

Final report

Project title: Leibniz-WissenschaftsCampus Phosphorforschung Rostock (P-Campus)

Project number: W19/2018

Report Period: 01.06.2019 - 31.03.2024

Participating (Leibniz) Institutes:

Leibniz-Institut für Ostseeforschung Warnemünde (IOW) [lead institute]

Leibniz-Institut für Katalyse (LIKAT), Rostock

Forschungsinstitut für Nutztierbiologie (FBN), Dummerstorf

Leibniz-Institut für Plasmaforschung und Technologie (INP), Greifswald

Leibniz-Institut für Pflanzengenetik und Kulturpflanzenforschung (IPK), Teilsammlungen Nord, Groß Lüsewitz

Participating university:

Universität Rostock

Other partners:

Ministerium für Klimaschutz, Landwirtschaft, ländliche Räume und Umwelt MV

Ministerium für Wissenschaft, Kultur, Bundes- und Europaangelegenheiten MV

Staatliches Amt für Landwirtschaft und Umwelt Mittleres Mecklenburg

Landesamt für Umwelt, Naturschutz und Geologie Mecklenburg-Vorpommern

European Sustainable Phosphorus Platform

Deutsche Phosphor-Plattform e.V.

Spokespersons:

Spokersperson of the P-Campus: Prof. Dr. Ulrich Bathmann, Leibniz Institute for Baltic Sea Research

Spokersperson of the P-Campus for the University of Rostock: Prof. Peter Leinweber, University of Rostock

List of abbreviations:

DDZ = German Diabetes Center

DFG = Deutsche Forschungsgemeinschaft

DFG-RTG = DFG Research Training Group

DPP = Deutsche Phosphor-Plattform e.V.

ESPP = European Sustainable Phosphorus Platform

FBH = Ferdinand-Braun-Institut, Leibniz-Institut für Hochfrequenztechnik

FBN = Research Institute for Farm Animal Biology

FNK = Research Unit Sustainability and Climate Policy

IGB = Leibniz Institute of Freshwater Ecology and Inland Fisheries

INP = Leibniz Institute for Plasma Research and Technology

IOM = Leibniz Institute for Surface Modification

IOW = Leibniz Institute for Baltic Sea Research

IPK = Leibniz Institute for Plant Genetics and Crop Plant Research

LIKAT = Leibniz Institute for Catalysis

LM-MV = Ministerium für Klimaschutz, Landwirtschaft, ländliche Räume und Umwelt MV

MV = Mecklenburg-Vorpommern

LRA = Leibniz Research Alliance

P-Campus = Leibniz ScienceCampus Phosphorus Research Rostock

PGS = P-Campus Graduate School

SAC = Scientific Advisory Council

UMR = Universitätsmedizin Rostock (Rostock University Medical Center)

UR = University of Rostock

WM-MV = Ministerium für Wissenschaft, Kultur, Bundes- und Europaangelegenheiten MV

WPK = Wissenschaftspressekonferenz

TROPOS = Leibniz Institute for Tropospheric Research

ZALF = Leibniz-Zentrum für Agrarlandschaftsforschung

Executive Summary

About 100 scientists collaborate in the second funding phase of the Leibniz ScienceCampus Phosphorus Research Rostock (P-Campus) for its overarching goal: the development of a sustainable P management. All objectives and milestones were achieved or are work in progress. For example, in the funded second P-Campus Graduate School all 15 PhD projects were successfully finished. Five dissertations were successfully defended, three dissertations were submitted by April 2024, five dissertations are planned to be submitted in the course of 2024 and only two projects were finalized without dissertations. The successful concept of seed projects (originally implemented from the first funding phase) was continued with a total of 17 projects, i.e., 11 of them with the vision of the planned Leibniz Research Alliance and the DFG Research Training Group. The PhD projects as well as the seed projects strengthened the partnership and interdisciplinary work of scientists of the (Leibniz) institutes and the university, as only projects with at least two partners were funded. The visible success of projects is to be expected beyond the funding period; for example resulting from the first Leibniz funding from 2015 to 2019, the patent of the seed project CrysPhos was submitted in 2021 and only published in 2023.

Contrary to expectations, the conversion of the annual P-Campus lecture series from a face-to-face event to an online event during the corona pandemic resulted in a higher number of participants on average. Additionally, more participants from outside the P-Campus or former P-Campus members are now also taking part.

The increase in peer reviewed partnership publications (authors from both University of Rostock + Leibniz Institutes) can also not be overlooked for this second funding phase. From 2012 to 2015 only 3 partnership publications were published, from 2016 to 2019 a total of 31 were published and from 2020 until the first quarter of 2024 a total of 50 articles were published. It is therefore assumed that repeating the network analysis of the P-Campus members from 2020 via the publications and conference contributions would confirm an even stronger networking of the P-Campus members.

Visibility of the research of the P-Campus was not only increased by continued updating of the P-Campus website, presentation of scientific results during scientific conferences or public events but also by the publishing the so-called "P-Handbook" in German and English languages on the Website and as well as through the concept video of the P-Campus, which is available on the P-campus website and on youtube (<https://www.youtube.com/@PhosphorCampus>). It should also be highlighted that the doctoral student Marisa Wirth won the communication competition „Rostock's Eleven“ for her presentation of her research about analysis of glyphosate in sea water.

A lot of (associated) international and national cooperations were newly established for example to the working group Soil Fertility at the University of Copenhagen, the Römisch-Germanische Kommission, the ZALF and the FBH.

In the 15 PhD projects, six of the doctoral students were female and seven were international doctoral students. Due to the new research clusters, three new members were sought for the steering group, with women in particular being invited to apply. All three positions were filled by female scientists, meaning that 39 % of the steering group members are now female instead of the previous 27 %.

In order to maintain and further expand the strong networking and interdisciplinary research at the P-Campus, it is planned to continue the P-Campus in the form of a Leibniz Research Alliance and a DFG Research Training Group. The draft proposals are to be submitted at the end of 2024/beginning of 2025.

1. Achievement of objectives and milestones

About 100 scientists collaborate in the second funding phase of the Leibniz ScienceCampus Phosphorus Research Rostock (P-Campus) for its overarching goal: the development of a sustainable P management. The first objective was the formation of a second **P-Campus Graduate School** (PGS 2). All 15 planned projects for the PGS 2 started by November 2020 (Table A1). The second objective was the extension of the **cooperation agreement** of the P-Campus (first one ended in December 2020), which was realized on June 17, 2020 at the IOW, resulting in a TV report and several media articles (Table A2). **Internal and external networking** was the third objective. An analysis about the network developed in the P-Campus was finished in June 2020 and was presented at a steering group meeting in September 2020 and at the annual meeting with representatives of both funding ministries of MV in December 2020. The external network was extended by two associated partnerships (Table A3). Generally, networking is an ongoing activity of all members of the P-Campus. The fourth objective, the “Handbook on the Selection of Methods for Digestion and Determination of Total Phosphorus in Environmental Samples”, in short “**E-handbook P analytics**” is a continuous work in progress and new chapters are created whenever possible and necessary. Since 2018, the chapters are available in German (wissenschaftscampus-rostock.de/intern.html, DOI: [10.12754/misc-2018-0001](https://doi.org/10.12754/misc-2018-0001)). Chapters were and are translated into English step by step (available since May 2020: <https://wissenschaftscampus-rostock.de/intern-en.html>, DOI: [10.12754/misc-2020-0001](https://doi.org/10.12754/misc-2020-0001)). The fifth objective **internationalisation** and the sixth one **public relations** are realized continuously; for details see the next chapters. The seventh objective, **seed projects**, started successfully in July 2019 with the first six projects (Table A4). In 2022 two calls for seed projects, focussing on the planned Leibniz Research Alliance and a DFG-RTG, resulted in 11 further projects (start: 4th quarter 2022 to 1st half 2023). Reports of finished projects are available by request. **Knowledge transfer** is the eighth objective, which is further ongoing and long-lasting. For example, a patent application, resulting from the seed project Crysphos [June to August 2018 (PGS1), by the Junior Research Group Biocatalytic Synthesis (UR) in cooperation with the working group Organocatalysis (LIKAT)], was registered in November 2021. Additionally, there were annual meetings with the funding ministries of MV (WM-MV and LM-MV) in December (2019-2022) and for 2023 in January 2024, at which current results of the P-Campus were presented. In May 2023 the most important results of the last years and the planned future of the P-Campus were presented to invited stakeholder and representatives of the funding ministries during a colloquium. Furthermore, cluster “V. P-Governance” was created for the second funding phase also with the idea of bringing natural scientific findings into legal practise. The ninth objective is the **future of the P-Campus after 2023**; a strong network and a lot of cooperations were developed during the years. Therefore, it is important to use this network for further intensive and interdisciplinary work. From 2020 to 2024, there were several meetings for organizing a Leibniz Research alliance and a DFG-RTG. Drafts with sub-projects and concepts are available for both planned funding lines. A summary of the objectives is presented in the appendix (Table A5).

2. Activities and obstacles

PGS 2: Due to the Corona restrictions, some projects were delayed for some months. Nevertheless, the last of the 15 projects started in October 2020 (Table A1). The vacant position in project I.1 had to be filled with a postdoc as no appropriate suitable PhD student could be found. Unfortunately, the postdoc died suddenly. Thus, the project had to be realigned and a new postdoc was employed on the project until April 2022. In project II.1, the PhD student decided for another job after one year. Therefore, the project was finished by another student (starting some months later) but without thesis because of the short time span. Nevertheless, five dissertations were successfully defended and three further were submitted by April 2024. The last five dissertations are to be submitted in the course of 2024.

The first possibilities for the first new six PhD students to get an initial impression about the research and network in the P-Campus were the International P-Campus Symposium, the

starting workshop “P analytics” at the Biological Station in Zingst and the “P breakfast” in November and December 2019. Due to Corona restrictions, a second starting workshop in summer 2020 for the next PhD students and further P breakfasts were not possible. New concepts such as a lecture series as webinar were developed and started in October 2020. Because of the success of the online lectures (more and external participants compared to on-site lectures), they were continued until June 2024. The summer school “Scientific Writing and Successful Publishing” for doctoral students, which had been postponed several times due to the coronavirus restrictions, was finally able to take place in September 2022. The International P-Campus Symposium was realised as online event in 2020 and 2021 and as hybrid event in 2022 and 2023. So, the PhD students were able to present their work progress and share and discuss with other P-Campus members, external experts in P research and members of the SAC. In some of the PhD projects, the work was strongly delayed due to Corona restrictions, caused by temporary closures of the research institutes and/ or illness of PhD students. Therefore, these PhD students were supported by the P-Campus and their institutes by additional financial resources and extensions of their contracts.

The **extension** of the **cooperation agreement** was signed on June 17, 2020. Due to Corona restrictions, members of the P-Campus were not present with posters at the event, and it was not possible to invite all cooperation partners. For this reason, some partners gave their signature prior to the event and some partners provided their greeting via video conferencing during the press conference. Generally, external **networking** is continuously realized by the members of the P-Campus by e. g. presenting scientific results at (online) conferences, during P-Campus Symposia and by cooperations in seed projects, where scientists of at least two partner institutes are involved. Thereby, two associated partnerships were realized (Table A3). A network analysis was created in May/June 2020 to improve the visibility of the internal and external network of the P-Campus and to identify points of further development (report can be provided by request). **Internationalisation** is ongoing as well, despite interim Corona restrictions. The International P-Campus Symposium took place every year (only postponed from November 2021 to January 2022) in: November 2019 (IOW on-site), November 2020 (online), January 2022 (online), November 2022 and October 2023 (IOW hybrid). One of the two associated partnerships is an international partnership (Table A3). Chapters of the e-handbook P analytics were translated into English and are available since May 2020. The coordination office participated in the planning and organisation of the European Workshop on Phosphorus Chemistry (EWPC18), which was cancelled in November 2020 due to the pandemic development (instead online event). Last but not least, the conference took place in September 2022 as a successful on-site event at the University of Rostock.

Public relations were, for example, realized by a meeting of P-Campus members with scientific journalists of the “Wissenschaftspressekonferenz” (WPK; www.wpk.org) in September 2019 during the WPK research trip “Phosphor und die Zukunft der Landwirtschaft”. An article (“Ressourcenmanagement - Ein paar Schippchen weniger”) by Brigitte Osterath was published in January 2020 in the journal “Nachrichten aus der Chemie” (Table A2). Members of the P-Campus successfully published an article about the PGS 1 “Nachwuchsförderung und Forschung am Leibniz-WissenschaftsCampus Phosphorforschung Rostock” in the journal “Wasser und Abfall” (Schaub et al. 2019, Table A2). A video of the work of the P-Campus was created and was published in the first half year of 2021 (<https://wissenschaftscampus-rostock.de/ziele-konzept.html>). Several members of the P-Campus wrote chapters in the book “Phosphor - Fluch und Segen eines Elements” (<https://www.oekom.de/buch/phosphor-9783962382827>), which was published 2021 (see Table A6). There was an article in the “Ostseezeitung” newspaper and a radio report on NDR about the research in doctoral project IV.1 SoilCrusts (Table A2). Unfortunately, the annual participation in the “Long Night of the Sciences” at the University of Rostock was not possible from 2020 to 2022 since it was cancelled due to Corona. In May 2023, members of the P-Campus presented their research to the public during this event.

