composition can be preserved in *ex situ* collections, which may change over time. It should be emphasized that Professor's activity aims at protecting against genetic erosion, i.e. against irreversible loss of genetic resources of utility plants important for breeding, research and economy.

Prof. Andreas Börner research regarding sowing material of various crop plants is also worth noting. This type of research is of great importance, as almost 90% of species are stored in gene banks in the form of seeds, hence the knowledge of their longevity is important for the conservation of plant genetic resources. Research conducted with the use of accelerated aging tests showed the durability of sowing material, both between crop species and within the same species (including barley, wheat, rape, chickpeas and tobacco). Part of the analyses (regarding tobacco) was carried out in cooperation with the Institute for Soil Science and Plant Cultivation, the State Research Institute in Pulawy. As a result, the genes responsible for seed aging, especially in cold and lack of water conditions ("naturally aged" seeds) were indicated, and a number of physiological and biochemical analyses was conducted. The profiling of metabolites by gas chromatography coupled with mass spectrometry of wheat sowing material stored for 6–15 years showed that the glycerol and glycerol phosphate content was negatively correlated with germination capacity, which indicated gradual lipid hydrolysis in aging seeds. It was also shown that during seed aging, reactive oxygen species led to hydrolytic degradation of lipids, damaging the cell membrane, and thus reducing seed viability.

It is also worth to emphasize the research carried out in cooperation with other scientific centers concerning, inter alia, detailed chemical composition and antioxidant potential of seeds of valuable crops (including cereals, legumes, poppy, Brassicaceae plants or oleiferous plants), as well as understanding the mecha-

nisms of plant resistance to abiotic stresses (salinity, irradiation, drought, metal content) or pathogens.

A valuable characteristic of Prof. A. Börner as a researcher is the ability to organize research teams in order to comprehensively solve the analyzed issues. Hence his leading involvement in various research programs carried out in cooperation with many scientific units, including Polish (in the latter case, the research resulted in a dozen or so scientific studies). The results of these studies have been presented at many national and international conferences and published in international journals. Research carried out as part of the International Triticaceae Mapping Initiative (ITMI), during which synthetic hexaploid wheat derived from the crossing of the cultivar “Opata 85” with *Aegilops squarrosa* (*A. tauschii*) was obtained, was an example of this type of cooperation. This synthetic wheat has been widely used for the genetic mapping of quantitative loci of important economic features, such as yield and its components, grain quality, resistance to pests and diseases, and various stress factors. Synthetic wheat was also the basis for the development of a unique set of wheat/*Aegilops tauschii* introgression lines. These lines have been analyzed in terms of agronomic traits in cooperation with many scientific centers, including the Institute of Plant Genetics, Breeding and Biotechnology of the University of Life Sciences in Lublin. The group of researchers led by Prof. Andreas Börner was one of the first in the world that performed associative mapping of hexaploid wheat using a panel of 96 genotypes, which were phenotyped for 20 agronomic traits for eight successive growing seasons.

Numerous scientific, textbook and implementation publications have been the result of many years of research on cereals, their genetics and biodiversity as well as the viability of various species carried out independently or in teams. Prof. Andreas Börner is the author or co-author more than 550 scientific articles, including 236 published in journals from JCR. His Hirsch index is 38 and the number of citations according to the Web of Science Core Collection is 4947.

Prof. A. Börner also pays great attention to the popularization and implementation of research results through popular science publications and lectures (including ones gave at our University) and participation in scientific and technical conferences.

The course of professional work of Prof. A. Börner can be a model for young researchers. After graduating from agricultural studies at Martin Luther University in Halle, Wittenberg in 1985, three years later he completed doctoral studies at the same University. Subsequently, Prof. Andreas Börner gained valuable experience during a scholarship at the Cereals Department at the John Innes Center in Norwich, UK, where he broadened his knowledge about the problems related to the genetics of cereals. Almost from the beginning of his academic career, he was affiliated with the Leibniz Institute of Plant Genetics and Crop Plant Research (IPK) Gatersleben – one of the 10 largest *ex situ* gene banks in the world, where he initially worked as a geneticist. In 1992–1996 he headed the Research Group on Wheat Genetics. In 1997 he joined the Gene Bank at IPK Gatersleben, heading the Research Group on Genetic Resources and Reproduction and since 2005 he managed the Gene Bank Program Management and Evaluation. In the IPK Genk Bank, he is responsible, among others, for the long-term maintenance of the crop plants collection and their related wild species, and also deals with a comprehensive phenotypic and genetic description of the main cereal species of the temperate zone. In close cooperation with many national and foreign scientific centers he works on creating genetic maps and quantitative trait loci mapping (QTL) responsible for the characteristic agronomic traits of valuable plant species.

According to scientific, publishing and didactic achievements as well as those in the field of staff education, Prof. Anderas Börner received successive promotions. In 1988, he defended his doctoral thesis and in 1995, he obtained the title of doctor habilitatus.

Achievements in personnel training

In over 30 years of scientific work, Prof. A. Börner has educated an impressive number of specialists in the field of genetics and cereal breeding, seed storage and agriculture.

Under his direct supervision, over 50 students from seven German prestigious universities have completed engineering and master theses, many of them have started scientific work, others have successfully performed important functions in administration and economy. Of those who devoted themselves to scientific work under the Professor's supervision, 16 became

doctors. This justifies the statement that Prof. A. Börner mentored high-class specialists in the field of breeding and storage of cereal sowing material, who successfully continue his research and enrich knowledge in this field. The scientific achievements of Professor's protégés are known not only in the country but also abroad.

While holding managerial functions in the Alma Mater, he created favorable conditions for young researchers development, among others, through equipment modernization of the Gene Bank in Gatersleben, which has become an important center for genetic research.

The achievements in the field of staff education also include numerous reviews of doctoral and habilitation dissertations and for the title performed by Prof. A. Börner. At the same time, they are an expression of appreciation for the Professor as an authority in the field of agricultural sciences.

Evaluation of organizational activity

Prof. Andreas Börner has particularly great achievements in organizational work. At IPK Gatersleben, he has been the Manager of many Working Groups for over twenty years and since 2005, he managed the Gene Bank Program Management and Evaluation.

The proof of recognition for Professor's academic and organizational achievements is his appointment to the Scientific Councils of journals as well as international associations and research groups. He is the Coordinator of the European Cereals Genetics Cooperative (EWAC) and representative of Germany in the Wheat Research Group of The European Cooperative Programme for Plant Genetic Resources (ECPGR). For many years, Prof. Börner has acted as the president of EUCARPIA (European Association for Research on Plant Breeding). He is also a representative of Germany and chairman of the Cereal Section at EUCARPIA. Moreover, he is a member of the Seed Storage Committee at ISTA (International Seed Testing Association) and Head of the Working Group on Seed and Certification Research of the German Society for Plant Breeding and the German Society for Crop Research. Furthermore, he is a member of the Scientific Councils of numerous recognized scientific journals, including: Plant Genetic Resources – Characterization and Utilization, Cambridge England, Cereal Research Communications with editors in Hungary, *Hereditas* from Lund, Swe-

den, Field and Vegetable Crops Research in Novy Sad, Serbia, Agriculture, Piestany, Slovakia, Vavilov Journal of Genetics and Breeding in Novosibirsk, Russia, or Agrophysics journal from St. Petersburg, Russia.

Professor cooperates with many research and academic centers in the world (Russia, Bulgaria, Argentina, England, Serbia, China, France, Australia, Czech Republic, Japan, Ukraine, Austria, the Netherlands, Iran, India, Egypt, Hungary, Romania). It should be emphasized that many studies have also been carried out by Professor in cooperation with researchers from our country (including the Institute of Plant Genetics, Breeding and Biotechnology of the University of Life Sciences in Lublin, Faculty of Biology and Biotechnology of the University of Warmia and Mazury in Olsztyn, Institute of Plant Genetics of Polish Academy of Sciences in Poznań or the Institute of Soil Science and Plant Cultivation – State Research Institute in Pulawy).

A huge contribution of Prof. Anderas Börner to the development of agricultural science and education through multidirectional, professional and social activity is highly valued by the academic community in the country and in the world.

I am fully convinced that the abovementioned achievements fully justify the initiative of the Faculty of Agrobioengineering of the University of Life Sciences in Lublin to honor Prof. Anderas Börner with the highest academic distinction of our University.

Lublin, 21.10.2018

DECANI ET PROMOTORE LAUDATIO

Prof. dr hab. Krzysztof Kowalczyk

University of Life Sciences in Lublin

Your Magnificence Rector,
High Senate,
Venerable Excellencies,
Honorable Professor, Highly Honorable *Doctor honoris causa*
Ladies and Gentlemen!

I have a great privilege and honor to present professor Andreas Börner, chairman and member of numerous Societies, Associations and Scientific Organizations, including the Manager of the Gene Bank in Gatersleben, Designated President, German Representative and President of the Cereals Section of the European Association for Research on Plant Breeding (EUCARPIA); Coordinator of the European Cereals Genetics Co-operative (EWAC); the German representative of the Working Group Wheat of the European Co-operative Program for Plant Genetic Resources (ECPGR), member of the Seed Storage Committee of the International Seed Testing Association (ISTA), an eminent world-renown scientist, geneticist, naturalist and prominent science organizer who is to receive today the title of doctor *honoris causa* of our University.

The title of Doctor Honoris Causa was introduced over 600 years ago at the University of Oxford in order to honor people who have great scientific authority and recognition in the scientific community in the country and in the world. With full conviction, I can say that the professor Andreas Börner belongs to the distinguished group of scientists recognized and valued in the world.

The Professor is known to the dignified assembly, gathered today in the Congress Hall of the University of Life Sciences in Lublin, not only from conferences and speeches, but above all from near five hundred sixty publications whose honorable doctor *honoris causa* is the author or co-author. However, I and probably many other people are asking themselves how a man can achieve such impressive accomplishments and cross the boundaries of science,

scientific seminars, perform so many honorable and responsible functions in societies and scientific organizations, and also have time for a wonderful family and be a fan of the Rolling Stones. Is it possible to achieve all this that the Honorable Doctor *honoris causa* has accomplished in science? The example of Professor Andreas Börner allows us to respond positively to such questions. Professor Andreas Börner is an outstanding scholar for whom science is the sense and purpose of life struggles. He co-creates science, lives with and for science, not forgetting the most important things like family, friendship, and above all, building mutual trust between nations through scientific cooperation based on partnership, responsibility for quality and innovation of scientific research and reciprocal understanding. The remarkable talent that the honorable Doctor *honoris causa* possesses has enabled him to create science not for illusive fame and benefit but for the sake of science itself. The Professor creates science in the humbleness and lowliness of the spirit, with extraordinary modesty.

Andreas Börner was born in Grimma at the 9th of April, 1959. He grew up in a small village named Schkortitz in Saxony. His parents were private farmers but later on staff members of a co-operative farm where they had to bring in their land. Spending much time with his grandmother he became familiar with plants growing in the garden. Andreas Börner started primary school in 1965 in his home village continuing in Grimma. He did like doing practical farming work and, therefore, after finishing school he did a vocational training as Agro Engineer in parallel with High School Education in Wachau, near Leipzig, from 1975 till 1978. In November 1978 Andreas Börner started serving his military service for 18 months which was mandatory in East Germany.

Having finished this, he was allowed to start studying Agronomy with specialisation in Plant Breeding at the Martin-Luther-University in Halle, in 1980. During the study he had to carry out another military course and became even a Sergeant. In 1983 Andreas Börner received a contract for the 'Promotion of Best Students' from the Faculty of Agriculture of the University in Halle. This was the starting point of his scientific career. The study at the University was finished in February 1985 with the Diploma degree. The title of the Diploma theses was: 'The Analysis of the Impact of the Gene *Rht2* on Plant Height and Yield in a Series of Winter Wheat Progenies'.

Immediately after graduation, in March 1985 he became an employee of the 'Central Institute for Genetics and Crop Plant Research' in Gatersleben as a PhD student. The topics of his studies were: 'The Investigation of the Genetic Relationships between Gibberellic Acid Response, Semidwarfism and Yield in Wheat (*Triticum aestivum* L.)' and 'The Screening for GA₃ Insensitivity in Genebank Accessions of *Triticum* and *Secale*'. Andreas Börner completed his thesis in less than 3 years and received the grade 'Summa cum laude' in 1988.

After obtaining the doctoral degree, he completed a scientific internship at the Cereal Plant Department, John Innes Center, Norwich, in Great Britain.

In 1989 big political changes started and Germany became re-unified in 1990. In the newly organized 'Institute of Plant Genetics and Crop Plant Research' Andreas Börner became the Head of the Working Group 'Wheat Genetics' in 1992. He began to work on his Habilitation at the Martin-Luther-University in Halle which was successfully completed in 1995. The title of the thesis was: 'The Genetics and Environmental Effects of the complex traits Reduced Plant Height and Day Length Response in Wheat'. In 1997 Andreas Börner became a Group Leader and in 2005 the Head of the Program 'Management and Evaluation' in the Genebank of the Gatersleben Institute. There he is responsible for the management of the Gatersleben genebank collection, which entails the long-term storage, multiplication and distribution of the germplasm.

Prof. Andreas Börner's academic achievements include works on classical and molecular genetics, plant breeding, plant physiology and biochemistry and genetic resources conservation. In the initial period of scientific work, Professor worked on the problems of cereal dwarfism genetics. He identified and described the *Rht10* dwarfing gene derived from the Chinese wheat cultivar 'Ai-bian 1' and (*RhtB1f*) in *Triticum aestivum*. Moreover, he detected GA insensitive *ct1* and *ct2* dwarfing genes in rye located on chromosomes 7R and 5R. Moreover he identified homoeological groups of chromosomes in wheat, barley and rye, on which GA insensitive dwarfing genes are located. His research in the field of molecular mapping of rye loci determining the ability to vernalization (Sp1), self-fertility (S, S5, Z), the restorer gene, restoring male fertility (Rfg1), hairy peduncle (Hp), waxless plant (wa), multiple pistils (mp) and waxy endosperm (Wx) is also extremely important. In the following research period, Professor was studying the pleiotropic effects of dwarfing

genes, molecular foundations of variability of phenotypic traits, mechanisms conditioning plant reactions to stress factors at the level of transcriptome, proteome and metabolome, and determination of markers for important agronomic traits. The Professor's significant achievements also involve research on sowing material, reproduction capacity after long-term storage and genetic, physiological and biochemical analyses related to the aging of seeds and fruits of crop plants, such as barley, wheat, rapeseed, chickpeas and tobacco. Professor and his team have proven that lipid degradation occurs during seed aging, causing damage to the cell membrane and, consequently, loss of their viability. In this record, both the scope of issues addressed and the courage to face the most difficult problems solved in team research raises admiration. Professor Barbara Kolodziej in her review emphasized that "Prof. A. Börner created a school of high-class specialists in the field of breeding and storage of cereal sowing material, who successfully continue his research and enrich knowledge in this field. The scientific achievements of the school created by the Professor are known not only in the country but also abroad."

The Professor's academic and research achievements are impressive. He is the author or co-author near of 560 papers, of which almost half was published in journals included in the Journal Citation Reports (JCR) database. The Hirsh *h*-Index is 44 according to Research Gate. The number of citations without self-citations is impressive and amounts to 4400. He published his works in such renowned journals as: *Euphytica*, *Genetic Resources and Crop Evolution*, *Theoretical and Applied Genetics*, *Plant Breeding*, *Cereal Research Communications*, *Plant Genetic Resources*, *Journal of Applied Genetics*, *Russian Journal of Plant Physiology*, *Czech Journal of Genetics*, *Genome*.

In the reviews, Professors agreeably emphasize great appreciation for Prof. Andreas Börner's publishing record, innovative research solutions, extensive scientific cooperation with many scientific centers in the world, activities in various scientific bodies. They fully appreciate his great scientific authority and recognition on the international arena. They recognize Professor Börner as an outstanding geneticist of cereals and other crops. They underline that his academic achievements serve not only scientists, but above all contribute to maintaining the safety of cereals as one of the main food sources. Prof. Grażyna Podolska wrote in her review: "The entirety of Professor Andreas

Börner scientific achievements brought many new innovative highly substantive solutions, his great recognition on the international arena, international cooperation, as well as activities in the science bodies make him a worthy candidate for the title of doctor *honoris causa* of the University of Life Sciences in Lublin.” Prof. Halina Wiśniewska stated that “Professor Andreas Börner has a very large, original and coherent publishing output that is the result of his scientific and research activity, which is a fruitful contribution to the development of agricultural sciences.”

The great value of the scientific works of Andreas Börner, but also his organizational and popularizing activities, is that he masterfully shows how to discover the secrets of nature, improving crops while preserving their unique important features.

The didactic and organization activity of Professor Andreas Börner is impressive. These achievements of the Honorable Doctor *Honoris Causa* were emphasized by Professor Halina Wiśniewska, who wrote that “However, the professor is acclaimed not only for scientific achievements, but also for the ability to pass on knowledge. He can skillfully combine scientific and research work with staff education. Professor Barbara Kolodziej wrote in her review that while holding managerial functions in Leibniz Institute, Andreas Börner created favorable conditions for the development of young researchers, among others, through the modern equipment of the Gene Bank in Gatersleben, which has become an important center for genetic research. The achievements in the field of staff education also include numerous reviews of doctoral and habilitation dissertations performed by Prof. A. Börner. At the same time, they are an expression of appreciation for the Professor as an authority in the field of agricultural sciences.”

Professor Andreas Börner was the supervisor of 16 doctoral theses, 35 master theses and 25 bachelor theses. He is a very good and active organizer of scientific conferences and participant in many scientific organizations and associations. He is the Designated President and also Representative of Germany and Chairman of the Cereals Section of the European Association for Research on Plant Breeding (EUCARPIA); Coordinator of the European Cereals Genetics Co-operative (EWAC); German representative of the Working Group Wheat of the European Cooperative Program for Plant Genetic

Resources (ECPGR) and a member of the Seed Storage Committee of the International Seed Testing Association (ISTA). Professor is a member of many editorial boards of international journals, including Plant Genetic Resources, Cereal Research Communications, Hereditas, Field and Vegetable Crops Research, Agriculture, Journal of Genetics and Breeding, Agrophysics.

Professor Andreas Börner is a model of a scholar who skillfully cooperates with numerous outstanding representatives of various fields of science from many renowned scientific centers in the world, including Russia, Bulgaria, Argentina, England, Serbia, China, France, Australia, the Czech Republic, Japan, and Ukraine, Austria, the Netherlands, Iran, India, Egypt, Hungary, Romania as well as Poland with the Institute of Genetics, Plant Breeding and Biotechnology of the University of Life Sciences in Lublin, Faculty of Biology and Biotechnology of the University of Warmia and Mazury in Olsztyn, Institute of Plant Genetics of the Polish Academy of Sciences in Poznań, Institute for the Cultivation of Fertilization and Soil Science, National Research Institute in Pulawy. In over a dozen years of cooperation with the Institute of Genetics, Plant Breeding and Biotechnology, Professor Börner participated in the implementation of the PBZ-MNiSW-2/3/2006/2 project titled "Identification and determination of DNA markers for powdery mildew resistance genes in oat and triticale useful in the cultivation of these cereals". In addition, he participated in research on the identification of dwarfing genes in barley cultivars growing in Poland, characteristics of the quantitative traits of the 'Steptoe' × 'Morex' barley population and analysis of selected quantitative traits in *T. aestivum*/*Ae. squarrosa* introgression lines. The results of these studies are publications and developing and editing of EWAC Newsletter.

Studying nature, discovering its laws and activities at the epigenetic and molecular level of both DNA and proteins, is the dominant field of scientific activity that the Professor works on. His research concerns not only explaining a vision of natural sciences that is coherent and comprehensible to modern humans, and expanding knowledge, but also applying results to breeding practice and agriculture. Without these achievements, there would be no human development and civilization as we know it. We are part of nature ourselves and we live in this environment. The vast majority of scientists at the University of Life Sciences in Lublin deals with nature research. We, as employees of

science, also ask questions for whom and why we perform research, what is the purpose of learning about nature and who should it serve? Our work contributes to the protection and utilization of environmental resources, that has been entrusted to us. This range of research is close to both us and Professor Börner.

Dear All,

The academic community of the University of Life Sciences in Lublin pays today a tribute to the amazing man, the eminent world-renowned Scholar Professor Andreas Börner. We do it in the Jubilee of the 75th Anniversary of the Faculty of Agrobioengineering. Resolution of the Senate of December 20, 2018 on granting Professor Andreas Börner the honorary title of doctor honoris causa of the University of Life Sciences in Lublin, based on the recommendation of the Council of the Faculty of Agrobioengineering, supported by the opinions of the Reviewers, is a recognition of the greatness of his scientific achievements in the world. We hand this title to an extraordinary man with high personal culture and academic friendliness. We also perceive this event as the ennoblement of the Faculty of Agrobioengineering and the University of Life Sciences in Lublin.

Honorable Doctor Honoris Causa, on this solemn and special day, honoring you with the highest academic distinction and title, I wish you many further achievements in scientific and organizational work on the field of agricultural and biological sciences, prosperity and the development of a further great scientific career and a lot of health and satisfaction in your personal life.

Lublin, 16.05.2019

DOCTORIS HONORIS CAUSA LECTIO

Professor Andreas Börner

Plant Genetic Resources for Food and Agriculture – the Backbone for Feeding Future Generations

Plant Genetic Resources Globally

There are two main strategies for maintaining plant genetic resources: *ex situ* and *in situ* conservation. Both terms are defined in the Convention on Biological Diversity (1992) as follows. ‘*Ex situ* conservation’ means the conservation of components of biological diversity outside their natural habitats. ‘*In situ* conservation’ means the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.

The present paper will focus on *ex situ* conservation only because this is the most significant and widespread mean of conserving plant genetic resources. Mainly, accessions are maintained in specialized facilities known as genebanks. Most of the countries world-wide are holding national or regional genebanks. However, there is also an international CGIAR (Consultative Group on International Agricultural Research) genebank platform comprising 11 institutions: AfricaRice, Côte d’Ivoire; Bioversity, Belgium; CIAT, International Center for Tropical Agriculture, Colombia; CIMMYT, International Maize and Wheat Improvement Center, Mexico; CIP, International Potato Center, Peru; ICRAF, World Agroforestry Centre, field collections in 15 countries, mostly in Africa but also in Bangladesh, Peru and Vietnam; ICARDA, International Center for Agricultural Research in the Dry Areas, Morocco and Lebanon; ICRISAT, International Crops Research Institute for the Semi-Arid Tropics, India; IITA, International Institute of Tropical Agriculture, Nigeria; ILRI, International Livestock Research Institute, Ethiopia;

IRRI, International Rice Research Institute, The Philippines. Regarding to the latest FAO report on the state of the world’s plant genetic resources for food and agriculture (FAO 2010) globally 7.4 million accessions are stored in about 1,750 *ex situ* genebanks of which 130 store more than 10,000 accessions (Figure 1). Nearly 800,000 are stored in the international CGIAR genebanks.