3. Results and successes

We understand the P-Campus as a scientific network of collaboration between scientists in phosphorus research within the P-Campus, but also with external scientists on the basis of research questions and topics, irrespective of the funding of the research. Some of the publications and qualification papers have emerged from the P-Campus. Wherever possible and appropriate, however, co-funding was sought.

Publications

From 2019 until March 2024, 307 papers were published; 246 of them were peer-reviewed and 67 of the peer-reviewed were a cooperation of at least two partner institutes (Table A6). From 2019 to March 2024, 203 papers (66 % of all) were published as open access articles. Key publications (topic phosphorus) of the P-Campus, which were endowed with the P-Campus Publication Award from 2019 to 2022 were marked in grey and **bold** (first author) in Table A6. Publication awards were endowed for (1) peer-reviewed publications with (2) phosphorus as key topic and (3) authors of at least two partner institutes. However, it is no prerequisite for the publication award that the research was exclusively financed by the P-Campus.

Theses/dissertations

Members of the P-Campus supervised 65 master and bachelor theses and 31 doctoral theses (Table A7). In 2022 the seventh doctoral thesis of the PGS1 was successfully defended. Five doctoral students of the PGS 2 successfully defended their doctoral thesis during the funding period. Three further students of the PGS 2 submitted their thesis by April 2024.

Third-party funding acquired

Between 2019 and March 2024, 44 third-party funded projects were running (Table A8).

Scientific events

Scientific events of the P-Campus such as the annual international P-Campus Symposium, the start-workshop P analytics, the P breakfast and the lecture series are listed in Table A10. These events were especially important for the new PhD students because they got the possibility of networking beside professional exchange. Additionally, members of the P-Campus presented their research at different conferences; e.g. at the International Phosphorus Workshop (IPW9) in Zurich (Table A9).

Transfer

Only a few examples of **transfer** and **public relations** are presented here; others are listed in the tables A2, A6, A9 and A10. Members of the P-Campus presented scientific results in P research for journalists of the "Wissenschaftspressekonferenz" in September 2019 (detailed program can be provided by request). A highlight is the creation of the video about the P-Campus, which was finished in the first quarter of 2021 and then published (<https://wissenschaftscampus-rostock.de/ziele-konzept.html>). It can also be highlighted that the doctoral student Marisa Wirth won the communication competition „Rostock's Eleven“ for her presentation of her research about analysis of glyphosate in sea water. However, knowledge transfer can be significantly delayed such as for the seed project CrysPhos during PGS 1 in 2018 (see excel spreadsheet 3). The patent application was submitted in November 2021 and successful published in 2023 (patent number: DE 102021213181 A1). In 2023 the results were published in a peer review journal (Neuburger et al. 2023; DOI: 10.1002/ceat.202200393) as well. Every year, an end-of-year meeting was held with representatives from the funding (P-Campus coordination office) ministries (LM-MV and WM-MV), at which new research results from the P-Campus were presented. The success of the P-Campus was also confirmed by the annual reports and the final report of the SAC.

4. Equal opportunities, career development and internationalisation

Equality concepts such as the cascade model of the Leibniz Association and the concepts of the partner institutes and the UR, which support e. g. women in scientific leadership positions, are fully applied in the P-Campus. In addition, the participating Leibniz Institutes and the UR have established concepts for reconciling work and family life, which are also practised in the

P-Campus. Aspects of gender equality were considered for staffing (six female and eight male PhD students (one PostDoc)). 40 % are international doctoral students. Because of the new research clusters a call was started for three additional members of the steering group in the first half-year of 2019, motivating especially women to apply. As a result, all three new members of the steering group are women (ratio of women increased from 27 % to 39 %).

5. Structures and collaboration

All cooperations and partnerships of the first funding phase were continued in the second funding phase and are not presented here. New cooperations in the second funding phase, which were deepened or developed, are: integration of members of (1) the Institute of Medicine (two PhD projects: III.2, IV.5) and (2) the working group Marine Biology (PhD project IV.4 and creation of cluster “IV. P in molecular biology”; Table A1). (3) Legal aspects and governance aspects of P research were deepened by the creation of cluster V. with a separate PhD project (Table A1). The importance of these topics in both new clusters was recognised by results of the PGS 1 and therefore included in the PGS 2. Two associated partnerships with working groups were implemented by members of the P-Campus (Table A3). A cooperation with the working group Soil Fertility is particularly useful because of the possibility of “comparison” and usage of both long-term-field experiments (at University of Rostock and University of Copenhagen). The Soil Science workgroup at Rostock University (Prof. P. Leinweber) supports the PROCESSOR project at Copenhagen University (Prof. J. Magid) by providing data acquired at the Canadian Synchrotron Facility (CLS Saskatoon, Saskatchewan, Canada) and educating young researchers in the synchrotron techniques for P-speciation in waste materials and soil. The association of the AG Phosphorus Chemistry of the German Chemical Society (GDCh) links cluster III and the entire P-Campus to phosphorus chemical research in Germany. Additionally, several online meetings were organized during 2020 for cooperation between P-Campus members, scientists of the ZALF and the IGB for development of a third-party proposal concerning effects/changes of Si- and P-availability in terrestrial, limnic and marine ecosystems. Seed funding from the P-Campus (“SERAIP”, March to June 2019, PGS 1) resulted in a collaboration between the Genomics Unit of the FBN and the FBH also in the second funding phase. A collaboration has been initiated between Dr. K. Rassmann (DAI; Römisch-Germanische Kommission (RGK) Frankfurt a.M.) and Prof. P. Leinweber (Soil Science, University of Rostock) to test in how far P-speciation in soil samples can support the interpretation of archaeological excavations.

6. Quality assurance

Regular meetings of the steering group ensure the quality assurance of the thematic work programs and strategies. In the PGS, quality management is carried out by the supervision teams with at least two supervisors from different partner institutions of the P-Campus. Annual campus symposia and thematic workshops with members of all partner institutes, researchers from other (inter)national research institutions and representatives from the ministries ensure an intensive exchange of information on the state of the art and research at the P-Campus. The members of the P-Campus present their research results in form of lectures and posters at (international) conferences. Additionally, the Scientific Advisory Council (SAC; five internationally renowned scientists) annually evaluates the quality of the work of the P-Campus and takes part in the International P-Campus Symposia. The reports of the SAC can be provided upon request. The scientific work is also presented to scientists in the partner institutions to ensure that the achieved P research is well integrated into the institute profiles. Additional measures for quality of research are e.g. maintenance of laboratory equipment and analysers, protection of a sufficient number of independent repetitions, publishing in peer-reviewed journals, storage of the raw data on the servers of the respective institutes or open access databases (PANGAEA). The doctoral students are trained in good scientific practice. Further information about open access publications can be found in chapter 3 and table A6. Open access funding by the University of Rostock and the Leibniz institutes is included in the

co-funding of the PhD projects of PGS 2. Additionally, all PhD students of the P-Campus can ask for open access funding by the P-Campus if no other funding is available.

7. Additional resources

Generally, the co-financing of **all Leibniz Institutes** and the **UR** includes proportionate staff costs for the members of the steering group, project managers, PhD students, technical staff and additional supervisors where necessary. The institutes also bear funding for research projects such as consumables, equipment and travels of the PhD students (e.g. for presentations at conferences). All working groups also co-financed technicians, consumables or the like when their seed projects were funded by the WGL. Additionally, all institutes provided rooms (also online) and if necessary technical equipment and helping staff for events of the P-Campus such as symposia, meetings of the steering group or workshops as well as lab facilities. Some of these costs cannot be estimated. The estimated costs are listed in tables A11-1 and A11-2. In the following, only co-financing contributions being specific for an institute are highlighted. The **IOW** additionally provided the office for the two coordination employees of the P-Campus (until 31.12.2023) and takes over administrative functions. In addition, it contributed to the time for research ships to carry out the necessary work in the Baltic Sea. The **LIKAT** additionally co-finances the use of facilities (e.g. analytical department, laboratory and office space, workshop) and made the premises available for the two coordination employees from January 2024. The **FBN** additionally co-financed costs for animal care, animal feed and housing. The **IPK** additionally co-financed the provision, multiplication and maintenance of plant material for pot and field trials over the entire project period, including the respective lab, growth chamber, cold storage, greenhouse and field space plus all media and materials needed for this. The additional co-financing of the **UR** includes the use of facilities such as the Biological Station Zingst (used e.g. for analysis-workshops for PhD students), the research vessel "Nauplius" (obtained sediment cores), technical equipment (e.g. electron microscopes) and qualification programs of the Graduate Academy. These costs of the UR cannot be estimated. In-kind resources for staff and technical equipment of the **UMR** for the work in PhD projects, seed projects and the steering group cannot be estimated.

8. Outlook

According to a network analysis of the P-Campus in 2020, a strong multidisciplinary network developed over the years between scientists of the University of Rostock and the five (Leibniz) Institutes, which intensified during the second funding period until 2024. This valuable interdisciplinary scientific network is to be maintained and further expanded even after 2023/24. Therefore, several meetings for discussing the future of the P-Campus have been held since 2020 and are planned in 2024 to finalize the developed ideas of a DFG-RTG and a LRA. The following research topics are to be covered by the research initiatives. The DFG-RTG "Phosphorus acquisition, metabolism and signaling in aquatic and terrestrial organisms" (PhAMoS) will focus on the topics "Phosphorus at the interface between organism and environment" and "P regulation and signaling at the molecular level in the organism". In this DFG-RTG the University of Rostock, the University of Greifswald, the IOW and the FBN will be integrated. The LRA "Phosphorus in nutrition, environment, economy: Ecological consequences and social challenges" (P Health). Will focusing on the following research clusters: "I. P in agriculture and nutrition", "II. P in the environment", "III P recycling", "IV P Governance and the cross-sectional topic "Transfer and education". The following institutes will be additionally integrated into the LRA: ZALF, IGB, TROPOS, DDZ, IOM, Hochschule Neubrandenburg, Universities of Paderborn, Hohenheim and Halle. It is planned that the basic research in the DFG-RTG "Phamos" and the applied research in the LRA "P-Health" will be linked by a common graduate school and common scientific events to ensure a strong interdisciplinary work and exchange between (young) scientists of different research areas, all linked by the element P.

Appendix

List of tables

Table No.	Title	Page
Table A1	Overview of PhD projects - planned and realized start	A1
Table A2	Press reports about the P-Campus	A2
Table A3	Associated partnerships	A2
Table A4	Seed-projects and most significant results/conclusions, if already available	A2
Table A5	Summary of objectives and degree of their achievement (ongoing objectives marked in red)	A5
Table A6	Table A6 Publications from 2019 to March 2024; highlighted as followed: joint publications (at least 2 Leibniz Institutes or 1 Leibniz institute + University of Rostock) in grey, if awarded for the P-Campus Publications Award first author in bold , German publications in orange, publications resulting from: PGS 2: PhD student violet, PGS 1: PhD student blue, seed-projects: lead author green)	A5
Table A7	Theses and dissertations supervised by P-Campus members	A21
Table A8	Raised third-party funds	A21
Table A9	Posters and presentations (external conferences) June 2019 – March 2024; contributions resulting from: PGS 2: PhD student purple, PGS 1: PhD student blue, seed project lead author green)	A23
Table A10	Events of the P-Campus, scientific public relations	A30
Table A11-1a	Planned total resources (in €) of the Leibniz institutes, the University of Rostock and the ministries, according to the proposal	A34
Table A11-1b	Realised total resources (in €) of the Leibniz institutes, the University of Rostock and both ministries MV	A34
Table A11-2	In-kind resources (in €) by institutes in detail (Project period: 01.06.2019 to 31.03.2024)	A35

Table A1 Overview of PhD projects - planned and realized start (Q =quarter)

Cluster	Subproject	Acronym	Start	
			planned	realized
I. Phosphorus in the environment	I.1 Risks and benefits of rewetting coastal wetlands after agricultural use	P-Risks	Q3 2019	Q1 2020 ^a
	^f I.2 P Pools and mobilization potential in lowlands and coastal regions	P-Pools	Q2/3 2019	Q3 2019
	^b I.3 Analysis of glyphosate and glufosinate in sea water and as indicator compounds for industrial cropping	Glyphosat	Q3/4 2019	Q1 2020
II. Sufficiency and efficiency of Phosphorus utilisation	^{c, d} II.1 P recycling in animal husbandry	P-Recycling	Q4 2019	Q4 2019
	^{c, f} II.2 Efficiency of recovered phosphorus for monogastric animals	Monogastric	Q4 2019	Q4 2019
	^{c, f} II.3 P efficiency of forage legumes and their capacity to utilize P from recycling products	P-legumes	Q4 2019	Q4 2019
III. Phosphorus in Synthesis and Catalysis	^f III.1 Synthesis of novel P-based ligands for complexes to activate small molecules	P-Cord	Q2/3 2020	Q3 2020
	^f III.2 Application of P-based organocatalysts and biocatalysts for the resolution of racemic carbonates	P-RaceCar	Q1 2020	Q1 2020
	III.3 Synthesis of potential anti-tumor and adhesion-promoting agents by P-based organocatalysis for oncology and biomedical engineering	P-Med	Q1 2020	Q1 2020
IV. Molecular Biology of Phosphorus: The central role of phosphorus in signalling and metabolism from cells to ecosystems	^f IV.1 Gene expression in biogeochemical cycling of phosphorus in biological soil crusts of sand dunes of the Baltic Sea	Soil crusts	Q2 2019	Q2 2019
	^f IV.2 Sustainability of potato production: Cloning and sequencing of candidate genes improving P acquisition efficiency to reduce fertilizer inputs	Stop-P	Q2 2020	Q2 2020
	^f IV.3 The role of inorganic phosphate supply on the development of cyanobacterial summer blooms in the Baltic Sea	Cyano blooms	Q4 2019	Q4 2019
	^{e, f} IV.4 Phosphorus as a metabolic regulator during environmental stress in animals	Meta-Phos	Q3/4 2019	Q3 2020
	^e IV.5 Molecular mechanisms of phosphate homeostasis and osteoimmunological processes and their consequence for health and welfare	Phosphate homeostasis	Q3/4 2019	Q4 2020
V. Phosphorus-Governance	^f V. Governance options for closed P cycles- the GAP 2020 revision	P-Governance	Q2/3 2019	Q3 2019