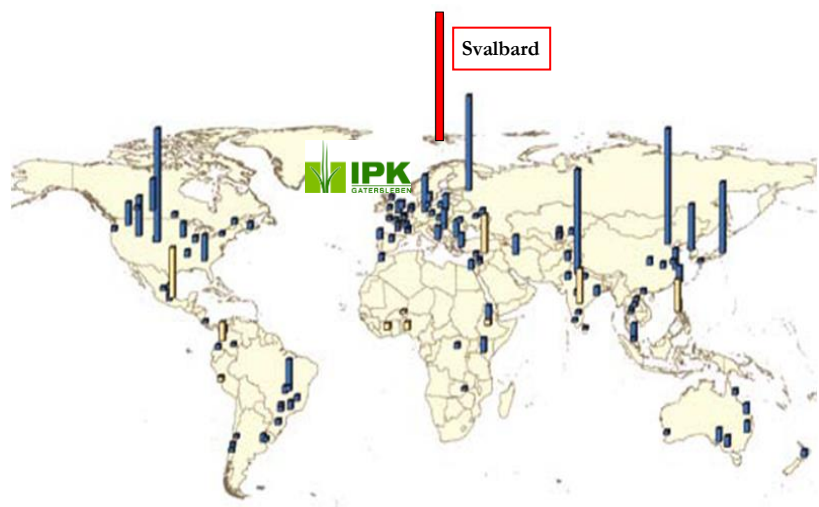


Figure 1. Geographic distribution of genebanks with holdings of >10 000 accessions (national and regional genebanks in blue; CGIAR centres genebanks in beige; *Svalbard* Global Seed Vault in red

The 10 largest collections consisting of six and four national and CGIAR genebanks, respectively, are listed in table 1. It is estimated that 90% of all genebank holdings are stored a seeds whereas less than 10% and less than 1% are maintained *in vivo* (field genebanks) and *in vitro* (tissue culture and cryo preservation), respectively (FAO 1998). Clearly, seed storage is the predominant mode of plant genetic resources conservation.

Considering major crop groups about 45 percent of all the accessions in the world’s genebanks are cereals, followed by legumes (15 percent), fruits and forage crops (each 6–9 percent) as well as roots and tubers, oil crops and fibre

crops (each 2–3 percent). The largest total numbers per crop are covered by wheat and rice, the two cereals feeding the world. Crops with more than 50,000 accessions stored in the global genebanks are listed in table 2.

Table 1. The ten largest germplasm collections on earth

Institution	Country	Accessions
NPGS (National Plant Germplasm System)	USA	508,994
ICGR-CAAS (Institute of Crop Germplasm Resources, Chinese Academy of Agricultural Science)	China	391,919
NBPGR (National Bureau of Plant Genetic Resources)	India	366,333
VIR (N. I. Vavilov Research Institute of Plant Industry)	Russia	322,238
NIAS (National Institute of Agrobiological Science)	Japan	243,463
CIMMYT (Centro Internacional de Mejoramiento de Maíz y Trigo)	Mexico	173,571
IPK (Leibniz-Institut für Pflanzengenetik und Kulturpflanzenforschung)	Germany	148,128
ICARDA (International Center for Agricultural Research in the Dry Areas)	Morocco and Lebanon	132,793
ICRISAT (International Crops Research Institute for the Semi-Arid Tropics)	India	118,882
IRRI (International Rice Research Institute)	Philippines	109,161

In February 2008, the Svalbard Global Seed Vault (SGSV) was opened to become a backup facility for the world's seed banks. The Seed Vault is managed in partnership by the Government of Norway, the Nordic Genetic Resource Center (NordGen) and the Global Crop Diversity Trust (the Trust). NordGen is a public regional institute supported by the governments of the Nordic countries, and the Trust is an independent international organization based in Bonn, Germany. The Norwegian Ministry of Agriculture and Food is the legally responsible authority for the Seed Vault, and its operation is overseen by an International Advisory Council consisting of international technical and policy experts representing, among others, the FAO, national genebanks, the CGIAR and the Governing Body of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). The Seed Vault

provides free-of-charge, long-term storage of duplicates from genebanks around the world and works as an insurance policy against incremental or catastrophic loss of the original collections (Westengen et al. 2013).

Table 2. World-wide germplasm collections with more than 50,000 accessions by crop

Crop	Genus	Accessions
Wheat	<i>Triticum</i>	856,168
Rice	<i>Oryza</i>	773,948
Barley	<i>Hordeum</i>	466,531
Maize	<i>Zea</i>	327,932
Bean	<i>Phaseolus</i>	261,963
Sorghum	<i>Sorghum</i>	235,688
Soybean	<i>Glycine</i>	229,944
Oat	<i>Avena</i>	130,653
Groundnut	<i>Arachis</i>	128,435
Cotton	<i>Gossypium</i>	104,780
Chickpea	<i>Cicer</i>	98,313
Potato	<i>Solanum</i>	98,285
Pea	<i>Pisum</i>	94,001
Medicago	<i>Medicago</i>	91,922
Tomato	<i>Lycopersicon</i>	83,720
Clover	<i>Trifolium</i>	74,158
Rubber	<i>Hevea</i>	73,656
Capsicum	<i>Capsicum</i>	73,518
Prunus	<i>Prunus</i>	69,497
Pearl Millet	<i>Pennisetum</i>	65,447
Cowpea	<i>Vigna</i>	65,323
Apple	<i>Malus</i>	59,922
Grape	<i>Vitis</i>	59,607
Lentil	<i>Lens</i>	58,405

On February 26, 2019, the 11th anniversary of the Svalbard Global Seed Vault opening, the total safety back-up collection comprised 983,524 accessions belonging to 1,091 genera and 6,005 species. Depositors are 76 institu-

tions from all over the world. The accessions stored at the Vault are safety duplicates of material already held in collections of the depositors. It should be clearly stated that all materials remain under the ownership of the providing institutions/countries (<https://www.nordgen.org/sgsv/>). Usually three regular openings for receiving seeds will be organized each year. In 1919 these are week 13 (24–28 March), week 23 (3–6 June) and week 43 (21–25 October) (Asdal, personal communication).

The ten largest depositors are presented in table 3. Among them there are five, each coming from national and CGIAR genebanks, respectively. Table 4 shows the depositors providing the most diverse collections to the Seed Vault (<https://www.nordgen.org/sgsv/>).

Table 3. The 10 largest depositors providing seed samples to the SGSV

Institution	Country	Accessions
CIMMYT	Mexico	158,218
IRRI	Philippines	125,493
NPGS	USA	120,745
ICRISAT	India	111,173
ICARDA	Morocco and Lebanon	66,786
CIAT	Columbia	56,246
IPK	Germany	54,209
PGRC	Canada	31,955
APG	Australia	28,493
Nordgen	Sweden	24,846

Table 4. The 10 depositors providing the most taxa to the SGSV

Institution	Country	Taxa
IPK	Germany	5,255
NPGS	USA	2,414
APG	Australia	1,050
ILRI	Ethiopia	786
CIP	Peru	702
CIAT	Columbia	702
Nordgen	Sweden	594
PGRC	Canada	476
VIR	Russia	471
CGN	The Netherlands	405

The German *Ex situ* Genebank

The ‘Federal *Ex situ* Genebank for Agricultural and Horticultural Crops’, operated by the Leibniz Institute of Plant Genetics and Crop Plant Research (IPK) in Gatersleben, Germany is among the ten largest genebanks on earth (Figure 1, Table 1). In total around 150,000 accessions belonging to 3,212 plant species and 776 genera are maintained, covering wild and primitive forms, landraces as well as old and more recent cultivars of mainly cereals and grasses (65,897 acc.) but also legumes (27,819 acc.), vegetables (21,052 acc.), forage crops (14,388 acc.), medicinal and spice plants (8,194 acc.), potatoes (6,217 acc.), oil, fibre and dye plants (5,478 acc.) and others (1,706 acc.). Crops having more than 2,000 accessions are listed in table 5 (Annonymus 2018).

Table 5. IPK germplasm collections with more than 2,000 accessions by crop

Crop	Genus	Accessions
Wheat	<i>Triticum</i>	28,206
Barley	<i>Hordeum</i>	23,607
Forage grasses	<i>Agrostis, Alopecurus, Arrhenatherum, Dactylis, Descampsia, Festuca, Holcus, Lolium, Phleum</i>	10,548
Bean	<i>Phaseolus</i>	8,979
Potato	<i>Solanum</i>	6,217
Pea	<i>Pisum</i>	5,312
Oat	<i>Avena</i>	4,849
Brassica (Oleracea + Rape)	<i>Brassica</i>	4,710
Tomato	<i>Lycopersicon</i>	4,469
Faba bean	<i>Vicia</i>	3,096
Lupin	<i>Lupinus</i>	2,768
Allium	<i>Allium</i>	2,761
Rye	<i>Secale</i>	2,410
Flax	<i>Linum</i>	2,321
Beets	<i>Beta</i>	2,293
Soybean	<i>Glycine</i>	2,023

Collecting activities are going back to the 1920’s. The oldest material at the IPK genebank originated from such expeditions are wheat and barley landraces collected between 1922 and 1932 by Erwin Mayr in the Salzsachtal region, Austrian Alps. Around 160 further collection missions did follow. Main regions covered by these expeditions are listed in table 6.

Table 6. IPK collection missions

Period	Number of expeditions	Main regions
Before 1950	9	Austria, Hindukusch, Tibet, Balkan
1950–1959	4	China, Iran, Italy
1960–1969	5	Mongolia, Cuba, Soviet Union (Amur region)
1970–1979	9	Czechoslovakia, Poland, Spain
1980–1989	57	Italy, Georgia, Austria, Libya, Cuba, Iraq, North Korea, Ethiopia
1990–1999	54	Albania, Tunisia, Romania, Italy, Iran, Uzbekistan, Turkmenistan, Croatia, Bulgaria
2000–2018	20	Uzbekistan, Georgia, Armenia, France, Ireland, Czech Republic, Germany (Bavarian Alps), Jordan, Switzerland

Seed storage is managed in large cold chambers at -18°C (Figure 2A). Seeds are divided into active samples, kept in glass jars covered with bags containing silica gel and basic samples stored in Aluminium bags under vacuum. A second Aluminium bag with seeds is prepared to be sent to the SGSV as safety duplicate. The cold chambers at IPK have a capacity to store a maximum of 160,000 glass jars, i.e. one jar per accession. However, there may be a surplus of seeds after harvesting the regeneration plots. These extra seeds are stored in a separate medium term seed storage at 20°C and 50% relative humidity (Figure 2B).



Figure 2. Storage facilities at IPK Gatersleben: A – long term storage (-18°C); B – medium term storage ($+20^{\circ}\text{C}$)

Beside seed storage the maintenance of the collection requires regeneration which becomes necessary when: (i) the quantity of stored seed has dropped below a pre-set threshold, due to supply to users, (ii) viability falls below a pre-set threshold, or (iii) new accessions which require multiplication and characterization enter the collection. Each year between 8,000 and 10,000 accessions are grown either in the field (Figure 3) or in glasshouses. Voucher specimens, photographs and written documentation (descriptors) are used to monitor the identity of the material.