^a no PhD student identified, employed postdoc died in 2020; new postdoc started 01.05.2021

^b linked to project I.4

^c linked to project II.4 Cross-sectional project

^d original PhD student accepted another job offer; a new candidate finished the project but without thesis because of the short time span

^e several job advertisements necessary, no matching candidate or the doctoral student's entry was delayed due to the corona restrictions, therefore projects started in the second half of 2020

^f projects were extended because of Corona restriction for work or illness of the PhD student (financed by P-Campus and/or Leibniz institutes or University of Rostock)

Table A2 Press reports about the P-Campus

Date	Medium	Title
29.07.2019	svz.de	Nährstoffbelastung im Blick: Rostocker erforschen Qualität der Küstengewässer
24.09.2019	herd-und-hof.de	Phosphor-Tour – Leibniz-Institut für Ostseeforschung
25.09.2019	herd-und-hof.de	Phosphor-Tour – Dr. Till Backhaus
26.09.2019	herd-und-hof.de	Phosphor-Tour – Fisch-Glas-Haus
01.10.2019	Wasser und Abfall	Nachwuchsförderung und Forschung am P-Campus Phosphorforschung Rostock
15.11.2019	NDR Nordmagazin	Phosphor-Campus-Symposium in Warnemünde
02.01.2020	Nachrichten aus der Chemie	Ein paar Schippchen weniger
17.06.2020	focus.de	Phosphorforschung bis 2023 gesichert
17.06.2020	NDR Nordmagazin	Geld für Phosphor-Campus
17.06.2020	svz.de	Phosphorforschung am Ostsee-Institut gesichert
17.06.2020	welt.de	Phosphorforschung bis 2023 gesichert
18.06.2020	NNN	Phosphorforschung gesichert
18.06.2020	Ostsee-Zeitung	Mehr als eine Million Euro für Projekt in Rostock: Phosphorforschung bis 2023 in MV gesichert
30.07.2020	Podcast „Interviews 4 Future“	Ostsee & Nordsee // Prof. Dr. Ulrich Bathmann (IOW), Karl-Michael Werner (Thünen-Institut)
14.12.2020	NDR Info Perspektiven	Neues Verfahren spürt Glyphosat in Meerwasser auf
21.06.2021	vdi-nachrichten.com	Neuer Recyclingdünger aus Rostock
21.06.2021	innovations-report.de	Rostocker Forscher entwickeln neuen Recycling-Dünger
21.06.2021	idw-online.de	Rostocker Forscher entwickeln neuen Recycling-Dünger
30.06.2021	Ostsee-Zeitung	Rostocker Forscher entwickeln neuen Dünger
16.11.2022	riffreporter.de	Zu viel Phosphor in der Landschaft: Wie wir besser mit Phosphor haushalten können
13.02.2023	PM Universität Rostock	Rostocker Forscherin untersucht Ostseedünen und findet "kleine Startups"
24.03.2023	Ostsee-Zeitung	Rostockerin erforscht als eine der ersten Bodenkruken und trägt zum Küstenschutz bei
18.04.2023	NDR1 Radiobeitrag	Ostseedünen als Klimaschützer

Table A3 Associated partnerships

Institute	Partnership since	Members
University of Copenhagen: Research Group Soil Fertility	February 2020	Prof Dr. Lars Stoumann Jensen
		Assoc. Prof. Dr. Jakob Magid
		Assoc. Prof. Dr. Dorette Sophie Müller-Stöver
German Chemical Society (GDCh): AG Phosphorus Chemistry	March 2020	Prof. Dr. Evamarie Hey-Hawkins
		Prof. Dr. Jan J. Weigand
		Prof. Dr. Robert Wolf

Table A4 Seed-projects and most significant results/conclusions, if already available

Seed-project	Cooperation
First call (summer 2019)	
The role of protists in the P biogeochemical cycle of biological soil crusts (ProCycle) Main results: Controlled feeding experiments showed that protists, which were isolated from biological soil crusts, reduced the number of bacteria drastically by feeding. As result, soluble, reactive phosphorus was released from the bacterial biomass to the surrounding medium. This indicates that protists with their central position in the microbial loop could have a fertilization effect by enhancing the P-turnover in biological soil crusts.	UR, IOW
Plasma-induced degradation reactions in glyphosat-containing substrats (PIAG) Main results: In this study, surface- corona discharges and thereby formed radicals can break down glyphosate in water (such as in waste water treatment plants) without addition of chemical or biological additives.	
Development enantio selective catalytic Wittig reactions based on chirale phosphorus compounds as catalysts (P-CAT)	LIKAT, UR

Seed-project	Cooperation
<p>Main results: The aim of the project was to optimize the conditions for an enantioselective catalytic Wittigreaction. Indeed it was possible to find a suitable catalysts and reaction conditions to obtain the desired product in good yields (>80%) and enantioselectivity (>85% ee).</p>	
<p>Phosphor - Protein - Interaktionen in der Quervernetzung (P-ChemBind)</p> <p>Main results: The aim of the project was the development of an efficient short-cut-method for binding of P-based side chains to proteins. It can be summarized that the necessary reaction conditions caused a nearly complete denaturation or unwanted change of proteins. So, it was not possible to produce the desired product in necessary quantities. It can be concluded from this project that this method is experimentally not promising and the more laborious alternative reaction route is necessary. The report can be provided by request</p>	UR, LIKAT
<p>Dietary effects on DNA methylation in porcine parathyroid glands (EpiPTG)</p> <p>Main results: In the start-up project, DNA methylation profiles of selected promoter sections of genes related to P excretion were to be mapped (including PTH - parathyroid hormone; PTH1R - parathyroid hormone receptor 1). The DNA methylation profiles were analysed using bisulphite sequencing. Epigenetic markers were successfully established in the respective promoter sequences. The promoter region of PTH showed a lower methylation rate in the parathyroid glands than in the muscle, which is consistent with the tissue-specific expression of PTH and indicates the possibility of epigenetic regulation of PTH. The PTH1R promoter region also showed a high tissue-specific methylation rate. Accordingly, epigenetic regulations possibly involved in the control of renal P excretion can be investigated in subsequent molecular studies in pigs.</p>	FBN, UR
<p>Phosphorus as a cue regulating microbial N₂O production (PQ4N)</p> <p>Main results: We conclude from the results that P availability could increase N conversion via mineralization, decrease nitrification and increase denitrification, coupled with an increase in N₂O production from denitrification, which was the main N₂O source here despite moderate water contents.</p>	UR, IOW
Second call (summer 2022)	
<p>Law and Governance of waters – international, European, national (Governance-Wasser)</p> <p>Main results: Developing the core issues of water law with regard to P fertilisation.</p>	FNK (UR), IOW
<p>The new phosphorus soil fertility classes and their relationship to phytodiversity and vegetation types (PhosPhyDiv)</p> <p>Main results: In contrast to large spatial scales and wide P concentration ranges, no differences in plant biodiversity on grassland could be detected on a small scale and at low concentrations of plant-available P (content classes A and B). This is presumably due to the fact that the content classes are oriented towards maximum yield and thus on a small-scale on natural grassland sites even the low content classes A (severely undersupplied) and B (undersupplied) appear to be far above a real P deficiency limit for plants of natural grassland sites. P content classes alone are therefore not sufficient to characterize such grassland sites with regard to phytodiversity and biomass, so that further analyses, e.g. of macro- and micronutrients, are necessary to determine which nutrient is de facto limiting for the plants at the respective site.</p>	UR (LÖ, GL)
<p>Methodical preliminary investigations for the analysis of MPn (MPn)</p> <p>Main results: Due to unforeseen necessary renovation work in the Organic Trace Substances labs at IOW, the project could not be brought forward as planned and essential analytical work had to be postponed to 2024. However, within this research topic and on the basis of the research conducted within PGS 1 a collaboration was initiated between the IOW working groups Organic Trace Substances and Trace Gases. Conducted studies revealed a contribution of methylphosphonate (MPn) to oxidic methane formation in the Baltic Sea. The results of this joined research could be published (Kanwischer et al., 2023; Environ. Sci. Technol. 57 (42), 15904pp., doi: 10.1021/acs.est.3c04098) showing the relevance of this subject. Thus, the objectives of the MPn seed money project will continue to be pursued as soon as the analytical infrastructure is reinstalled.</p>	IOW, UR
<p>Plasma-assisted treatment of biomass and sewage sludge for phosphorus recovery (PlaBiPhos)</p> <p>Main results: The aim of the study was to investigate the influence of microwave plasmas on liquid manure and sewage sludge substrates with regard to the effect on the mobilization of phosphate. The results show no clear effect on the mobilization of</p>	INP, UR

Seed-project	Cooperation
<p>phosphate. While the cuvette tests showed a slight increase in dissolved P in three samples, the measurements after three weeks showed the opposite effect, with the proportion of dissolved P falling significantly. On the other hand, however, the results show that a change in the substrates was basically effected.</p> <p>A reasonable plasma treatment may be achieved by combining it with a supporting acid disintegration, whereby a more efficient use of acid can be expected. Alternatively or in addition, the combination with a downstream anaerobic treatment step (with improved degradability of organic matter) can lead to increased P release.</p>	
<p>Development of an ELISA for quantification of FGF23 as a marker of phosphate homeostasis in pigs (porcine FGF23)</p>	FBN, UMR
<p>Main results: It was possible to identify commercially available antibodies against FGF23 and α-Klotho that enable the immunohistochemical detection of these proteins in porcine target tissues of mineral homeostasis. Furthermore, a commercially available ELISA was identified that is suitable for the quantification of porcine FGF23 from serum and plasma. Unfortunately, it has not been possible to produce recombinant porcine FGF23.</p>	
<p>Gene networks of phosphorus metabolism in fish and facultative anaerobic invertebrate (GePfi)</p>	FBN, UR
<p>The genome database screening and molecular comparative analyses resulted in the identification of numerous key genes of P metabolism (especially bone metabolism) in two bony fish species (Atlantic salmon, pikeperch). For many of these genes, qRT-PCRprimers have been successfully validated and are available for functional analyses. For invertebrates (mussel) no genes were identified with the chosen approach. Targeted genome database analysis for genes of P transport is therefore proposed for invertebrates.</p>	
Third call (autumn 2022)	
<p>Plasma-assisted oxidation of phosphonic acid waste for phosphorus recovery (Plasma)</p>	INP, UR
<p>Main results: The chemical analyses of the plasma-treated samples, which were intended to show an oxidation of phosphonate to phosphate, did not produce a clear result. The untreated reference samples of both treatment series already showed extremely high phosphate values. Unfortunately, the subsequent analysis of the treated samples no longer gave any useful evidence of an oxidation reaction that could be caused by the plasma. The results rather lead to the conclusion that the phosphate test method according to DIN EN ISO 11885:2009 was not suitable for these samples in particular and not only detects phosphate, but also phosphonate.</p> <p>Additional precipitation tests with calcium hydroxide were carried out to determine the phosphate content. In these tests, too, very high precipitation quantities were already obtained in the untreated phosphonic acid samples, so that no reasonable results were obtained. The tests will also be carried out after the end of the project period. The next step will be to use ^{31}P-NMR investigations.</p>	
<p>Detection of crop root architecture in medium size rhizotrons (MedRhizo)</p>	IPK, UR
<p>Main results: The rhizotrones developed and acquired within the project were successfully employed to assess (differences in) root formation of <i>Medicago sativa</i> accessions under standard and low P conditions. Due to time constraints, a complete evaluation of the results is not possible before the second half of 2024.</p>	
<p>Root exudations and root architecture in mixed crops (MixedRoots)</p>	UR, IPK, ZALF
<p>Main results: The combination of plant species can affect the root physiology as well as the root architecture. A rhizobox study was established in order to investigate interactions between plant species in a very early development in dependence of the phosphorus (P) supply at the University of Rostock. Beside the development of the shoot also root traits were measured. Clear differences were found between the root systems of the plant species with much higher lengths for the monocots German ryegrass and cocksfoot and the legumes red clover and lucerne. The P supply affected only the monocots while the cultivation design had no effects under these experimental conditions. In order to obtain effects of the cultivation design, the growth period would probably have to be extended.</p>	
<p>Investigation of selected antibodies for immunohistochemical analysis of the parathyroid glands of pigs (histoNSD)</p>	UMR, FBN
<p>Main results: With chromophore-coupled specific antibody binding, we have demonstrated that collagen types I and III are present as interlobular structural proteins in porcine parathyroid glands. Furthermore, collagen type III was detected in the intralobular capillaries. Our stainings indicate that CaSR is membrane-bound receptor protein while PTH is intracellularly located in the main cells of the NSD. Co-localization of</p>	

Seed-project	Cooperation
PTH and CaSR was demonstrated with immunofluorescence double staining. Both signals correspond to the morphological correlate in the form of the main cells from the histochemical stains	
Cultivation of bone-forming cells and analysis of respective expression profiles (CULTIVATE)	FBN, UMR
Main results: Primary synovial mesenchymal stem cells of porcine origin and a murine osteoblast-like cell line (MC3T3) were cultivated. The mesenchymal stem cells were successfully differentiated into bone-forming cells (osteoblasts) and their incorporation of calcium phosphate was demonstrated. Aliquots of the subcultured MC3T3 cells were also cryopreserved and are available for follow-up experiments. Initial analyses to map the expression profile of cultured bone cells have been completed.	

Table A5 Summary of objectives and degree of their achievement (Ongoing work after the end of funding of PGS2 marked in orange)

Objectives	Degree of achievement of objectives
(1) PGS 2	all 15 projects started by October 2020, all projects were completed; 5 dissertations were completed, 3 dissertations were submitted by April 2024; submission of 6 dissertations is planned for 2024; for 2 projects no dissertation ist possible
(2) Extension of cooperation agreement	signed on June 17, 2020, objective achieved
(3) Networking	2 associated partnerships, networking-analysis realized, extension of network via planned DFG-RTG and Leibniz Research Alliance (LFV) after end of PGS 2
(4) E-handbook P analytics	Since 2018, chapters are available in German; since May 2020 also in English; chapters will be extended step by step
(5) Internationalisation	International P-Campus Symposium each year, presentations at conferences (e.g. IPW9), ass. partnerships
(6) Public relations	Meeting with WPK, video about P-Campus, publications in German (e.g. Schaub et al. (2019), see Table A2), public lecture series via Webex in 2020, 2021, 2022, 2023, 2024 presentations of P-Campus members at "Long Night of the Sciences"
(7) Seed-projects	First 6 projects started July 2020, all finished; 11 projects, thematically oriented to planned DFG-RTG and Leibniz Research Alliance, started end of 2022 or beginning of 2023, 10 projects finished, one (MPn) will be finished during 2024
(8) Knowledge transfer	e.g. annual meeting with ministries (LM-MV, WM-MV), patent application (seed project Crysphos)
(9) Future of P-Campus	Idea findings started February, September 2020, planned DFG-RTG, LFV: further meetings in 2021 to 2024, draft submission planned for end of 2024/ beginning 2025

Table A6 Publications from 2019 to March 2024; highlighted as followed: joint publications (at least 2 Leibniz Institutes or 1 Leibniz institute + University of Rostock) in grey, if awarded for the P-Campus Publication Award first author in **bold**, **German publications in orange**, publications resulting from: **PGS 2: PhD student violet**, **PGS 1: PhD student blue**, **seed-projects: lead author green**)

Publication	involved institutes
2019	
Acksel, A., Baumann, K., Hu, Yongfeng, Leinweber, P. (2019) A look into the past: Tracing ancient sustainable manuring practices by thorough P speciation of northern European anthrosols. Soil Systems 3, 72, DOI: 10.3390/soilsystems3040072	UR
Acksel, A., Baumann, K., Hu, Yongfeng, Leinweber, P. (2019) A critical review and evaluation of some P-research methods. Comm. Soil Sci. Plant Anal., DOI: 10.1080/00103624.2019.1679165	UR
Ahmed, A. A., Gypser, S., Leinweber, P., Freese, D., Kühn, O. (2019) Infrared Spectroscopic Characterization of Phosphate Binding at the Goethite-Water Interface. Physical Chemistry Chemical Physics 21, 4421, DOI: 10.1039/C8CP07168C	UR

Publication	involved institutes
Andert, S., Mutz, J.-E., Wiese, A., de Mol, F., Steinmann, H.-H., Gerowitt, B. (2019) Farmers' statements are reliable – comparing two different data sources about Glyphosate use in Germany. <i>Crop Protection</i> 124: 104876, DOI: 10.1016/j.cropro.2019.104876	UR
Baumann, K., Siebers, M., Kruse, J., Eckardt, K.-U., Hu, Y., Michalik, D., Siebers, N., Kar, G., Karsten, U., Leinweber, P. (2019) Biological soil crusts as key player in biogeochemical P cycling during pedogenesis of sandy substrate. <i>Geoderma</i> 338, 145–158, DOI: 10.1016/j.geoderma.2018.11.034	LIKAT, UR
Bauwe, A., Eckhardt, K.-U., Lennartz, B. (2019) Predicting dissolved reactive phosphorus in tile-drained catchments using a modified SWAT model. <i>Ecohydrol. Hydrobiol.</i> 19 (2), 198-209, DOI: 10.1016/j.ecohyd.2019.03.003	UR
Bauwe, A., Neumann, D., Lennartz, B. (2019) Einfluss des Klimawandels auf Abfluss und Phosphoraustrag: Eine Fallstudie aus Mecklenburg-Vorpommern. <i>KW Korrespondenz Wasserwirtschaft</i> 3/2019, 166-171	IOW, UR
Bauwe, A. (2019) Potential der P-Reduktion aus Punktquellen im Einzugsgebiet der Warnow: ein modelltechnischer Ansatz. <i>Schriftenreihe Umweltingenieurwesen</i> 88, 20-28	UR
Berthold, M., Karsten, U., Nausch, G., Schumann, R. (2019) Prozesse der Eutrophierung und Re-Mesotrophierung der Darß-Zingster Boddenkette. <i>Wasser und Abfall</i> 21(3), 24-30	IOW, UR
Berthold, M. , Wulff, R., Reiff, V., Karsten, U., Nausch, G., Schumann, R. (2019) Magnitude and influence of atmospheric phosphorus deposition on the southern Baltic Sea coast over 23 years - Management implications for coastal waters. <i>Environmental Sciences Europe</i> . 31:27, DOI: 10.1186/s12302-019-0208-y	IOW, UR
Bitschowsky, F., Nausch, M. (2019) Spatial and seasonal variations in phosphorus speciation along a river in a lowland catchment (Warnow, Germany). <i>Science of The Total Environment</i> 657: 671-685, DOI: 10.1016/j.scitotenv.2018.12.009	IOW
Bitschowsky, F., Felgentreu, L., Nausch, G., Leipe, T., Nausch, M. (2019) Phosphortransport und -transformation entlang eines norddeutschen Tieflandflusses im Einzugsgebiet der Ostsee. <i>KW Korrespondenz Wasserwirtschaft</i> 3/2019, 134-139	IOW
Borchhardt, N., Baum, C., Thiem, D., Köpcke, T., Karsten, U., Leinweber, P. & Hryniewicz, K. (2019) Link between soil microbial phosphorus turnover and diversity of algae and fungi in biological soil crusts along a transect in a glacier foreland. <i>European Journal of Soil Biology</i> 91, 9-17, DOI: 10.1016/j.ejsobi.2018.12.006	UR
Buczko, U., Steinfurth, K., van Laak, M. (2019) Auswirkungen von unterlassener Phosphordüngung auf die Entwicklung der Erträge und Boden- P-Gehalte – Ergebnisse einer Metastudie. <i>VDLUFA Kongressband 2019 Gießen</i> , 74-81	UR
Buczko, U., Steinfurth, K., van Laak, M. (2019) Meta-analysis of the yield response to phosphorus fertilization based on long-term field experiments. <i>Agricul. Forest.</i> 65 (4), 7-14, DOI: 10.17707/AgriculForest.65.4.01	UR
Buczko, U., Zicker, T., Eichler-Löbermann, B., Brandt, T. (2019) Abschätzung von diffusen Phosphor-Austrägen mit Index-Verfahren - Entwicklung und Anwendung eines PI für Nordost-Deutschland. <i>KW Korrespondenz Wasserwirtschaft</i> 3/2019, 154-158	UR
Büttner, H., Kohrt, C., Wulf, C., Schäffner, B., Groenke, K., Hu, Y., Kruse, D., Werner, T. (2019) Life Cycle Assessment for the Organocatalytic Synthesis of Glycerol Carbonate Methacrylate. <i>ChemSusChem</i> 12, 2701–2707, DOI: 10.1002/cssc.201900678	LIKAT
Cramer, M., Rinas, M., Kotzbauer, U., Tränckner, J. (2019) Surface contamination of impervious areas on biogas plants and conclusions for an improved stormwater management. <i>Journal of Cleaner Production</i> 217, 1-11, DOI: 10.1016/j.jclepro.2019.01.087	UR
Cramer, M., Tränckner, J., Kotzbauer, U. (2019) Kinetic of denitrification and enhanced biological phosphorus removal (EBPR) of a trickling filter operated in a sequence-batch-reactor-mode (SBR-TF). <i>Environmental Technology</i> , DOI: 10.1080/09593330.2019.1709564	UR
Eckardt, f. (2019) Sustainability: transformation, governance, ethics, law. Springer 2019 (isbn: 978-3-030-19276-1)	UR
Falfushynska, H., Sokolov, E.P., Haider, F., Oppermann, C., Kragl, U., Ruth, W., Stock, M., Glufke, S., Winkel, E.J., Sokolova, I. (2019): Effects of a common pharmaceutical, atorvastatin, on energy metabolism and detoxification mechanisms of a marine bivalve <i>Mytilus edulis</i> . <i>Aquatic Toxicology</i> 208: 47-61, DOI: 10.1016/j.aquatox.2018.12.022	IOW, UR
Friedland, R., Buer, A.-L., Dahlke, S., Schernewski, G. (2019) Spatial Effects of Different Zebra Mussel Farming Strategies in an Eutrophic Baltic Lagoon. <i>Frontiers in Environmental Science</i> 6: 158, DOI: 10.3389/fenvs.2018.00158	IOW
Friedland, R., Schernewski, G., Gräwe, U., Greipsland, I., Palazzo, D., Pastuszak, M. (2019) Managing Eutrophication in the Szczecin (Oder) Lagoon-Development, Present State and Future Perspectives. <i>Frontiers in Marine Science</i> 5: 521, DOI: 10.3389/fmars.2018.00521	IOW
Ganta, P. B., Kühn, O., Ahmed, A. A. (2019) QM/MM simulations of organic phosphorus adsorption at the diaspore-water interface. <i>Physical Chemistry Chemical Physics</i> , DOI: 10.1039/C9CP04032C	UR