More recently new molecular tools (genomics) were used to genotype whole collections as in the case of barley. Genome-wide genotyping-by-sequencing data for 21,500 barley accessions of the Gatersleben genebank are available now (Millner et al. 2019). The data provides insights into the global population structure of the collection and points out redundancies and coverage gaps.

The Longevity of Seeds Deposited in Genebanks

Since the majority of genebank accessions is stored in the form of seed, seed longevity is of particular importance for crop germplasm preservation. Therefore, at the IPK research was initiated for a range of crops stored in the genebank over decades. As expected, variation between crop species was revealed. Nagel and Börner (2010) studied 18 crop species covering cereals, legumes and oil crops and stored for up to 26 years at 20°C and 50.5% relative humidity. Germination rates decreased in a sigmoid fashion. Pea, common bean and maize seeds retained their viability over the longest period (23, 21 and 19 years, respectively). In contrast, chive seeds survived for only 5 years and lettuce for 7 years. Seeds in which oil was the major seed storage component were more short lived, whereas carbohydrates or proteins did not show an effect on seed longevity. In addition to the interspecific variability, there were also indices for intraspecific variability, particularly in bean and chive seeds, just as in collard, lupin, poppy, wheat and maize.

Intraspecific variation of genebank collections was investigated by Nagel et al. (2010). The study included accessions of barley, wheat, rye, sorghum, oilseed rape and flax which were stored in the cold chambers of the Gatersleben genebank between 26 and 33 years. Most crops showed high germination when tested within 5 years post harvest but germination within species separated strongly after 20 years. In particular, wheat germination resulted between

0 and 87% germination after 34 years of storage and barley accessions germinated between 43 and 95% after 35 years. Rye accessions had reduced germinations between 8 and 47% after 27 years.



Figure 3. View on the genebank regeneration fields at IPK in Gatersleben

Agacka et al. (2013; 2014) investigated the longevity of *Nicotiana* seeds stored under ambient (20°C) and reduced temperature of either 0°C or –15/–18°C. Materials from ambient storage were maintained for up to 12 years at two different sites (IUNG Pulawy, Poland – Experiment 1 and IPK Gatersleben, Germany – Experiment 2). At the former site, no attempt was made to control either temperature or relative humidity (RH), allowing the temperature to range between 18°C and 22°C (no records have been kept of the variation in RH). At IPK, the seed was maintained in the medium term storage at 20°C and 50% RH. Seeds stored under reduced temperatures were originated from IUNG (Experiment 3) and IPK (Experiment 4). The IUNG material was

maintained at the Plant Breeding and Acclimatization Institute in Radzików, Poland (IHAR). Seed stocks were regenerated at IUNG between 1981 and 2000. Seeds were stored in paper bags under vacuum in air-tight glass jars in a cold chamber at 0°C. Glass jars contained a bag with 70 g of bentonite as a drying substance, which kept seed moisture content at around 4%. The investigated seed stocks from the IPK collection were regenerated between 1975 and 1991. Seeds were stored in hermetically closed glass jars in a cold chamber at -15/-18 °C. The glass jars contained a fabric bag with silica gel granules (SiO₂), which kept the seed moisture content at around 6%.

The results of the four experiments are summarized in figure 4. Although in both Experiments 1 and 2 seeds were stored under ambient conditions, there were large differences in longevity. After 11 years the proportion of seed lots (accessions) with germination > 75% reached 0 in Experiment 1 while it was still 40% in Experiment 2. The alteration in storage temperature was small between the two sites, however, the moisture content of the seed, which is determined by ambient RH, was only controlled in Experiment 2. The RH as recorded at the weather station at Pulawy over the period 2000–2010 varied from 73.7% to 82.7% (mean ~77%), levels which were substantially above that imposed at IPK. It seems likely therefore that a high RH was the major cause of the reduced viability of the seed stored at IUNG. At reduced temperature (0°C) proportion of accessions with germination > 75% was less than 10% after 30 years of storage (Experiment 3) whereas at temperatures of -15°C/-18°C (IPK) more than 50% of all accessions had germination rates higher than 75% after nearly 40 years of storage (Experiment 4). It can be concluded that decreasing the temperature from 20 to 0°C increases the storability of tobacco seeds from about 10 to 30 years and decreasing it further to -15/-18°C increases storability to more than 50 years, measured by a germination threshold higher than 75%.

Considering the high level of intraspecific variation between the accessions within the species under investigation one should taken into account that they were regenerated and harvested in the same year, the same harvest (threshing and cleaning) technologies were applied and the storage conditions were identical. Therefore, it can be concluded that the differences in germina-

tion after long term storage are genetically based. Therefore, genetic analyses of seed longevity were initiated at IPK. Genetic mapping was performed for barley (Nagel et al. 2009; 2014; 2016; 2018), wheat (Landjeva et al. 2010; Rehman Arif et al. 2012; 2017; Börner et al. 2018, Rehman Arif and Börner 2019), oilseed rape (Nagel et al. 2011) and tobacco (Agacka-Moldoch et al. 2015).

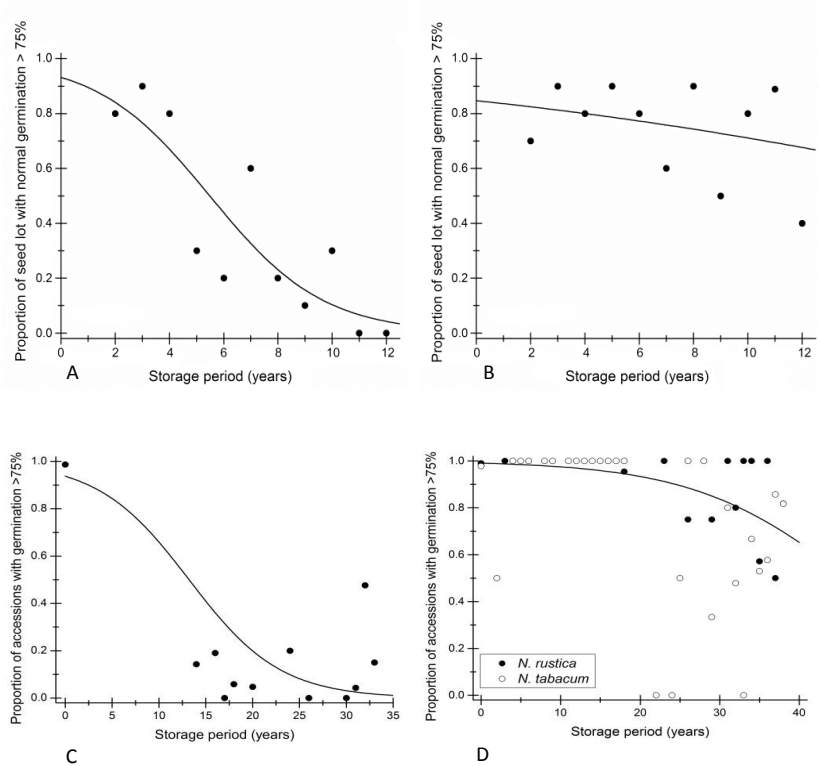


Figure 4. Proportion of *Nicotiana* seed lots with a germination rate higher than 75% (normal seedlings). A – Experiment 1 (Ambient storage at IUNG); B – Experiment 2 (Ambient storage at IPK); C – Experiment 3 (0°C storage at IHAR); D – Experiment 4 (-15/-18°C storage at IPK)

In tobacco Agacka-Moldoch et al. (2015) investigated 122 recombinant inbred lines derived from a cross between the cultivars ‘Florida 301’ and ‘Hicks’. Four germination-related traits (% total germination, % normal germination, time to 50% of total germination and the area under the curve after 200 hours of germination) were investigated by examining seeds either untreated or after controlled deterioration. QTL mapping revealed four genomic regions located on four different linkage groups to be associated with the selected traits (Figure 5).

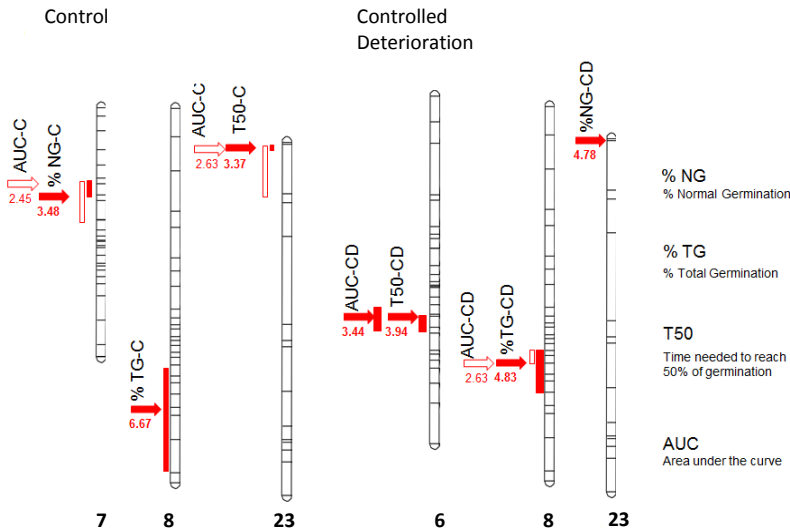


Figure 5. Positions of the QTL of control seeds (left) and seeds after controlled deterioration (right) for the traits % total germination, % normal germination, time needed to reach 50% of total germination and area under the curve after 200 hours of germination. LODs are given below the arrows. Vertical bars indicate intervals LOD>3 (major QTL; filled bars) and LOD>2<3 (minor QTL; empty bars)

Positive alleles for the individual traits were contributed by both parents. A major quantitative trait locus (QTL) for high percentage total germination located on linkage group 8/18 appeared in both control and deteriorated seeds and was contributed by ‘Hicks’. In contrast, ‘Florida 301’ donated a favorable allele for germination speed on linkage group 7 after controlled deterioration only.

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BSc Theses

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2. Hecht, M.: Untersuchungen im Winterweizensortiment „Boris96“ zum Auftreten von Weizengallmücken am Standort Quedlinburg 2015. (Bachelor Thesis) Martin-Luther-Universität Halle-Wittenberg, Naturwissenschaftliche Fakultät III, Institut für Agrar- und Ernährungswissenschaften, Halle/S. (2016) 93 pp.
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Journal of Experimental Botany, Journal of Applied Genetics, Journal of Genetics, Journal of Phytopathology, Journal of Plant Growth Regulation, Journal of Plant Physiology, Journal of Zhejiang University, Methods in Ecology and Evolution, Microscopy and Microanalysis, Molecular Breeding, Molecular Ecology, Molecular Genetics and Genomics, Net Journal of Agricultural Science, New Zealand Journal of Crop & Horticultural Science, Phytopathology, Plant Biology, Plant Breeding, Plant Genetic Resources Characterization & Utilization, Plant Growth Regulation, Plant Production Science, Plant Science, Plant Systematics and Evolution, Planta, Plants, PLoS One, Scientific Reports, Seed Science Research, Seed Science and Technology, Taxon, The Journal of Horticultural Science & Biotechnology, The Plant Genome, Theoretical and Applied Genetics, Trends in Plant Science.