Publication	involved institutes
Garske, B., Douhaire, C., Ekaradt, F. (2019) Phosphor-Governance durch deutsches und europäisches Ordnungsrecht. Jahrbuch des Umwelt- und Technikrechts, Band 137, S. 95-131, ISBN: 978-3-503-18806-2	UR
Gerlinger, C., Oster, M., Borgelt, L., Reyer, H., Muráni, E., Ponsuksili, S., Polley, S., Vollmar, B., Reichel, M., Wolf, P., Wimmers, K. (2019) Physiological and transcriptional responses in weaned piglets fed diets with varying phosphorus and calcium levels. <i>Nutrients</i> 2019, 11, 436, DOI: 10.3390/nu11020436	FBN, UR
Gros, P., Ahmed, A.A., Kühn, O., Leinweber, P. (2019) Influence of metal ions on glyphosate detection by FMOC-Cl. <i>Environmental Monitoring and Assessment</i> 191: 244, DOI: 10.1007/s10661-019-7387-2	UR
Hagemann, M., Möke, F., Springer, A., Westermann, L., Frank, M., Wasmund, N., Bauwe, H. (2019) Cyanobacterium <i>Nodularia spumigena</i> strain CCY9414 accumulates polyphosphate under long-term P-limiting conditions. <i>Aqu Micr Ecol</i> 82: 267-276, DOI: 10.3354/ame01896	IOW, UR
Haider, F., Sokolov, E.P., Timm, S., Hagemann, M., Blanco Rayón, E., Marigómez, I., Izagirre, U., Sokolova, I. (2019) Interactive effects of osmotic stress and burrowing activity on protein metabolism and muscle capacity in the soft shell clam <i>Mya arenaria</i> . <i>Comparative Biochemistry and Physiology</i> 228: 81–93, DOI: 10.1016/j.cbpa.2018.10.022	IOW, UR
Jahanbakhsh, S., Brüser, V., Brandenburg, R. (2019) Experimental investigation of single microdischarges in a barrier corona arrangement with a cathodic metal pin. <i>Plasma Sources Sci. Technol.</i> , DOI: 10.1088/1361-6595/ab52e9	INP, UR
Jahanbakhsh, S., Hoder, T., Brandenburg, R. (2019) Correlation between electric field, current and photon emission in subsequent barrier corona microdischarges. <i>J. Appl. Phys.</i> 126, 19330, DOI: 10.1063/1.5124363	INP, UR
Jung, P., Baumann, K., Lehnert, L. W., Samolov, E., Achilles, S., Schermer, M., Wraase, L. M., Eckhardt, K.-U., Bader, M. Y., Leinweber, P., Karsten, U., Bendix, J., Büdel, B. (2019) Desert breath—How fog promotes a novel type of soil biocenosis, forming the coastal Atacama Desert's living skin. <i>Geobiology</i> , DOI: 10.1111/gbi.12368	UR
Jung, P., Schermer, M., Briegel-Williams, L., Baumann, K., Leinweber, P., Karsten, U., Lehnert, L., Achilles, S., Bendix, J., Büdel, B. (2019) Water availability shapes edaphic and lithic cyanobacterial communities in the Atacama Desert. <i>J. Phycol.</i> 55: 1306-1318, DOI: 10.1111/jpy.12908	UR
Kahle, P., Bauwe, A., Lennartz, B. (2019) P-Austräge aus dränierten landwirtschaftlichen genutzten Böden und Möglichkeiten zur Minderung. <i>KW Korrespondenz Wasserwirtschaft</i> 3/2019, 148-153	UR
Kiobia, D., Graef, H., Reuben, P., Kahimba, F., Graef, F., Eichler-Löbermann, B. Silayo, V. (2019) Combining biochar with low rate of chemical fertiliser boosts maize biomass yield, regardless of tillage system, under humid conditions. <i>J. Agricul. Rural Devel. Tropics Subtropics</i> 120, 1: 55-62, DOI: 10.17170/kobra-20190613557	UR
Koch, S., Kahle, P., Lennartz, B. (2019) Biogas digestate application modifies solute transport conditions in soils and increases the release of phosphorus. <i>Vadose Zone Journal</i> 18/1, DOI: 10.2136/vzj2019.03.0031	UR
Köhn, J., Zimmer, D., Leinweber, P. (2019) Is phosphorus really a scarce resource? <i>Scientific Reports</i> , DOI: 10.1504/IJETA.2018.100584	IOW, UR
Koning, L.A., de Mol, F., Gerowitt, B. (2019) Effects of management by glyphosate or tillage on the weed vegetation in a field experiment. <i>Soil & Tillage Research</i> 186, 79-86, DOI: 10.1016/j.still.2018.10.012	UR
Leinweber P., Hagemann P., Kebelmann L., Kebelmann K., Morshedizad M. (2019) Bone Char As a Novel Phosphorus Fertilizer. In: Ohtake H., Tsuneda S. (eds): <i>Phosphorus Recovery and Recycling</i> . Springer, Singapore: 419-432, DOI: 10.1007/978-981-10-8031-9_29	UR
Lennartz, B. (2019) Phosphor - von der Quelle bis ins Meer (Editorial) <i>KW Korrespondenz Wasserwirtschaft</i> 3/2019, 121	UR
Liu, X., de Vries, J. G., Werner, T. (2019) Transfer hydrogenation of cyclic carbonates and polycarbonate to methanol and diols by iron pincer catalysts. <i>Green Chemistry</i> 21: 5248-5255, DOI: 10.1039/C9GC02052G	LIKAT
Löffler, N., Fiebig, J., Mulch, A., Tütken, T., Schmidt, B.C., Bajnai, D., Conrad, A.C., Wacker, U., Böttcher, M.E. (2019) Refining the temperature dependence of the oxygen and clumped isotope partitioning during formation of carbonate-bearing hydroxy-apatite. <i>Geochim. Cosmochim. Acta</i> , 253: 19-38, DOI: 10.1016/j.gca.2019.03.002	IOW
Longwitz, L., Jopp, S., Werner, T. (2019) Organocatalytic Chlorination of Alcohols by P(III)/P(V) Redox Cycling. <i>J. Org. Chem.</i> 84, 7863–7870, DOI: 10.1021/acs.joc.9b00741	LIKAT
Longwitz, L., Spannenberg, A., Werner, T. (2019) Phosphetane oxides as redox cycling catalysts in the catalytic Wittig reaction at room temperature. <i>ACS Catalysis</i> , DOI: 10.1021/acscatal.9b02456	LIKAT
Longwitz, L., Werner, T. (2019) The Mitsunobu reaction, reimagined. <i>Science</i> 365: 866-867, DOI: 10.1126/science.aay6635	LIKAT
Longwitz, L., Werner, T. (2019) Reduction of activated alkenes by P(III)/P(V) redox cycling catalysis. <i>Angewandte Chemie Internationale Edition</i> , DOI: 10.1002/anie.201912991	LIKAT

Publication	involved institutes
López Sánchez, R.C., Eichler-Löbermann, B., Campos Posada, R., Campos-Posada, G., Gomez Padilla, E. (2019) Selection of effectiveness of rhizobia nodulating <i>Macroptilium atropurpureum</i> under salt stress. <i>Livestock Research for Rural Development</i> . 31, Article #26, from http://www.lrrd.org/lrrd31/2/rlope31026.html	UR
Meyer, L.-E., Gummesson, A., Kragl, U., von Langermann, J. (2019) Application of ionic liquid-water-based thermomorphic solvent (TMS)-systems for biocatalytic reactions. <i>Biotechnol. J.</i> , DOI: 10.1002/biot.201900215	UR
Müller, J., Heller, S. (2019) Effects of land management practices on phosphorus pools in a restored wet grassland on fen peat. In: WETSCAPES Conference - Understanding the ecology of restored fen peatlands for protection and sustainable use. p. 154	UR
Neumann, D. (2019) Abschätzung der biogeochemischen Umsetzung, Sedimentation und Resuspension von Phosphorverbindungen in der Unterwarnow für Flusseinträge in die Ostsee. <i>Scientific Reports</i> , DOI: 10.12754/misc-2019-0002	IOW
Oster, M., Reyer, H., Gerlinger, C., Wubuli, A., Vollmar, B., Wolf, P., Wimmers, K. (2019) Effekte einer differentiellen Phosphorversorgung bei Monogastriern. 15. Tagung Schweine- und Geflügelernährung, 19. - 21. November 2019, Lutherstadt Wittenberg. Tagungsband. Halle (Saale) 2019. Martin-Luther-Universität Halle-Wittenberg, Institut für Agrar- und Ernährungswissenschaften. 211p. ISBN 978-3-96670-009-2	FBN, UR
Palm, H. W., Knaus, U., Appelbaum, S., Strauch, S. M., Kotzen, B. (2019) Coupled aquaponics systems. In: Goddek, S., Joyce, A., Kotzen, B., Burnell, G. (Ed.): <i>Aquaponics food production systems</i> . Springer 2019 Kapitel 7: 163-199.	UR
Peine, M., Vitow, N., Graf, M., Baum, C., Zicker, T., Eichler-Löbermann, B., Schulz, S., Schlöter, M., Leinweber, P. (2019) Effect of triple superphosphate and biowaste compost on mycorrhizal colonization and enzymatic P mobilization under maize in a long-term field experiment. <i>JPNSS</i> 182 (2): 167-174, DOI: 10.1002/jpln.201800499	UR
Prüter, J., Leipe, T., Michalik, D., Klysubun, Leinweber, P. (2019) Phosphorus speciation in sediments from the Baltic Sea, evaluated by a multi-method approach. <i>J. Soils Sediments</i> , DOI: 10.1007/s11368-019-02518-w	IOW, LIKAT, UR
Reyer, H., Oster, M., Wittenburg, D., Muráni, E., Ponsuksili, S., Wimmers, K. (2019) Genetic contribution to variation in blood calcium, phosphorus, and alkaline phosphatase activity in pigs. <i>Frontiers in Genetics</i> 10:590, DOI: 10.3389/fgene.2019.00590	FBN, UR
Saki, H., Alemayehu, E., Schomburg, J., Lennartz, B. (2019) Halloysite Nanotubes as Adsorptive Material for Phosphate Removal from Aqueous Solution. <i>Water</i> 2019, 11, 203, DOI: 10.3390/w11020203	UR
Sarhan, M.S., Mourad, E.F., Nemr, R.A., Abdelfadeel, M.R., Daanaa, H.-S.A., Youssef, H.H., Goda, H.A., Hamza, M.A., Fayez, M., Eichler-Löbermann, B., Ruppel, S., Hegazi, N.A. (2019) An inoculum-dependent culturing strategy (IDC) for the cultivation of environmental microbiomes and the isolation of novel endophytic Actinobacteria. <i>J Antibiotics</i> 73, 66-71, DOI: 10.1038/s41429-019-0226-4	UR
Schaub, I., Baum, C., Schumann, R. & Karsten, U. (2019) Effects of an early successional biological soil crust from a temperate coastal sand dune (NE Germany) on soil elemental stoichiometry and phosphatase activity. <i>Microbial Ecology</i> 77, 217-229, DOI: 10.1007/s00248-018-1220-2	UR
Schaub, I., Zimmer, D., Strauch, S. (2019) Nachwuchsförderung und Forschung am Leibniz-WissenschaftsCampus Phosphorforschung Rostock. <i>Wasser und Abfall</i> 10/2019: 40-46.	IOW, UR
Schumann, A., Reiß, F., Siewert, J.-E., Jiao, H., Rabeah, J., Krummenacher, I., Braunschweig, H., Hering-Junghans, C. (2019) A selective route to aryl-triphosphiranes and their titanocene-induced fragmentation. <i>Chemical Science</i> 34: 7859-7867, DOI: 10.1039/C9SC02322D	LIKAT
Sokolov, E.P., Markert, S., Hinzke, T., Hirschfeld, C., Becher, D., Ponsuksili, S., Sokolova, I.M. (2019) Effects of hypoxia-reoxygenation stress on mitochondrial proteome and bioenergetics of the hypoxia-tolerant marine bivalve <i>Crassostrea gigas</i> . <i>J. Proteomics</i> 194, 99-111, DOI: 10.1016/j.jprot.2018.12.009	FBN, IOW, UR
Sokolov, E.P., Sokolova, I.M. (2019) Compatible osmolytes modulate mitochondrial function in a marine osmoconformer <i>Crassostrea gigas</i> (Thunberg, 1793). <i>Mitochondrion</i> 45, 29-37, DOI: 10.1016/j.mito.2018.02.002	IOW, UR
Sokolova, I., Sokolov, E.P., Haider, F., (2019) Mitochondrial mechanisms underlying tolerance to fluctuating oxygen conditions: Lessons from hypoxia-tolerant organisms. <i>Integr. Compar. Biol.</i> 59: 938-952, DOI: 10.1093/icb/icz047	IOW, UR
Steinfurth, K., Buczko, U. (2019) Ertragswirkung von Phosphordüngung: Eine paneuropäische Metastudie. <i>VDLUFA Kongressband 2019 Gießen</i> , 169-175	UR
Strauch, S.M., Bahr, J., Baßmann, B., Bischoff, A.A., Oster, M., Wasenitz, B., Palm, H.W. (2019) Effects of ortho-phosphate on growth performance, welfare and product quality of juvenile african catfish (<i>Clarias gariepinus</i>). <i>Fishes</i> 4, 3; DOI: 10.3390/fishes4010003	UR, IOW
Tonn, C., Buczko, U., Jurasinski, G. (2019) Schilfröhricht als Schnittstelle zwischen Land und Wasser. <i>Rostocker Meeresbiologische Beiträge</i> 29, 75–84	UR