Organisation of International Conferences

1. General Congress of EUCARPIA, Rotterdam, The Netherlands, August 23-28, 2020, Organising committee.
2. 5th Conference of Cereal Biotechnology and Breeding jointly organized with the EUCARPIA Cereals Section, Budapest, Hungary, November 4–7, 2019, Co-organiser.
3. 2nd International Conference ‘Agrophysics Trends: from actual challenges in arable farming and crop growing towards advanced technologies’, St. Petersburg, October 2–4, 2019, International Scientific Committee.
4. 5th International Scientific Conference ‘Plant Genetics, Genomics, Bioinformatics and Biotechnology’ (PLANTGEN2019), Novosibirsk, Russia, June 24-29, 2019, Organising committee.
5. International Conference ‘Breads of the Future: Genomics, Genetics, Breeding’, 125 Years of Federal Research Center ‘Vavilov All-Russian Institute of Plant Genetic Resources’ – VIR, St. Petersburg, June 20–21, 2019, International Scientific Committee.
6. 2nd Seed Longevity Workshop, International Society of Seed Science, Fort Collins, Colorado USA July 30–August 1, 2018, 112 participants, Organising committee.
7. 2nd International Conference on Triticale Biology, Breeding and Production, Erzurum, Turkey, June 24–28, 2018, 102 participants, Organising committee.
8. 17th EWAC – The European Cereals Genetics Co-operative jointly organized with the EUCARPIA Cereals Section ‘Cereals for Tomorrow’ Bucharest, Romania, June 3–8, 2018, 55 participants, Co-organiser.
9. International Conference of the Working Group Seed Science and Certification (GPZ/GPW) & Section IV Seeds (VDLUFA), ‘Testing Methods and Research on Seed Quality’, Gatersleben, April 10–12, 2018, 155 participants, Co-organiser.
10. 4th International conference on Genetic Resources and Plant Breeding, Novosibirsk, Russia, April 4–6, 2018, 110 participants, Organising committee.

11. EUCARPIA Cereals Section Conference 'Breeding cereals for sustainable agriculture', Clermont-Ferrand, France, 19–21 March 2018, 230 participants, Organising committee.
12. The 3rd International Conference "Plant genetic collections and breeding", Novosibirsk, Russia, March 28–30, 2017, 105 participants, Organising committee.
13. EUCARPIA Section Genetic Resources Conference 'Crop diversification in a changing world' Montpellier, France, May 8–11, 2017, 196 participants, Organising committee.
14. The 8th International Triticaceae Symposium (8ITS)/EUCARPIA Cereals Section, Wernigerode, Germany, June 12–16, 2017, 124 participants, Organising committee.
15. International Conference on Triticale Biology, Breeding and Production – EUCARPIA Triticale Working Group of Cereals Section, Radzikow, Poland, July 2–5, 2017, International, 95 participants, Organising committee.
16. 4th Conference of Cereal Biotechnology and Breeding jointly organized with the EUCARPIA Cereals Section, Budapest, Hungary, November 6–9, 2017, 131 participants, Co-organiser.
17. International Vavilov Conference, 'N. I. Vavilov's Ideas in the Modern World', St. Petersburg, Russia, November 20–24, 2017, 412 participants, Organising committee.
18. Tagung der Arbeitsgemeinschaft Saatgut und Sortenwesen der der Gesellschaft für Pflanzenbauwissenschaften (GPW) und der Gesellschaft für Pflanzenzüchtung (GPZ), Erhaltungsstrategien für Saatgut im Kontext sich verändernder Umweltbedingungen, Regensburg, Germany, April 4–5, 2016, 50 participants, Co-organiser.
19. The 9th International Triticale Symposium, Szeged, Hungary, May 23–27, 2016, 110 participants, Organising committee.
20. The 1st International Workshop "Plant Genetics and Genomics for Food Security", PGGFS-2016, Novosibirsk, Russia, August 26–28, 2016, 120 participants. Organising committee.
21. The 7th International Seminar 2016, Sustainable Resource Management "Towards Food, Energy, Environment and Livelihood", Göttingen, Germany, November, 27–29, 2016, 54 participants. Organising committee.
22. EWAC – The European Cereals Genetics Co-operative – EUCARPIA Cereals Section Conference, May 24–29, 2015, Lublin, Poland, 47 participants, Co-organiser.
23. DROPS (Drought-tolerant yielding Plants) – EUCARPIA Conference on Drought Tolerance, Montpellier, France, June 8–9, 2015, 307 participants, Organising committee.
24. The 3rd International Conference 'Plant Genetics, Genomics, Bioinformatics and Biotechnology', Novosibirsk, Russia, June 17–21, 2015, 143 participants, Organising committee.
25. International Conference on Rye Breeding and Genetics, Wroclaw, Poland, June 24–26, 2015, 81 participants, Organising committee.

26. International Society for Seed Science (ISSS), Seed Longevity Workshop, Wernigerode/Gatersleben, Germany, July 5–8, 2015, 212 participants, Co-organiser.
27. EUCARPIA Cereals Section-ITMI Joint Conference ‘Cereals for Food, Feed and Fuel – Challenge for Global Improvement’, Wernigerode/Gatersleben, Germany, June 29–July 4, 2014, 333 participants, Co-organiser.
28. International Conference of the Working Group Seed Science and Certification (GPZ/GPW) & Saatgut Austria ‘Future Seeds – Production, Marketing, Utilization and Conservation’, Gumpenstein, Austria, November 24–26, 2014, 136 participants, Co-organiser.
29. Conference of the Working Group Seed Science and Certification (GPZ/GPW) ‘Saatguterhaltung und Nutzbarmachung von Kulturpflanzen und heimischen Wildarten’, Osnabrück, Germany, May 8–9, 2012, 80 participants, Co-organiser.
30. 19th General Congress of EUCARPIA, ‘Plant Breeding for Future Generations’, Budapest, Hungary, May 21–24, 2012, 350 participants, Organising committee.
31. International Durum Wheat Symposium, ‘Genetics and Breeding of Durum Wheat’, Rome, Italy, May 27–30, 2013, 250 participants, Organising committee.
32. Joint AGRISAFE – EUCARPIA Cereals Section Workshop for Young Cereal Scientists ‘Climate Change and Plant Breeding Answers’, Budapest, Hungary, March 21–23, 2011, 160 participants, Organising committee.
33. EWAC – The European Cereals Genetics Co-operative – EUCARPIA Cereals Section Conference, ‘Development and Utilisation of Cereal Stocks for Gene Identification and Molecular Mapping’, Novi Sad, Serbia, November 7–11, 2011, 60 participants, Co-organiser.
34. Conference of the Working Group Seed Science and Certification (GPZ/GPW) ‘Saatgut als Kulturerbe – Produktion, Nutzung und Erhaltung’, Gatersleben, Germany, February 24–25, 2010, 100 participants, Co-organiser.
35. 8th International Wheat Conference, St. Petersburg, Russia, June 1–4, 2010, 650 participants, Organising committee.
36. 2nd International Symposium on Genomics of Plant Genetic Resources, Bologna, Italy, April 24–27, 2010, 350 participants. Organising committee.
37. EWAC – The European Cereals Genetics Co-operative, Istanbul, Turkey, May 6–10, 2007, 40 participants, Co-organiser.
38. EWAC – The European Aneuploid Co-operative, Prague, Czech Republic, June 27–July 1, 2005, 33 participants, Co-organiser.
39. EWAC – The European Aneuploid Co-operative, Norwich, UK, July 1–6, 2002, 47 participants, Co-organiser.
40. EWAC – The European Aneuploid Co-operative, ‘Cereal Aneuploids for genetical analysis and molecular techniques’, Gatersleben-Wernigerode, Germany, July 4–8, 2002, 45 participants, Co-organiser.

Invited Oral Presentations

- Börner, A., M. Nagel, M. Agacka-Moldoch, M. Börner, U. Lohwasser, D. Riewe & T. Altmann: The conservation of plant genetic resources for future generations. 3rd International & 15th National Iranian Crop Science Congress, Karaj, Iran, September 4th to 6th, 2018.
- Börner, A., M. Nagel, M.A. Rehman Arif, M. Agacka-Moldoch, U. Lohwasser, D. Riewe, J. Wiebach & T. Altmann: Why seed longevity matters. International Society for Seed Science (ISSS), The Second Seed Longevity Workshop, Fort Collins, Colorado, USA, July 30 – August 01, 2018.
- Börner A., M. Nagel, M.A. Rehman Arif, M. Börner, U. Lohwasser, D. Riewe & T. Altmann: Plant Genetic Resources for improving wheat quality. Wheats and Women International Conference, Rome, Italy, June 14–15, 2018.
- Börner A., U. Lohwasser, E.K. Khlestkina, T.A. Pshenichnikova, S.V. Osipova, S. Misheva (Landjeva) & M.R. Simon: Examples on successful collaboration (2015–2018). EWAC-EUCARPIA Cereals Section International Conference, Bucharest, Romania, June 3–8, 2018.
- Börner, A., M. Nagel, M.A. Rehman Arif, M. Agacka-Moldoch, U. Lohwasser, D. Riewe, J. Wiebach & Th. Altmann: The *Ex situ* Conservation of Cereals Genetic Resources – The current status. EWAC-EUCARPIA Cereals Section International Conference, Bucharest, Romania, June 3–8, 2018.
- Börner, A., M. Nagel, M.A. Rehman Arif, M. Agacka-Moldoch, M. Börner, U. Lohwasser, D. Riewe, J. Wiebach & Th. Altmann: The *Ex situ* Conservation of Plant Genetic Resources for Food and Agriculture – State of the Art. Global Genome Biodiversity Network (GGBN) Conference, Vienna, Austria, May 22–25.
- Börner, A.: The Conservation and Exploitation of Plant Genetic Resources in the German *ex situ* Genebank. Faculty of Plant Production, Gorgan University of Agricultural Sciences and Natural Resources, Post Code 49138–15739, Gorgan, Golestan, Iran, May 16, 2018.
- Börner, A.: The Conservation and Exploitation of Plant Genetic Resources for Food and Agriculture. 15th National and 3rd International Congress of the Iranian Genetics Society, Tehran, Iran, May 13–15, 2018.
- Börner, A., M. Nagel, M. Agacka-Moldoch, M. Börner, U. Lohwasser, D. Riewe, J. Wiebach, T. Altmann, T.A. Pshenichnikova & E. Khlestkina: Genebank collections – Conservation and utilization for plant breeding and research. 3rd International Conference "Plant genetic collections and breeding", dedicated to the 130th anniversary of N.I. Vavilov, Novosibirsk, Russia, March 28–30, 2017.
- Börner, A., M. Nagel, M.A. Rehman Arif, M. Agacka-Moldoch, M. Börner, U. Lohwasser, D. Riewe, J. Wiebach & T. Altmann: Plant genetic resources – conservation and exploitation for research activities. Sympozjum Naukowe Zasoby Genowe Roślin Użytkowych na Rzecz Hodowli (Symposium "Plant Genetic Resources for Breeding"), Kazimierz Dolny, Poland, September 6–8, 2017.

- Börner, A.: Key factors affecting seed quality – from regeneration to storage. Workshop “Seed quality in genetic resources conservation of horticultural plants”, Skierniewice, Poland, October 27, 2017.
- Börner, A., M. Nagel, M. Allam, M. Agacka-Moldoch, M.A. Rehman Arif, M. Börner, R. Tarawneh, U. Lohwasser, D. Riewe, J. Wiebach & T. Altmann: Plant genetic resources in the federal *ex situ* genebank of Germany – Conservation and utilization. National Research Centre (NRC), Cairo, Egypt, October 30, 2017.
- Börner, A., M. Nagel, M. Allam, M. Agacka-Moldoch, M.A. Rehman Arif, M. Börner, R. Tarawneh, U. Lohwasser, D. Riewe, J. Wiebach & T. Altmann: The conservation and exploitation of plant genetic resources in *ex situ* genebanks. Conference, “Efforts of ASRT in the conservation and documentation of the Genetic Resources“ (Wealth of Egypt), Academy of Scientific Research and Technology (ASRT), Cairo, Egypt, October 31, 2017.
- Börner, A., M. Nagel, M. Allam, M. Agacka-Moldoch, M.A. Rehman Arif, M. Börner, R. Tarawneh, U. Lohwasser, D. Riewe, J. Wiebach & T. Altmann: Conservation and utilisation of plant genetic resources in the federal *ex situ* genebank of Germany. 8th Annual International Conference of Arab Biotechnology Association: Biotechnology, Biodiversity, Biosafety & Bioindustry, Sharm El Sheikh, Egypt, November 1–2, 2017.
- Börner, A., M. Nagel, R. Tarawneh, M.A. Rehman Arif, M. Agacka-Moldoch, M. Börner, U. Lohwasser, D. Riewe, J. Wiebach & T. Altmann: Plant genetic resources in the global genebanks – conservation and exploitation. 4th Conference of Cereal Biotechnology and Breeding (CBB4), Budapest, Hungary, November 6–9, 2017.
- Börner, A., M. Nagel, M. Agacka-Moldoch, M. Börner, U. Lohwasser, D. Riewe, J. Wiebach, T. Altmann, T.A. Pshenichnikova & E. Khlestkina: Conservation and utilisation of plant genetic resources – Vavilov’s heritage. 4th International Vavilov Conference, N. I. Vavilov’s Ideas in the Modern World, Saint-Petersburg, Russia, November 20–24, 2017.
- Börner A., M. Nagel, M.A. Rehman Arif, M. Allam, M. Agacka-Moldoch, U. Lohwasser, T.A. Pshenichnikova & E. Khlestkina: Germplasm collections – The source for future breeding and food sustainability. The 1st International Workshop “Plant Genetics and Genomics for Food Security”, PGGFS-2016, Novosibirsk, Russia, August 26–28, 2016.
- Börner, A., M. Allam, M.A. Rehman Arif, M. Agacka-Moldoch, M. Börner, R. Tarawneh, U. Lohwasser & M. Nagel: The role of ex-situ gene banks in biodiversity conservation. Humboldt Kolleg / Helwan University First International Conference on “Biodiversity and Sustainable Development”, Cairo, Egypt, October 15–16, 2016.
- Börner, A.: Seed storage in *ex situ* genebanks – Genetic and biochemical investigations. National Genebank, Institute of Crop Science (CAAS), Beijing, China, 20. October 20, 2016.
- Börner, A.: Conservation and utilization of plant genetic resources – The German *ex-situ* Genebank at the IPK Gatersleben. Zhengzhou Fruit Research Institute (CAAS), Zhengzhou, China, October 22, 2016.

- Börner, A.: Plant genetic resources for food and agriculture – Maintenance and research. Henan Agricultural University, Zhengzhou, China, October 23, 2016.
- Börner, A.: From the perspective of an *ex situ* genebank manager: Maintenance and utilization of a certified collection. Access and Benefit Sharing 2016, 1st International Conference, Basel, Switzerland, November 8–9, 2016.
- Börner A., M. Agacka-Moldoch, M. Allam, M.A. Rehman Arif, M. Börner, R. Tarawneh, U. Lohwasser & M. Nagel: Plant Genetic Resources for Food and Agriculture (PGRFA) – Conservation and utilization for research and plant breeding. 7th International Seminar 2016, Sustainable Resource Management “Towards Food, Energy, Environment and Livelihood”, Göttingen, Germany, November, 27–29, 2016.
- Börner, A.: Plant Genetic Resources for Food and Agriculture (PGRFA) – Maintenance and research. Universität Innsbruck, Institut für Botanik, Innsbruck, Österreich, May 15, 2015.
- Börner, A.: Plant genetic resources for food and agriculture – Maintenance and utilization for genetic studies. Institute of Plant Genetics, Polish Academy of Sciences, Poznan, Poland, June 1, 2015.
- Börner, A., M. Nagel, M.A. Rehman Arif, M. Allam, U. Lohwasser, M. Agacka-Moldoch, T. Doroszewska & E. Khlestkina: Plant genetic resources – The prerequisite for future genetic studies and plant breeding. The 3rd International Conference “Plant genetics, Genomics, Bioinformatics and Biotechnology”, PlantGen, Novosibirsk, Russia, June 17–21, 2015.
- Börner, A.: Gene bank management and seed materials reproduction. 6th Annual International Arab Workshop on Biotechnology, “Plant Genetic Resources: Conservation, Documentation and Better Utilization”, Cairo, Egypt, August 24–25, 2015.
- Börner, A.: Wie lassen sich die pflanzengenetischen Ressourcen für künftige Generationen erhalten? – Die Genbank für Kulturpflanzen und verwandte Wildarten in Gatersleben. Museum für Naturkunde, Magdeburg, Germany, March 20, 2014.
- Börner, A.: Genbanken für landwirtschaftliche und gärtnerische Kulturpflanzen – Erhaltung und Nutzbarmachung der Sammlungen. Abschlusstagung Genbank WEL, Regensburg, Germany, April 29–30, 2014.
- Börner, A.: Plant genetics resources for food and agriculture – maintenance and research. Mendel University, Brno, Czech Republic, May 26, 2014.
- Börner, A.: Conservation and utilization of plant genetic resources for food and agriculture (PGRFA) – The German view. National Genebank, Chinese Academy of Agricultural Sciences (CAAS), Beijing, China, September 12, 2014.
- Börner, A., S. Landjeva, M. Negel, M.A. Rehman Arif, M. Allam, M. Agacka, T. Doroszewska, K. Neumann & U. Lohwasser: Plant genetic resources for food and agriculture (PGRFA) – Maintenance and research. Scientific Conference “Plant Physiology and Genetics, Achievements and Challenges”, Sofia, Bulgaria, September 24–26, 2014.
- Börner, A.: Plant genetic resources maintained via seed storage – management and research. Institute of Vegetables and Flowers, Chinese Academy of Agricultural Sciences, Beijing, China, November 5, 2013.

- Börner, A.: Plant genetic resources – the basis for future breeding. Symposium: Future Challenges of Plant Breeding – Preparing the Next Generation. Hohenheim, Germany, November 18, 2013.
- Börner, A., E.K. Khlestkina, S. Chebotar, R.K. Varshney, M. Nagel, M.A. Rehman Arif, U. Lohwasser & M.S. Röder: Molecular tools for the characterization and utilization of plant genetic resources for food and agriculture (PGRFA). Indraprastha International Conference on Biotechnology (IICB-2013), New Delhi, India, October 22–25, 2013.
- Börner, A.: Die Kulturpflanzenbank in Gatersleben – Grundlage für künftige Pflanzenzüchtung. Plant Breeding Seminar, Universität für Bodenkultur, Department für Nutzpflanzenwissenschaften, Abteilung Pflanzenzüchtung, Wien, Austria, March 28, 2012.
- Börner, A.: Plant genetic resources for food and agriculture (PGRFA) – conservation and utilization. Universität für Bodenkultur, Universität und Forschungszentrum Tulln, Austria, March 28, 2012.
- Börner, A.: Genetic resources for crop improvement in future breeding. International Conference on “Biotechnology and Plant Breeding, Perspectives towards food security and sustainability”, Radzikow, Poland, September 10–12, 2012.
- Börner, A.: Plant genetic resources conservation in Germany – the impact of Nikolai Ivanovich Vavilov. III International Vavilov Conference “N.I. Vavilov’s Ideas in the Modern World”, St. Petersburg, Russia, November 6–9, 2012.
- Börner, A.: Molecular tools for investigating plant genetic resources. Global Crop Diversity Trust, Annual Genebank Meeting, Rome, Italy, November 19–23, 2012.
- Börner A.: The German *ex situ* genebank in Gatersleben: Conservation and utilisation of plant genetic resources. Seminar, USDA-ARS, National Center for Genetic Resources Preservation, Fort Collins, Colorado, USA, January 13, 2001.
- Börner A.: Plant genetic resources – molecular tools for characterization and utilization. Genomics of genebanks workshop. Plant & Animal Genome XIX, San Diego, USA, January 15–19, 2011.
- Börner A.: Plant genetic resources for food and agriculture (PGRFA) – conservation and utilisation. Symposium on Genomics and Biodiversity, Hyderabad, India, February 23–25, 2011.
- Börner A.: Conservation and utilisation of plant genetic resources in the German *ex situ* genebank in Gatersleben. National Bureau of Plant Genetic Resources, New Delhi, India, February 27, 2011.
- Börner A., E.K. Khlestkina, S. Chebotar, M. Nagel, M.A. Rehman-Arif, K. Neumann, B. Kobiljski, U. Lohwasser & M.S. Röder: Maintenance and exploitation of genetic resources for future plant breeding. Agrisafe Final Conference, climate change: challenge for training of applied plant scientists, Budapest, Hungary, March 21–23, 2011.
- Börner A., E.K. Khlestkina, T.A. Pshenichnikova, K. Neumann, U. Lohwasser, B. Kobiljski, V. Korzun & M.S. Röder: Cereal genetic stocks – examples of successful co-operation. EWAC-EUCARPIA Cereals Section Conference, Novi Sad, Serbia, November 7–11, 2011.
- Börner A.: Pflanzengenetische Ressourcen – Ausgangsmaterial zur Züchtung auf abiotische Stresstoleranz bei Getreide. Pflanzengenetisches Kolloquium, Georg-August-Universität Göttingen, Germany, January 14, 2010.

- Börner A.: High quality long term conservation, reproduction and utilisation of plant genetic resources at the German *ex situ* genebank. 2nd Workshop “Seed quality in genetic resources conservation of cultivated plants, Warsaw, Poland, May 25–26, 2010.
- Börner A.: Pflanzengenetische Ressourcen – Kleingärten in ihrer Bedeutung zur Erhaltung der Artenvielfalt. 14. Forum Stadtgrün, Dresden, Germany, November 26, 2010.
- Börner A.: The German *ex situ* genebank in Gatersleben – conservation and research. Departmental Science and Conservation Seminar Series, Millennium Seed Bank Project, Wakehurst Place, West Sussex, United Kingdom, January 14, 2009.
- Börner A.: Pflanzengenetische Ressourcen als Grundlage für die Züchtung klimatoleranter Sorten. Norddeutsches Weizenforum 2009, Lübeck, Germany, February 5–6, 2009.
- Börner A., M. Nagel & U. Lohwasser: Samenbanken – Ressourcen für künftige Generationen. Getreide ist funktionell. 17. Internationale Tagung der IGV GmbH, Bergholz-Rehbrücke, Germany, May 11–12, 2009.
- Börner A.: Plant genetic resources for future generations. National Institute of Agricultural Biotechnology, Suwon, Republic of Korea, September 3, 2008.
- Börner A.: Plant genetic resources – maintenance and utilisation. Congress International Society for Biological and Environmental Repositories ‘No Resources, No Future’, Seoul, Republic of Korea, September 4, 2008.
- Börner A.: Plant genetic resources – maintenance and utilisation. Chungnam National University, Daejeon, Republic of Korea, September 5, 2008.
- Börner A.: Plant genetic resources for future breeding. 18th Eucarpia General Congress, Valencia, Spain, September 9–12, 2008.
- Börner A., K. Neumann, U. Lohwasser, M.S. Röder, E.K. Khlestkina, O. Dobrovolskaya, T.A. Pshenichnikova, P. Martinek, M. R. Simon & B. Kobiljski: Germplasm collections as an important tool for breeding – examples on wheat. Breeding 08 – Conventional and Molecular Breeding of Field and Vegetable Crops, Novi Sad, Serbia, November 24–27, 2008.
- Börner, A.: Genbanksortimente – Ausgangsmaterial für genetische und molekulare Forschung. Justus-Liebig-Universität Giessen, Germany, January 22, 2001.
- Börner, A.: The utilisation of molecular markers in Plant Breeding. Conference for Biotechnology, Tripoli, Libya, April 21–24, 2001.
- Börner, A.: Gene and genome mapping in cereals. Conference for Biotechnology, Tripoli, Libya, April 21–24, 2001.
- Börner, A.: Long term storage, regeneration and characterization of plant genetic resources in the Gatersleben genebank. International Conference on Seed Industry, Tripoli, Libyen, March 27–30, 2000.