Publication	involved institutes
Tränckner, J. (2019) Niederschlagswasser auf landwirtschaftlichen Betriebshöfen und Biogasanlagen. Schriftenreihe Umweltingenieurwesen 88, 86-103	UR
Tränckner, S., Stapel, C., Cramer, M., Tränckner, J. (2019) Einfluss kleiner Kläranlagen auf die Gewässerbeschaffenheit hinsichtlich Phosphat im norddeutschen ländlichen Raum. KW Korrespondenz Wasserwirtschaft, 03/2019, 159-165	UR
Tränckner, S., Niendorf, J. (2019) Phosphorelimination in kleinen Kläranlagen durch nachgeschaltete alkalische Fällungsfiltration. Schriftenreihe Umweltingenieurwesen 88, 29-38	UR
Vortmeyer-Kley, R., Lünsmann, B., Berthold, M., Gräwe, U., Feudel, U. (2019) Eddies: fluid dynamical niches or transporters? - A case study in the Western Baltic Sea. Front. Mar. Sci. 6, 118, DOI: 10.3389/fmars.2019.00118	IOW, UR
Wacker-Fester, K., Uptmoor, R., Pfahler, V., Dehmer, K. J., Bachmann-Pfabe, S., Kavka, M. (2019) Genotype-specific differences in phosphorus efficiency of potato (<i>Solanum tuberosum</i> L.). Front. Plant Sci. 10: 1029, DOI: 10.3389/fpls.2019.01029	IPK, UR
Wiek, S., Helm, B., Karrasch, P., Hunger, S., Hoffmann, T. G., Schonrock, S., Klehr, W., Six, A., Staglich, I., Kuhn, K., Mehl, D., Tränckner, J., Bernard, L., Krebs, P. (2019) Boot-gestütztes längskontinuierliches Monitoring von Fließgewässern mit online-Sonden. Hydrologie und Wasserbewirtschaftung 63 (1): 19-32, DOI: 10.5675/HyWa_2019.1_2	UR
Wirth, M.A., Sievers, M., Habedank, F., Kragl, U., Schulz-Bull, D.E., Kanwischer, M. (2019) Electrodialysis as a sample processing tool for bulk organic matter and target pollutant analysis of seawater. Marine Chemistry 217, DOI: 10.1016/j.marchem.2019.103719	IOW, UR
Wubuli, A., Reyer, H., Muráni, E., Ponsuksili, S., Wolf, P., Oster, M., Wimmers, K. (2019) Tissue-wide gene expression analysis of sodium/phosphate co-transporters in pigs. Intern. J. Mol. Sci. 20, 5576, DOI: 10.3390/ijms20225576	FBN, UR
Zimmer, D., Panten, K., Frank, M., Springer, A., Leinweber, P. (2019) Sulfur-enriched bone char as alternative P fertilizer: spectroscopic, wet chemical, and yield response evaluation. Agriculture 9, 21; DOI: 10.3390/agriculture9010021	IOW, UR
2020	
Baumann, K., Nasta, S., Shaheen, S.M., Rinklebe, J., Leinweber, P. (2020) Phosphorus cycling and spring barley crop response to varying redox potential. Vadose Zone Journal, DOI: 10.1002/vzj2.20088	UR
Baumann, K., Shaheen, S.M., Hu, Yongfeng, Gros, P., Heilmann, E., Morshedizad, M., Wang, J., Wang, S.-L., Rinklebe, J., Leinweber, P. (2020) Speciation and sorption of phosphorus in agricultural soil profiles of redoximorphic character. Environ. Geochem. Health, DOI: 10.1007/s10653-020-00561-y	UR
Beer, H., Bläsing, K., Bresien, J., Chojetzki, L., Schulz, A., Stoer, P., Villinger, A. (2020) Trapping of Bronsted acids with a phosphorus-centered biradicaloid - synthesis of hydrogen pseudohalide addition products. Dalton Transactions, 49, 13655-13662, DOI: 10.1039/d0dt03251d	LIKAT, UR
Beer, H., Bresien, J., Michalik, D., Rölke, A.-K., Schulz, A., Villinger, A., Wustrack, R. (2020) Heterocyclopentenediyls vs heterocyclopentadienes: A Question of Silyl Group Migration. Journal of Organic Chemistry, 85, 14435-14445, DOI: 10.1021/acs.joc.0c00460	LIKAT, UR
Beer, H., Bresien, J., Michalik, D., Schulz, A., Villinger, A. (2020) Reversible switching between housane and cyclopentenediyl isomers: an isonitrile-catalyzed thermal reverse reaction. Dalton Transactions, 49, 13986-13992, DOI: 10.1039/D0DT02688C	LIKAT, UR
Berthold, M., Nausch, G., von Weber, M., Koch, S., Kahle, P., Lennartz, B., Tränckner, J., Buczko, U., Tonn, C., Ekardt, F., Bathmann, U. (2020) Phosphorus and the Baltic Sea: Sustainable Management. Encyclopedia of Water: Science, Technology, and Society: 2479-2498, DOI: 10.1002/9781119300762.wsts0146	IOW, UR
Berthold, M., Schumann, R. (2020) Phosphorus dynamics in a eutrophic lagoon: Uptake and utilization of nutrient pulses by phytoplankton. Front. Mar. Sci. 7: 281, DOI: 10.3389/fmars.2020.00281	UR
Bresien, J., Pilopp, Y., Schulz, A., Szych, L.S., Villinger, A., Wustrack, R. (2020) Synthesis of sterically demanding secondary phosphides and diphosphanes and their utilization in small-molecule activation. Inorganic Chemistry, 59, 13561-13571, DOI: 10.1021/acs.inorgchem.0c01934	LIKAT, UR
Chojetzki, L., Schulz, A., Villinger, A., Wustrack, R. (2020) Cycloaddition of alkenes and alkynes to the P-centered singlet biradical [P(μ -N π Ter)] ₂ . Zeitschrift fuer Anorganische und Allgemeine Chemie, 646, 614-624, DOI: 10.1002/zaac.201900191	LIKAT, UR
Ekardt, F., Jacobs, B., Stubenrauch, J., Garske, B. (2020) Peatland Governance: The problem of depicting in sustainability governance, regulatory law, and economic instruments. Land 2020, 9(3), 83, S. 1-24, DOI: 10.3390/land9030083	UR
Eichler-Löbermann, B., Busch, S., Jablonowski, N.D., Kavka, M., Brandt, C. (2020) Mixed cropping as affected by phosphorus and water supply. Agronomy 2020, 10(10), 1506, DOI: 10.3390/agronomy10101506	IPK, UR

Publication	involved institutes
Falfushynska, H.I., Sokolov, E., Piontkivska, H., Sokolova, I. (2020) The role of reversible protein phosphorylation in regulation of the mitochondrial electron transport system during hypoxia and reoxygenation stress in marine bivalves. <i>Front. Mar. Sci.</i> 7: 467, DOI: 10.3389/fmars.2020.00467	IOW, UR
Garske, B., Heyl, K., Ekardt, F., Weber, L.M., Gradzka, W. (2020) Challenges of food waste governance: An assessment of European legislation on food waste and recommendations for improvement by economic instruments. <i>Land</i> 2020, 9, 231, DOI: 10.3390/land9070231	UR
Garske, B., Stubenrauch, J., Ekardt, F. (2020) Sustainable phosphorus management in European agricultural and environmental law. <i>Review of European, Comparative and International Environmental Law</i> 2020;29: 107-117, DOI: 10.1111/reel.12318	UR
Gerlinger, C., Oster, M., Reyer, H., Polley, C., Vollmar, B., Muráni, E., Wimmers, K., Wolf, P. (2020) Effects of excessive or restricted phosphorus and calcium intake during early life on markers of bone architecture and composition in pigs. <i>J. Anim. Physiol. Anim. Nutr.</i> 2020;00:1–11, DOI: 10.1111/jpn.13286	FBN, UR
Grandane, A., Nocentini, A., Werner, T., Zalubovskis, R., Supuran, C.T. (2020) Benzoxepinones: A new isoform-selective class of tumor associated carbonic anhydrase inhibitors. <i>Bioorg. Med. Chem.</i> 2020, 28, 115496, DOI: 10.1016/j.bmc.2020.115496	LIKAT
Gros, P., Meissner, R., Wirth, M.A., Kanwischer, M., Rupp, H., Schulz-Bull, D.E., Leinweber, P. (2020) Leaching and degradation of ¹³ C ₂ - ¹⁵ N-glyphosate in field. <i>Environ. Monit. Assess.</i> 192: 127, DOI: 10.1007/s10661-019-8045-4	IOW, UR
Guardia-Puebla, Y., Llanes-Cedeño, E., Rodríguez-Pérez, S., Arias-Cedeño, Q., Sánchez-Girón, V., Morscheck, G., Eichler-Löbermann, B. (2020) Sustainable management of wastewaters generated from fruit and vegetables processing: Theoretical design of combined UASB and artificial wetlands systems. <i>J Water Land Develop</i> 47, 66-76, DOI: 10.24425/jwld.2020.135033	UR
Gussone, N., Böttcher, M.E., Conrad, A.C., Fiebig, J., Pelz, M., Grathoff, G., Schmidt, B.C. (2020) Calcium isotope fractionation upon experimental apatite formation. <i>Chem. Geol.</i> , 551, 119737, DOI: 10.1016/j.chemgeo.2020.119737	IOW, UR
Habedank, F., Feldhusen, F., Schulz-Bull, D., Kanwischer, M. (2020) Analysis of organophosphate pesticides in surface water - Comparison of method optimization approaches. <i>J. Chemometr.</i> 34, 5: e3220, DOI: 10.1002/cem.3220	IOW
Harloff, J., Schulz, A., Stoer, P., Villinger, A. (2020) Pseudohalide HCN aggregate ions: [N ₃ (HCN) ₃] ⁻ , [OCN(HCN) ₃] ⁻ , [SCN(HCN) ₂] ⁻ and [P(CN·HCN) ₂] ⁻ . <i>Dalton Transactions</i> , 49, 13345-13351, DOI: 10.1039/d0dt02973d	LIKAT, UR
Heyl, K., Döring, T., Garske, B., Stubenrauch, J., Ekardt, F. (2020) The Common Agricultural Policy beyond 2020: A critical review in light of global environmental goals. <i>Review of European, Comparative and international Environmental Law</i> 2020, 00, S. 1-12, DOI: 10.1111/reel.12351	UR
Hu, Yuya, Peglow, S., Longwitz, L., Frank, M., Epping, J.D., Brüser, V., Werner, T. (2020) Plasma-assisted immobilization of a phosphonium salt and its use as a catalyst in the valorization of CO ₂ . <i>ChemSusChem</i> 2020, 13, 1825 –1833, DOI: 10.1002/cssc.201903384	INP, LIKAT
Hu, Yuya, Wei, Z., Frey, A., Kubis, C., Ren, C.-Y., Spannenberg, A., Jiao, H., Werner, T. (2020) Catalytic, kinetic and mechanistic insights into the fixation of CO ₂ with epoxides catalyzed by phenol functionalized phosphonium salts. <i>ChemSusChem</i> 2020, DOI: 10.1002/cssc.202002267	LIKAT
Hülsewede, D., Temmel, E., Kumm, P., von Langermann, J. (2020) Concept Study for an Integrated reactor-crystallizer process for the continuous biocatalytic synthesis of (S)-1-(3-methoxyphenyl)ethylamine. <i>Crystals</i> , 10(5), 1-13, DOI: 10.3390/cryst10050345	UR
Jung, P., Baumann, K., Emrich, D., Springer, A., Felde, V.J.M.N.L., Dultz, S., Baum, C., Frank, M., Büdel, B., Leinweber, P. (2020) Lichens bite the Dust - A bio-weathering scenario in the Atacama Desert. <i>iScience</i> 23, 11, DOI: 10.1016/j.isci.2020.101647	UR
Legesse, S., Lemessa, F., Wolf, P., Eichler-Löbermann, B. (2020) Oat (<i>Avena sativa</i> L.) supplemented with fenugreek (<i>Trigonella foenum-graecum</i> L.) as a potential alternative for teff [<i>Eragrostis tef</i> (Zucc.) Trotter] for human nutrition in Ethiopia. <i>Comm. Soil Sci. Plant Anal.</i> 51, 22, 2846-2857, DOI: 10.1080/00103624.2020.1849268	UR
Leinweber, P., Baum, C., Zacher, A. (2020) Und jetzt auch noch der Phosphor <i>DLG-Mitteilungen</i> 6/2020, 13-15.	UR
Lennartz, B., Bauwe, A., Koch, S., Kahle, P. (2020) Wie gelangt Phosphor ins Meer?, <i>DLG-Mitteilungen</i> 6/2020, 20-21.	UR
Liu, X., Longwitz, L., Spiegelberg, B., Tönjes, J., Beweries, T., Werner, T. (2020) Erbium-catalyzed regioselective isomerization–cobalt-catalyzed transfer hydrogenation sequence for the synthesis of anti-markovnikov alcohols from epoxides under mild conditions. <i>ACS Catal.</i> 2020, 10, 13659–13667, DOI: 10.1021/acscatal.0c03294	LIKAT
Lohrer, C., Cwierz, P., Wirth, M., Schulz-Bull, D., Kanwischer, M. (2020) Methodological aspects of methylphosphonic acid analysis: Determination in river and coastal water samples. <i>Talanta</i> , DOI: 10.1016/j.talanta.2020.120724	IOW
Longwitz, L., Werner, T. (2020) Reduction of activated alkenes by P(III)/P(V) redox cycling catalysis. <i>Angew Chem Int Ed</i> 132, 2782 –2785, DOI: 10.1002/anie.201912991	LIKAT