External Funding

Title	Duration	Project number
A cooperative programme to promote adaption to low input (pesticide, fungicide, fertiliser, irrigation) regimes of crop species, by exploitation of genetic variation from related wild donors (EU "Agriculture & Agroindustry Framework")	01.10.1993 30.09.1996	EG-EG00470341 PL Nr. 921137
Herstellung und Evaluierung umweltfreundlicher Weizengentypen (ARC-Programm)	01.07.1993 31.12.1994	DAAD-06 80421 313-ARC-VII-93
Einführung von neuen Genen für Halmverkürzung bei Getreide zur Substitution von toxischen, umweltbelastenden Halmstabilisatoren	01.01.1992 30.11.1993	MWF-LSA02 30421 244A0931
9. Tagung der European Wheat Aneuploid Co-operative in Gatersleben	04.07.1994 08.07.1994	DFG-D 65 20421
Charakterisierung einer PstI DNA-Library des Roggens – Förderung wissenschaftlicher Beziehungen zu Ländern Mittel- und Osteuropas	01.12.1994 31.06.1995	DFG - D 81 20422 436WER17/4/94
Molecular and cytogenetical charaterication of the rye genome and evaluation of new genes for plant breeding	01.07.1994 30.06.1994	EU - EU 011 70342 INTAS-93-355
9. Tagung der European Wheat Aneuploid Co-operative in Gatersleben	04.07.1994 08.07.1994	LSA 40 30422 09TA1994
Genetical and molecular characterization of agro-nomically important genes in wheat (Förderung der Zusammenarbeit mit Indien)	03.07.1995 02.11.1995	DFG - D 95 446 Ind-112/4/95 20351
Projektbezogener Personalaustausch mit Großbritannien (ARC-Programm)	01.07.1995 31.12.1996	DAAD - 13 313- ARC-IX-95 80422
Marker-unterstützte Selektion bei der Zuckerrübe, Teilprojekt: Selektion auf Resistenz gegen die viröse Vergilbung	01.01.1996 30.04.1997	BMBF 0310504A 101101
Nutzung einer Pst-DNA-Library des Roggens zur Kartierung morphologischer Gene	01.01.1996 30.06.1996	DFG 436 WER 17/6/95S 203502
Sustainable crop improvement of wheat through the evaluation and utilization of precise genetic resources and new biotechnologies	01.07.1997 30.06.1999	DAAD ARC 801210
Organization of visit and training at IPK of Dr. D. Murariu, Genbank Suceava	01.12.1996 31.03.1997	IPGRI 96/121 901302

Genetische Kartierung im Roggen Studienaufenthalt Dr. I.A. Egorova	18.05.1998 17.08.1998	BML 115-0807/GUS 101201
Implementation of the European network for evaluation, conservation and utilization of European Maize landraces genetic resources	01.01.1997 31.12.2001	EU CT96-88 701102
Stable yields in Mediterranean barley: Application of molecular technologies in improving drought tolerance and mildew resistance	01.01.1998 31.12.2000	EU INCO 911201
Deutsch-Russische Zusammenarbeit auf dem Gebiet der Agrarforschung, Studien aufenthalt Dr. Voylokov	01.10.1999 31.12.1999	BML 115-0807/GUS 101203
Evaluation and Enhancement of <i>Beta</i> collections for extensification of agricultural production	01.06.1996 31.05.2001	EU CT95-42 701101
Deutsche Stiftung für Internationale Entwicklungshilfe, 11 Langzeitstipendiaten, Pflanzengenetische Vielfalt und Ernährungssicherung: Erhaltung, Nutzung und Zugang zu pflanzengenetischen Ressourcen	01.01.1999 31.12.1999	DSE/ZEL 901201
Gastaufenthalt Ibrahim Ben Amer	13.10.1999 20.12.1999	UNESCO SC/LSC/99/BAC 901203
Untersuchung verschiedenre Herkünfte von Rosmarin auf antioxidative Inhaltsstoffe	01.06.1998 31.12.1999	010023 Rosmarin 911107
Molekulare Kartierung von Genen für Braunrostresistenz im Weizen	01.09.1999 31.08.2000	010110 AZ:06020202 911202
Aufbau eines NIRS-Netzsystems für Medizinal- und Gewürzpflanzen einschließlich der daraus hergestellten Rohstoffe; Teilvorhaben 2: Methodik, Kalibration und Datenbankeinbindung	01.07.1999 31.12.2001	010041 98NR053 911203
Entwicklung einer vereinigten genetischen Karte des Roggens unter Verwendung molekularer und biochemischer Marker	01.10.2000 29.05.2003	BML 216-0807/GUS 101204
Genotypische und phänotypische Charakterisierung von definierten Weizen-Introgressionslinien	01.09.2000 31.08.2002	DFG RO 1055/1-5 203917
<i>Brassica</i> collections for broadening agricultural use including characterising and utilising genetic variation in <i>Brassica carinata</i> for its exploitation as an oilseed crop	01.01.2000 31.12.2003	EU RESGEN-CT99-109 701103

The future of European Carrot: a Programme to conserve, characterise, evaluate and collect carrot and wild relatives	01.01.2000 31.12.2003	EU CT99-105 701201
Management, conservation and valorisation of genetic resources of Eggplants	01.01.2000 31.12.2004	EU CT99-113 701202
Management, conservation and valorization of genetics resources of <i>Cucumis melo</i> and wild relatives	01.01.2000 31.12.2002	EU CT99-108 701203
Deutsche Stiftung für Internationale Entwicklungshilfe, 11 Langzeitstipendiaten, Pflanzengenetische Vielfalt und Ernährungssicherung: Erhaltung, Nutzung und Zugang zu pflanzengenetischen Ressourcen	01.01.2000 31.12.2000	DSE 901204
Genkartierung im Weizen: Finanzierung der Einladung ost- und mitteleuropäischer Wissenschaftler, Elena Khlestkina, Institut für Cytologie und Genetik, RNA, Novosibirsk	15.01.2001 14.04.2001	DFG 436RUS17/9/01 201201
Aufbau einer bundeszentralen <i>ex situ</i> -Genbank für landwirtschaftliche und gartenbauliche Kulturpflanzen: Zusammenführung der Genbanken des IPK und der BAZ Braunschweig: AP2-TP2 "Vermehrungsanbau"	01.02.2003 31.01.2006	BMBF 0312830 131101
Aufbau einer bundeszentralen <i>ex situ</i> -Genbank für landwirtschaftliche und gartenbauliche Kulturpflanzen: Zusammenführung der Genbanken des IPK und der BAZ Braunschweig: AP2-TP1 "Übergabe-Kühlzellen"	01.11.2002 31.12.2002	BMBF 0312830 131102
Aufbau einer bundeszentralen <i>ex situ</i> -Genbank für landwirtschaftliche und gartenbauliche Kulturpflanzen: Zusammenführung der Genbanken des IPK und der BAZ Braunschweig: AP2-TP1 "Umfüllen"	01.11.2002 28.02.2005	BMVEL 0312830 141101
Aufbau einer bundeszentralen <i>ex situ</i> -Genbank für landwirtschaftliche und gartenbauliche Kulturpflanzen: Zusammenführung der Genbanken des IPK und der BAZ Braunschweig: AP2-TP1 "Keimfähigkeit"	01.11.2002 31.05.2005	BMVEL 0312830 141102
Untersuchungen zur genetischen Diversität im Weizen	09.02.2002 23.06.2002	DFG 436 RUS 17/16/02 201202
INTAS Grant to support research cooperation with the New Independant States	01.06.2002 30.06.2002	EU 93-355 Ext 701204

Aneignung zur Genkartierung geeigneter molekular-genetischer Techniken (RFLP, SSR) und Kartierung von Kupfertoleranz beeinflussenden Gene unter Verwendung von Weizen-, Gersten- und Einkorn-Kartierungspopulationen	01.10.2002 31.07.2003	DAAD A/02/20255 801211
Improving the efficiency of disease resistance in bread wheat	01.01.2001 31.12.2003	BMBF DLR ARG 99/004 901206
Deutsche Stiftung für Internationale Entwicklungshilfe, 9 Langzeitstipendiaten, Pflanzengenetische Vielfalt und Ernährungssicherung: Erhaltung, Nutzung und Zugang zu pflanzengenetischen Ressourcen	01.01.2002 31.12.2002	DSE/ZEL 901207
Deutsch-Russische Zusammenarbeit auf dem Gebiet der Agrarforschung: Studienaufenthalt des russischen Wissenschaftlers Dr. Voylov	29.11.2003 21.12.2003	BMVEL 101205
Deutsche Stiftung für Internationale Entwicklungshilfe, 9 Langzeitstipendiaten, Pflanzengenetische Vielfalt und Ernährungssicherung: Erhaltung, Nutzung und Zugang zu pflanzengenetischen Ressourcen	01.01.2003 31.12.2003	DSE/ZEL 901208
Erhöhung der abiotischen Stresstoleranz im Weizen	01.01.2003 31.12.2004	BMBF 901209
Deutsch-Russische Zusammenarbeit auf dem Gebiet der Agrarforschung: Studienaufenthalt des russischen Wissenschaftlers Dr. A. Voylov	01.11.2004 23.12.2004	BMVEL 101205
Plant Resource Phase I - To Development Genetics Resources for Safe Food Production	01.12.2004 31.03.2006	BMBF/DLR HUN 04/A01 101210
Deutsche Stiftung für Internationale Entwicklungshilfe, 11 Langzeitstipendiaten, Pflanzengenetische Vielfalt und Ernährungssicherung: Erhaltung, Nutzung und Zugang zu pflanzengenetischen Ressourcen	01.03.2004 30.11.2004	InWent 901211
Forschungsaufenthalt Dr. Natalia D. Tikhenko	01.02.2006 31.05.2006	DFG 436 RUS 17/76/05 201203
Deutsche Stiftung für Internationale Entwicklungshilfe, 11 Langzeitstipendiaten, Pflanzengenetische Vielfalt und Ernährungssicherung: Erhaltung, Nutzung und Zugang zu pflanzengenetischen Ressourcen	01.01.2005 30.11.2005	InWent 901212