Publication	involved institutes
López, R., Eichler-Löbermann, B., Campos, R., Campos-Posada, G., Gomez, E. (2020) Respuesta de combinaciones rizobio – Sesbania rostrata en condiciones de estrés salino en el Valle del Cauto en Cuba. <i>Livestock Research for Rural Development</i> 32 (3), article #48	UR
Meyer, L.-E., Brundiek, H., von Langermann, J. (2020) Integration of ion exchange resin materials for a downstream-processing approach of an imine reductase-catalyzed reaction. <i>Biotechnology Progress</i> 36, 5, DOI: 10.1002/btpr.3024	UR
Negassa, W., Michalik, D., Klysubun, W., Leinweber, P. (2020) Phosphorus speciation in long-term drained and rewetted peatlands of northern Germany. <i>Soil Syst.</i> 4, 11, DOI: 10.3390/soilsystems4010011	LIKAT, UR
Oster, M., Reyer, H., Keiler, J., Ball, E., Mulvenna, C., Muráni, E., Ponsuksili, S., Wimmers, K. (2020) Comfrey (<i>Symphytum</i> spp.) as an alternative field crop contributing to closed agricultural cycles in chicken feeding. <i>Sci. Total Environ.</i> 742: 140490, DOI: 10.1016/j.scitotenv.2020.140490	FBN
Oster, M., Reyer, H., Ponsuksili, S., Trakooljul, N., Camarinha-Silva, A., Bennewitz, J., Rodehutschord, M., Wimmers, K. (2020) Towards improved phosphorus efficiency in poultry species. <i>Eur. Poultry Sci.</i> 2020, 84, DOI: 10.1399/eps.2020.314	FBN
Oster, M., Reyer, H., Trakooljul, N., Weber, F. M., Xi, L., Muráni, E., Ponsuksili, S., Rodehutschord, M., Bennewitz, J., Wimmers, K. (2020) Ileal transcriptome profiles of japanese quail divergent in phosphorus utilization. <i>Int. J. Mol. Sci.</i> 2020, 21, 2762, DOI: 10.3390/ijms21082762	FBN
Ponsuksili, S., Reyer, H., Hadlich, F., Weber, F., Trakooljul, N., Oster, M., Siengdee, P., Muráni, E., Rodehutschord, M., Camarinha-Silva, A., Bennewitz, J., Wimmers, K. (2020) Identification of the key molecular drivers of phosphorus utilization based on host miRNA-mRNA and gut microbiome interactions. <i>Int. J. Mol. Sci.</i> 2020, 21, 2818, DOI: 10.3390/ijms21082818	FBN
Prüter, J., Strauch, S.M., Wenzel, L.C., Klysubun, W., Palm, H.W., Leinweber, P. (2020) Organic matter composition and phosphorus speciation of solid waste from an african catfish recirculating aquaculture system. <i>Agriculture</i> 2020, 10(10), 466, DOI: 10.3390/agriculture10100466	UR
Rönspieß, L., Dellwig, O., Lange, X., Nausch, G., Schulz-Bull, D. (2020) Spatial and seasonal phosphorus dynamics in a eutrophic estuary of the southern Baltic Sea. <i>Estuar. Coast. Shelf Sci.</i> 233, DOI: 10.1016/j.ecss.2019.106532	IOW
Siengdee, P., Oster, M., Reyer, H., Viergutz, T., Wimmers, K., Ponsuksili, S. (2020) Morphological and molecular features of porcine mesenchymal stem cells derived from different types of synovial membrane, and genetic background of cell donors. <i>Front. Cell Dev. Biol.</i> 8:601212, DOI: 10.3389/fcell.2020.601212	FBN
Stubenrauch, J., Ekardt, F. (2020) Plastic pollution in soils: Governance approaches to foster soil health and closed nutrient cycles. <i>Environments</i> 2020, 7, 38, S. 1-18, DOI: 10.3390/environments7050038	UR
Stubenrauch, J., Garske, B., Ekardt, F. (2020) Kunststoffe in Meeren und Böden: Regulierungsansätze im Wasser-, Naturschutz-, Bodenschutz- und Agrarrecht, Teil 2. <i>Natur und Recht</i> 2020, 42, S. 457-464, DOI:10.1007/s10357-020-3706-1	UR
Sukhotin, A., Kovalev, A., Sokolov, E., Sokolova, I. (2020): Mitochondrial performance of a continually growing marine bivalve, <i>Mytilus edulis</i> , depends on body size. <i>J. Exper. Biol.</i> 223: jeb22633, DOI: 10.1242/jeb.226332	IOW, UR
Tränckner, J. (2020) Konzept zur Klärschlammentsorgung einschließlich Phosphor-Recycling in MV. <i>DIALOG Abfallwirtschaft MV, Tagungsband, Schriftenreihe Umweltingenieurwissenschaften, Band 95, ISBN 978-3-86009-507-2, S. 475-488</i>	UR
Vassileva, M., Malusá, E., Eichler-Löbermann, B., Vassilev, N. (2020) <i>Aspegillus terreus</i> : From soil to industry and back. <i>Microorganisms</i> 8 (11), 1-10, DOI: 10.3390/microorganisms8111655	UR
Waseem, M., Schilling, J., Kachholz, F., Tränckner, J. (2020) Improved representation of flow and water quality in a north-eastern German lowland catchment by combining low-frequency monitored data with hydrological modelling. <i>Sustainability</i> 2020, 12, 4812, DOI: 10.3390/su12124812	UR
Weishaupt, A., Ekardt, F., Garske, B., Stubenrauch, J., Wieding, J. (2020) Land use, livestock, quantity governance and economic instruments: Sustainability beyond big livestock herds and fossil fuels. <i>Sustainability</i> 2020, 12, 2053, S. 1-27, DOI: 10.3390/su12052053	UR
Wieding, J., Stubenrauch, J., Ekardt, F. (2020) Human rights and precautionary principle: Limits to geoengineering, SRM, and IPPC scenarios. <i>Sustainability</i> 2020, 12(21), 8858, S. 1-23, DOI: 10.3390/su12218858	UR
Wubuli, A., Gerlinger, C., Reyer, H., Oster, M., Muráni, E., Trakooljul, N., Ponsuksili, S., Wolf, P., Wimmers, K. (2020) Reduced phosphorus intake throughout gestation and lactation of sows is mitigated by transcriptional adaptations in kidney and intestine. <i>BMC Genomics</i> 21: 626, DOI: 10.1186/s12864-020-07049-0	FBN
Zicker, T., Kavka, M., Bachmann-Pfabe, S., Eichler-Löbermann, B. (2020) Long-term phosphorus supply with undigested and digested slurries and their agronomic effects under field conditions. <i>Biomass & Bioenergy</i> , DOI: 10.1016/j.biombioe.2020.105665	IPK, UR
Zwicker, J., Smrzka, D., Steindl, F., Böttcher, M.E., Libowitzky, E., Kiel, S., Peckmann, J. (2020) Mineral authigenesis within chemosynthetic microbial mats: Coated grain formation and	IOW, UR

Publication	involved institutes
phosphogenesis at a Cretaceous hydrocarbon seep, New Zealand. The Depositional Record 6, DOI: 10.1002/dep2.123	
2021	
Amorim, K., Piontkivska, H., Zettler, M. L., Sokolov, E., Hinzke, T., Nair, A. M., Sokolova, I. M. (2021) Transcriptional response of key metabolic and stress response genes of a nuculanid bivalve, <i>Lembulus bicuspidatus</i> from an oxygen minimum zone exposed to hypoxia-reoxygenation. Comparative Biochemistry and Physiology, Part B: Biochemistry and Molecular Biology 256, 110617, DOI: 10.1016/j.cbpb.2021.110617	IOW, UR
Angello, Z.A., Behailu, B. M., Tränckner, J. (2021) Selection of optimum pollution load reduction and water quality improvement approaches using scenario based water quality modeling in Little Akaki river, Ethiopia. Water, 13 (5), 584, 1-22, DOI: 10.3390/w13050584	UR
Angello, Z. A., Tränckner, J., Behailu, B. M. (2021) Spatio-temporal evaluation and quantification of pollutant source contribution in Little Akaki river, Ethiopia: Conjunctive application of factor analysis and multivariate receptor model. Polish Journal of Environmental Studies 30 (1), 23-34, DOI: 10.15244/pjoes/119098	UR
Arlt, S., Blaesing, K., Harloff, J., Laatz, K.C., Michalik, D., Nier, S., Schulz, A., Stoer, P., Stoffers, A., Villinger, A. (2021) Pseudohalogen chemistry in ionic liquids with non-innocent cations and anions. ChemistryOpen 10, 62-71, DOI: 10.1002/open.202000252	LIKAT, UR
Baumann, K., Eckhardt, K.-U., Acksel, A., Gros, P., Glaser, K., Gillespie, A.W., Karsten, U., Leinweber, P. (2021) Contribution of biological soil crusts to soil organic matter composition and stability in temperate forests. Soil Biology and Biochemistry 160, DOI: 10.1016/j.soilbio.2021.108315	UR
Bresien, J., Michalik, D., Schulz, A., Villinger, A., Zander, E. (2021) Azadiphosphaindane-1,3-diyls: A class of resonance-stabilized biradicals. Angewandte Chemie International Edition 60, 3, 1507-1512, DOI: 10.1002/anie.202011886	LIKAT, UR
Eichler-Löbermann, B., Zicker, T., Kavka, M., Busch, S., Brandt, C., Stahn, P., Miegel, K. (2021) Mixed cropping of maize or sorghum with legumes as affected by long-term phosphorus management. Field Crops Research 265, 1-10, 108120, DOI: 10.1016/j.fcr.2021.108120	IPK, UR
Fischer, M., Hering-Junghans, C. (2021) On 1,3-phosphaazaallenes and their diverse reactivity. Chem. Sci. 12, 10279, DOI: 10.1039/d1sc02947a	LIKAT
Ganta, P.B., Kühn, O., Ahmed, A.A. (2021) <i>Ab Initio</i> molecular dynamics simulations of the interaction between organic phosphates and Goethite. Molecules 26(1), 160, DOI: 10.3390/molecules26010160	UR
Ganta, P.B., Morshedizad, M., Kühn, O., Leinweber P., Ahmed, A.A. (2021) The binding of phosphorus species at Goethite: A joint experimental and theoretical study. Minerals 11(3), 323, DOI: 10.3390/min11030323	UR
Garske, B., Bau, A., Ekardt, F. (2021) Digitalisierung und KI in der europäischen Landwirtschaft: Strategie zur Erreichung der Klima- und Biodiversitätsziele? Natur und Recht 43, 445-455, DOI: 10.1007/s10357-021-3867-6	UR
Garske, B., Bau, A., Ekardt, F. (2021) Digitalization and AI in European agriculture: A strategy for achieving climate and biodiversity targets? Sustainability 13, 4652, DOI: 10.3390/su13094652	UR
Garske, B., Ekardt, F. (2021) Ökonomische Instrumente der Phosphor-Governance unter Berücksichtigung der Klima- und Biodiversitätsziele aus Paris-Abkommen und Biodiversitätskonvention. Natur und Recht 43, 245-256, DOI: 10.1007/s10357-021-3827-1	UR
Garske, B., Ekardt, F. (2021) Economic policy instruments for sustainable phosphorus management: Taking into account climate and biodiversity targets. Environ Sci Eur 33, 56, 1-20, DOI: 10.1186/s12302-021-00499-7	UR
Garske, B., Heyl, K., Ekardt, F., Weber, L.M., Gradzka, W. (2021) Lebensmittelverluste als Governance- und Rechtsproblem. NuR 43, 168-179, DOI: 10.1007/s10357-021-3814-6	UR
Gläsel, T., Jiao, H., Hapke, M. (2021) Synthesis of phosphinines from coii-catalyzed [2+2+2] cycloaddition reactions. ACS Catalysis 11: 13434-13444, DOI: 10.1021/acscatal.1c03483	LIKAT, UR
Grafe, M., Kurth, J.K., Panten, K., Raj, A.D., Baum, C., Zimmer, D., Leinweber, P., Schloter, M., Schulz, S. (2021) Effects of different innovative bone char based P fertilizers on bacteria catalyzing P turnover in agricultural soils. Agriculture, Ecosystems & Environment 314, DOI: 10.1016/j.agee.2021.107419	UR
Guardia-Puebla, Y., Llanes Cedeno, E., Rodríguez Perrez, S., Arias Q., Eichler-Löbermann, B. (2021) Dynamic modelling of an UASB reactor treating coffee wet wastewater via multiple regression model. J Water Land Develop. 50, 229-239, DOI: 0.24425/jwld.2021.138178	UR
Gupta, P., Siewert, J.-E., Wellnitz, T., Fischer, M., Baumann, W., Beweries, T., Hering-Junghans, C. (2021) Reactivity of phospho-Wittig reagents towards NHCs and NHOs. Dalton Trans. 50, 1838-1844, DOI: 10.1039/D1DT00071C	LIKAT, UR
Heyl, K., Ekardt, F., Roos, P., Stubenrauch, J., Garske, B. (2021) Free trade, environment, agriculture, and plurilateral treaties: The ambivalent example of Mercosur, CETA, and the EU-Vietnam free trade agreement. Sustainability 13, 3153, DOI: 10.3390/su13063153	UR