Georg Forster-Forschungsstipendium der Alexander von Humboldt-Stiftung für Dr. Nayyer Iqbal	01.09.2005 30.06.2006	A. v. H. Stiftung IV-PAK/1117127 STP 901213
Deutsch-Russische Zusammenarbeit auf dem Gebiet der Agrarforschung: Studienaufenthalt des russischen Wissenschaftlers Dr. A. Voylovokov	01.10.2005 23.12.2005	BMVEL 101205
Collection, Distribution, Phenotyping and Genotyping Directed towards Utilization of Existing Wheat Genetics Stocks to Enhance Tolerance/Resistance of Wheat Cultivars to Abiotic and Biotic Stresses	17.11.2005 31.12.2007	MEXICO 921201
German-Hungarian distributed project Plant Resource to develop genetics for food production	01.10.2005 30.09.2007	MK LSA 301201
GABI-GRAIN: Entwicklung von Gerstenlinien mit gessteigertem Ertrag und verbesserter Kornqualität unter Trockenstress während der Kornfüllung Teilprojekt A	01.07.2007 30.06.2010	BMBF GABI- GRAIN 0315041 A 181201
Gastaufenthalt Dr. Oxana Dobrovolskaya, Russland	01.06.2007 31.08.2007	DFG BO 1423/6-1 201204
Gastaufenthalt Dr. Svetlana Landjeva, Bulgaria	01.09.2007 30.11.2007	DFG BO 1423/6-1 201205
German-Hungarian distributed project Plant Resource to develop genetics for food production	01.10.2005 30.09.2008	MK LSA 3593A/04055T 301201
Leafy Veg, AGRI GEN RES vegetables germplasm, stimulating use	01.01.2007 31.12.2010	EU-34, AGRI GEN RES 870/2004 711210
Deutsche Stiftung für Internationale Entwicklungshilfe, 7 Langzeitstipendiaten, Pflanzengenetische Vielfalt und Ernährungssicherung: Erhaltung, Nutzung und Zugang zu pflanzengenetischen Ressourcen	16.04.2007 30.09.2007	InWent 901215
Forschungsstipendium Dr. I. Daniel, Nigeria Studying seed longevity of genebank collections	01.01.2007 31.05.2008	A. v. H. Stiftung 3- NRI/ 1121662 STP 901217
EWAC – The European Cereals Genetics Co-operative – Tagung	01.07.2007 31.12.2008	EWAC 901218
Preparative isolation of sugar ester fractions from tobacco leaf surface exudates and exudate profiling of <i>Nicotiana</i> varieties	01.11.2007 30.05.2010	Phillip Moris D1010165 921210

Deutsch-Russisches Forum Biotechnologie Novosibirsk	01.05.2009 30.06.2009	BMBF/DLR RUS 09/A09 101206
Gastaufenthalt Dr. O. Borisovna – Molecular genetic mapping of genes for inflorescence architecture in wheat (<i>T. aestivum</i>)	01.09.2009 30.06.2010	DFG BO 1423/11- 1 201209
Gastaufenthalt Dr. S. Petkova - Applibability of artificial seed aging to differentiate wheat genotypes by their seed vigour and longevity and to map responsible genomic regions	15.09.2009 14.12.2009	DFG BO 1423/12- 1 201210
Leafy Veg, AGRI GEN RES Vegetables germplasm – Stimulating use	01.01.2007 31.12.2010	EU-001 AGRI GEN RES 870/2004 711210
Developing drought and heat tolerant wheat germplasm and its utilisation for the drylands of Central and West Asia and North Africa	01.01.2008 31.12.2011	ICARDA - gtz 921211
FROWHEAT: Pflanzenbiotechnologie- -Verbundvorhaben: Evaluierung von Weizen Pre-Breeding-Material hinsichtlich von Frosttoleranzen (Teilprojekt D)	01.09.2011 31.08.2014	BMBF/FROWHE AT 0315953D 191210
Gastaufenthalt Mian Abdur Rehmann Arif: The genetics of seed longevity in wheat	01.10.2008 30.09.2011	DAAD A/08/94798 801214
Aufenthalt Dr. I. Daniel, Nigeria Studying seed longevity of genebank collections	01.07.2011 30.09.2011	A. v. H. Stiftung 901221
STABILSTROH: KMU-innovativ-8: Molekulargenetische und biologische Charakterisierung des Merkmals Stabilstroh bei Roggen	01.05.2012 30.04.2015	BMBF KMU- innovativ 031A000
EcoSeed, Impacts of Environmental Conditions on Seed Quality	14.12.2012 31.12.2016	FP7-KBBE-2012-6 GA 311840 721210
Complex study and physical mapping of genes in hexaploid wheat, responsible for embryo development of wheat-rye hybrids via interaction with rye genome	01.05.2013 30.09.2016	DFG BO 1423/17- 1 201211
Förderung einer internationalen wissenschaftlichen Veranstaltung: EUCARPIA Cereals Section-ITMI Joint Conference ‘Cereals for Food, Feed and Fuel – Challenge for Global Improvement’, Wernigerode/Gatersleben, Germany, June 29–July 4, 2014	01.01.2014 31.12.2014	DFG

Förderung einer internationalen wissenschaftlichen Veranstaltung: International Society for Seed Science (ISSS), Seed Longevity Workshop, Wernigerode/Gatersleben, Germany, July 5–8, 2015	01.01.2015 31.12.2015	DFG
BRIDGE: Biodiversity informatics to bridge the gap from genome information to educated utilization of genetic diversity hosted in Genebanks	01.05.2015 31.12.2018	SAW-2015-IPK-1 Pakt für Forschung 0401210
Gastaufenthalt Rasha Tarawneh: Mapping and Identifying Genes for Stress Tolerance in Barley	01.10.2015 30.09.2018	DAAD 801215
G2P-SOL – Linking genetic resources, genomes and phenotypes of Solanaceous crops	01.03.2016 28.02.2021	EU 0677379 — G2P-SOL 0731210
WHEATSCAN – Aufklärung der Ursachen für Weizen-unverträglichkeiten	01.04.2016 31.03.2019	SAW-2016-DFA-2 Pakt für Forschung 0401212
Complex study and physical mapping of genes in hexaploid wheat, responsible for embryo development of wheat-rye hybrids via interaction with rye genome (Extension)	01.06.2017 31.05.2020	DFG BO1423/17-2 201214
GENDIV 2.0 – Integrative Nutzbarmachung der genetischen Diversität bei Winterweizen	01.01.2018 31.12.2019	2814603713 101214

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APPENDIX

MARTIN-LUTHER-UNIVERSITÄT HALLE-WITTENBERG



Unter dem Rektorat des Professors für Experimentalphysik
Dr. rer. nat. habil. Dr.-Ing. Gunnar Berg
und unter dem Dekanat des Professors für Tierzucht einschl. Produktkunde
Dr. agr. habil. Gerhard von Lengerken
verleiht die

Landwirtschaftliche Fakultät

Herrn Dr. agr. Andreas Börner,
geboren am 9. April 1959 in Grimma,

nach einem ordentlichen Habilitationsverfahren
auf Grund der Habilitationsschrift

*"Untersuchungen zur Genetik und umweltabhängigen Ausprägung der Merkmalskomplexe reduzierte
Pflanzenlänge und Tageslängenreaktion beim Weizen",*

ihrer erfolgreichen öffentlichen Verteidigung am 29. Mai 1995
und einer gehaltenen Probevorlesung am 12. Juli 1995

den akademischen Grad eines

habilitierten Doktors der Landwirtschaftswissenschaften
(Dr. agr. habil.)

für das Fachgebiet Pflanzenzüchtung und Genetik.

Gleichzeitig wird die Lehrbefugnis für dieses Fachgebiet zuerkannt.

Halle (Saale), 7. September 1995

Der Rektor

Prof. Dr. rer. nat. habil. Dr.-Ing. G. Berg

Der Dekan

Prof. Dr. agr. habil. G. v. Lengerken

**MÄRTIN=LUTHER=UNIVERSITÄT
HALLE=WITTENBERG**

**DER WISSENSCHAFTLICHE RAT
DER MÄRTIN=LUTHER=UNIVERSITÄT
VERLEIHT**

Herrn Andreas Börner

geboren am 9. April 1959 in Grimma

DEN AKADEMISCHEN GRAD

doctor agriculturarum (Dr. agr.)

**NACHDEM ER SEINE
WISSENSCHAFTLICHE BEFÄHIGUNG AUF DEM GEBIET**

Pflanzenzüchtung und Genetik

NACHGEWIESEN HAT UND DAS GESAMTURTEIL

„Ausgezeichnet“ (summa cum laude)

ERTEILT WURDE.

Halle (Saale), den 28. Juni 1988

DER REKTOR



Prof. Dr. W. Isbaner

DER DEKAN



Prof. Dr. sc. agr. G. Schilling

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Martin-Luther-Universität
Halle - Wittenberg
Sektion Pflanzenproduktion
Stellvertr. d. Direktors
für Erziehung, Ausbildung
und Weiterbildung

Halle, . 1. 2. 1983 .

Vertrag über die Förderung von Beststudenten

Auf der Grundlage der "Konzeption zur Förderung von Beststudenten"
vom 24.3.1980 wird zwischen der Sektion Pflanzenproduktion
und dem Studenten / ~~der~~Studentin Andreas Börner

Fachrichtung Pflanzenzüchtung u. Saatgutproduktion
Matrikel 1980/81

der folgende Vertrag über die Förderung abgeschlossen.

1. Wissenschaftliche Qualifikation

Die im diesem Vertrag festgelegten Maßnahmen haben das Ziel,
die wissenschaftliche Qualifikation des Studenten auf folgenden
Gebieten über die im Studienplan festgelegten Anforderungen
hinaus zu vertiefen und zu erweitern:

Genetische und biostatistische Grundlagen der Pflanzen-
züchtung mit dem Ziel, das Forschungsstudium zu absolvieren

Dazu werden folgende Sondermaßnahmen vereinbart:

1.1. Inhaltliche Regelungen

Besuch zusätzlicher Lehrveranstaltungen:

1. Grundlagen d. Genetik, Sektion Biowissenschaften
2. Seminare über Biostatistik, Sektion Pflanzenproduktion

Befreiung von Lehrveranstaltungen:

ggf. im 8. oder 9. Semester, in Abhängigkeit vom
Stundenplan

1.2. Zeitliche Regelungen

Beginn der Förderung: 15.12.1982
Auslaufen der Förderung: Februar 1985
Änderungen des Studienablaufes

- vorgezogene Prüfungstermine

1. MLG - Vorlage einer Jahresarbeit

- vorgezogene Termine der Hauptprüfungen
nein

- vorgezogener Termin des Diplomverfahrens: nein

- vorgezogener Termin der Dissertation: wird angestrebt

2. Pflichten und Rechte des Studenten

Über die Ausführungen in der "Konzeption" hinaus wird vereinbart:

1. A.B. erhält eine Teilforschungsaufgabe zur Bearbeitung

2. A.B. wird zu wiss. Veranstaltungen delegiert

3. A.B. beginnt ab Mai 83 mit einer experiment. Diplomarbeit

4. A.B. verpflichtet sich, seinen Notendurchschnitt zu verbessern

5. A.B. aktiviert seine gesellsch. Arbeit in der SG und im HSG-Bereich

3. Pflichten und Rechte der Sektion

Über die Ausführungen der "Konzeption" hinaus wird vereinbart:

Der Student wird mit Arbeitsplatz in das Fo.-Kollektiv integriert,
bearbeitet ein Diplomthema, das in einer Dissertation weiterge-
führt werden kann und wird zielgerichtet in das Leitungsprakti-
kum eingewiesen.

4. Verantwortlicher Hochschullehrer für die wissensch. Betreuung

Prof. Dr. D. Mettin

5. Sonstige Vereinbarungen keine

Stellv. Dir. EAW Student

Sekretär der
FDJ-GO

betreuender
Hochschullehrer

Mettin
Kenntnis genommen:

Bömer
Direktor der Sektion

i.V. Bracht
i.V. Blüthner

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