Publication	involved institutes
Iqbal, M.A., Ali, A., Hadlich, F., Oster, M., Reyer, H., Trakooljul, N., Sommerfeld, V., Rodehutschord, M., Wimmers, K., Ponsuksili, S. (2021) Dietary phosphorus and calcium in feed affects miRNA profiles and their mRNA targets in jejunum of two strains of laying hens. <i>Sci Rep.</i> 11:13534, DOI: 10.1038/s41598-021-92932-3	FBN
Kavka, M., Korn, K., Hazarika, M., Bachmann-Pfabe, S., Uptmoor, R. (2021) Potato root and leaf phosphatase activity in response to P deprivation. <i>Journal of Plant Nutrition and Soil Science</i> , 1–10. DOI: 10.1002/jpln.202100112	IPK, UR
Kavka, M., Majcherczyk, A., Kűes, U., Polle, A. (2021) Phylogeny, tissue-specific expression, and activities of root-secreted purple acid phosphatases for P uptake from ATP in P starved poplar. <i>Plant Science</i> 307, 1-11, 110906. DOI: 10.1016/j.plantsci.2021.110906	UR
Koczorski, P., Furtado, B.U., Golebiewski, M., Hulisz, P., Baum, C., Weih, M., Hryniewicz, K. (2021) The effects of host plant genotype and environmental conditions on fungal community composition and phosphorus solubilization in willow short rotation coppice. <i>Front. Plant Sci.</i> 12, 1-16, DOI: 10.3389/fpls.2021.647709	UR
Leinweber, P., Baum, C., Zacher, A. (2021) Phosphor im System Boden – Pflanze – Gewässer. In: Emeis, S. und Schlögl-Flierl, K. (Hrsg.). <i>Phosphor - Fluch und Segen eines Elements</i> . Oekom-Verlag, München, S. 115-130	UR
Lencha, S.M., Tränckner, J., Dananto, M. (2021) Assessing the water quality of lake Hawassa Ethiopia—Trophic state and suitability for anthropogenic uses—Applying common water quality indices. <i>Int. Environmental Research and Public Health</i> 18, 8904, 1-31, DOI: 10.3390/ijerph18178904	UR
Liu, X., Werner, T. (2021) Indirect reduction of CO ₂ and recycling of polymers by manganese-catalyzed transfer hydrogenation of amides, carbamates, urea derivatives, and polyurethanes. <i>Chem. Sci.</i> 12, 10590-10597, DOI: 10.1039/d1sc02663a	LIKAT
Liu, X., Werner, T. (2021) Selective construction of C–C and C=C Bonds by manganese catalyzed coupling of alcohols with phosphorus ylides. <i>Adv. Synth. Catal.</i> 363, 1096-1104, DOI: 10.1002/adsc.202001209	LIKAT
Nees, S., Fantuzzi, F., Wellnitz, T., Fischer, M., Siewert, J.-E., Goettel, J. T., Hofmann, A., Härterich, M., Braunschweig, H., Hering-Junghans, C. (2021) Cyclo-dipnictadialanes. <i>Angew. Chem. Int. Ed.</i> , 60, 24318–24325, DOI: 10.1002/anie.202111121	LIKAT
Noor, M. N., Wu, F., Sokolov, E. P., Falfushynska, H., Timm, S., Haider, F., Sokolova, I. M. (2021) Salinity-dependent effects of ZnO nanoparticles on bioenergetics and intermediate metabolite homeostasis in a euryhaline marine bivalve, <i>Mytilus edulis</i> . <i>Science of the Total Environment</i> 774, 1-18, 145195, DOI: 10.1016/j.scitotenv.2021.145195	IOW, UR
Omotoso, A.O., Reyer, H., Oster, M., Ponsuksili, S., Trakooljul, N., Muráni, E., Sommerfeld, V., Rodehutschord, M., Wimmers, K. (2021) Jejunal transcriptomic profiling of two layer strains throughout the entire production period. <i>Scientific Reports</i> 11, 1-11, DOI: 10.1038/s41598-021-99566-5	FBN
Oster, M., Reyer, H., Gerlinger, C., Trakooljul, N., Siengdee, P., Keiler, J., Ponsuksili, S., Wolf, P., Wimmers, K. (2021) mRNA profiles of porcine parathyroid glands following variable phosphorus supplies throughout fetal and postnatal life. <i>Biomedicines</i> 2021, 9, 454, DOI: 10.3390/biomedicines9050454	FBN, UR
Oster, M., Reyer, H., Keiler, J., Ball, E., Mulvenna, C., Ponsuksili, S., Wimmers, K. (2021) Comfrey (<i>Symphytum</i> spp.) as a feed supplement in pig nutrition contributes to regional resource cycles. <i>Sci. Total Environ.</i> 796, DOI: 10.1016/j.scitotenv.2021.148988	FBN
Ponsuksili, S., Hadlich, F., Reyer, H., Oster, M., Trakooljul, N., Iqbal, M.A., Sommerfeld, V., Rodehutschord, M., Wimmers, K. (2021) Genetic background and production periods shape the microRNA profiles of the gut in laying hens. <i>Genomics</i> 113, 4, 1790-1801, DOI: 10.1016/j.ygeno.2021.04.018	FBN
Ponsuksili, S., Oster, M., Reyer, H., Hadlich, F., Trakooljul, N., Rodehutschord, M., Camarinha-Silva, A., Bennewitz, J., Wimmers, K. (2021) Genetic regulation and heritability of miRNA and mRNA expression link to phosphorus utilization and gut microbiome. <i>Open Biol.</i> 11, 2, 200182, DOI: 10.1098/rsob.200182	FBN
Pudnika, L., Domraceva, I., Werner, T., Zalubovskis, R., Grandane, A. (2021) Base-free catalytic wittig/cross-coupling reaction sequence as short synthetic strategy for the preparation of highly functionalized arylbenzoxepinones. <i>Synthesis</i> 53, 3545-3554, DOI: 10.1055/a-1509-6078	LIKAT
Pushkareva, E., Baumann, K., Van, A., Mikhailyuk, T., Baum, C., Hryniewicz, K., Demchenko, E., Thiem, D., Köpcke, T., Karsten, U., Leinweber, P. (2021) Diversity of microbial phototrophs and heterotrophs in Icelandic biocrusts and their role in phosphorus-rich Andosols. <i>Geoderma</i> 386, 114905, DOI: 10.1016/j.geoderma.2020.114905	UR
Reyer, H., Oster, M., Ponsuksili, S., Trakooljul, N., Omotoso, A.O., Iqbal, M.A., Muráni, E., Sommerfeld, V., Rodehutschord, M., Wimmers, K. (2021) Transcriptional responses in jejunum of two layer chicken strains following variations in dietary calcium and phosphorus levels. <i>BMC Genomics</i> 22:485, DOI: 10.1186/s12864-021-07814-9	FBN

Publication	involved institutes
Reyer, H., Sjöberg, P.J.R., Oster, M., Wubuli, A., Murani, E., Ponsuksili, S., Wolf, P., Wimmers, K. (2021) Mineral phosphorus supply in piglets impacts the microbial composition and phytate utilization in the large intestine. <i>Microorganisms</i> 9(6), 1197, DOI: 10.3390/microorganisms9061197	FBN, UR
Rönspieß, L., Nausch, G., Schulz-Bull, D. (2021) Bioavailability of various phosphorus fractions and their seasonality in a eutrophic estuary in the southern Baltic Sea - A laboratory approach. <i>Front. Mar. Sci.</i> 8: 715238, DOI: 10.3389/fmars.2021.715238	IOW
Roshan, S. K., Dumack, K., Bonkowski, M., Leinweber, P., Karsten, U., Glaser, K. (2021) Taxonomic and Functional Diversity of heterotrophic protists (<i>Cercozoa</i> and <i>Endomyxa</i>) from biological soil crusts. <i>Microorganisms</i> 9, 205, DOI: 10.3390/microorganisms9020205	UR
Schille, J.T., Nolte, I., Beck, J., Jilani, D., Roof, C., Pews-Davtyan, A., Rolfs, A., Henze, L., Beller, M., Brenig, B., Junghans, C., Schütz, E., Murua Escobar, H. (2021) PDA indolymaleimides induce anti-tumor effects in prostate carcinoma cell lines through mitotic death. <i>Front. Vet. Sci.</i> 7:558135, DOI: 10.3389/fvets.2020.558135	LIKAT, UR
Schulz, A., Hinz, A., Roelke, A., Villinger, A., Wustrack, R. (2021) On new staudinger type reactions of phosphorus centered biradicaloids, $[P(\mu-NR)]_2$ (R = Ter, Hyp), with ionic and covalent azides. <i>Zeitschrift fuer Anorganische und Allgemeine Chemie</i> 647, 4, 245-257, DOI: 10.1002/zaac.202000228	UR
Shaheen, S.M., Wang, J., Baumann, K., Wang, S.-L., Leinweber, P., Rinklebe, J. (2021) Redox-induced mobilization of phosphorus in groundwater affected arable soil profiles. <i>Chemosphere</i> 275, DOI: 10.1016/j.chemosphere.2021.129928	UR
Siewert, J.-E., Schumann, A., Hering-Junghans, C. (2021) Phosphine-catalysed reductive coupling of dihalophosphanes. <i>Dalton Transactions</i> 42, 15111-15117, DOI: 10.1039/D1DT03095G	LIKAT
Sokolov, E. P., Adzibli, L., Markert, S., Bundgaard, A., Fago, A., Becher, D., Hirschfeld, C., Sokolova, I. M. (2021) Intrinsic mechanisms underlying hypoxia-tolerant mitochondrial phenotype during hypoxia-reoxygenation stress in a marine facultative anaerobe, the blue mussel <i>Mytilus edulis</i> . <i>Frontiers in Marine Science</i> 8:773734, DOI: 10.3389/fmars.2021.773734	FBN, IOW, UR
Sowoidnich, K., Oster, M., Wimmers, K., Maiwald, M., Sumpf, B. (2021) Shifted excitation Raman difference spectroscopy as enabling technique for the analysis of animal feedstuff. <i>Journal of Raman Spectroscopy</i> , DOI: 10.1002/jrs.6140	FBN
Steinfurth, K., Hirte, J., Morel, C., Buczko, U. (2021) Conversion equations between Olsen-P and other methods used to assess plant available soil phosphorus in Europe – A review. <i>Geoderma</i> 401, 115339, DOI: 10.1016/j.geoderma.2021.115339	UR
Stubenrauch, J. (2021) Übertragbarkeit des BVerfG-Beschlusses zum Klimaschutz auf andere Umweltbereiche am Beispiel Phosphor, <i>ZUR</i> 32 (11), S. 617-623.	UR
Stubenrauch, J. (2021) Mögliche Wege der Phosphor-Governance. In: Emeis, S. und Schlögl-Flierl, K. (Hrsg.), <i>Phosphor - Fluch und Segen eines Elements</i> . Oekom-Verlag, München, S. 235-248	UR
Stubenrauch, J., Ekardt, F., Heyl, K., Garske, B., Schott, V.L., Ober, S. (2021) How to legally overcome the distinction between organic and conventional farming - Governance approaches for sustainable farming on 100% of the land. <i>Sustain. Prod. Consum.</i> 28, 716-725, DOI: 10.1016/j.spc.2021.06.006	UR
Tönjes, J., Longwitz, L., Werner, T. (2021) Poly(methylhydrosiloxane) as a reductant in the catalytic base-free Wittig reaction. <i>Green Chemistry</i> 23, 4852-4857, DOI: 10.1039/D1GC00953B	LIKAT
Tränckner, J. (2021) Phosphorrückgewinnung und -recycling aus Abwasser. In: Emeis, S. und Schlögl-Flierl, K. (Hrsg.), <i>Phosphor - Fluch und Segen eines Elements</i> . Oekom-Verlag, München, S. 196-219	UR
Vázquez-Glaría, A., Eichler-Löbermann, B., Loiret, F. G., Ortega, E., Kavka, M. (2021) Root-system architectures of two cuban rice cultivars with salt stress at early development stages. <i>plants</i> 10, 1-19, 1194, DOI: 10.3390/plants10061194	UR
Vitow, N., Zicker, T., Chiba, A., Zacher, A., Eichler-Löbermann, B., Schulz, S., Schloter, M., Baum, C., Leinweber, P. (2021) Impact of the legume catch crop serradella on subsequent growth and P mobilization under barley in different fertilization treatments. <i>Agronomy</i> 11, 1-12, DOI: 10.3390/agronomy11122437	UR
Winklhofer, P., Andert, S., Hüttel, S., Gerowitt, B. (2021) Measuring on-farm phosphorus fertiliser use—Lessons learned from surveying data of five regions in northern Germany. <i>Agronomy</i> 11, 2123, 1-21, DOI: 10.3390/agronomy1112123	UR
Wirth, M.A., Longwitz, L., Kanwischer, M., Gros, P., Leinweber, P., Werner, T. (2021) AMPA- ¹⁵ N – Synthesis and application as standard compound in traceable degradation studies of glyphosate. <i>Ecotoxicology and Environmental Safety</i> 225, 1-8, DOI: 10.1016/j.ecoenv.2021.112768	IOW, LIKAT, UR
Wirth, M.A., Schulz-Bull, D.E., Kanwischer, M. (2021) The challenge of detecting the herbicide glyphosate and its metabolite AMPA in seawater – Method development and application in the Baltic Sea. <i>Chemosphere</i> 262, DOI: 10.1016/j.chemosphere.2020.128327	IOW
Wirth, M.A., Schulz-Bull, D.E., Kanwischer, M. (2021) Nachweis von Glyphosat in Meerwasser: Besondere Analyseanforderungen in Gegenwart einer Salzmatrix. <i>GIT-Laborfachz.</i> 65, 36-38	IOW

Publication	involved institutes
Wu, F., Sokolov, E. P., Dellwig, O., Sokolova, I. M. (2021) Season-dependent effects of ZnO nanoparticles and elevated temperature on bioenergetics of the blue mussel <i>Mytilus edulis</i> . <i>Chemosphere</i> 263, 127780, 1-13, DOI: 10.1016/j.chemosphere.2020.127780	IOW, UR
Zacher, A., Baum, C., de Mol, F., Dehmer, K.J., Gerowitt, B. (2021) Mixed growth with weeds promotes mycorrhizal colonization and increases the plant-availability of phosphorus under maize (<i>Zea mays</i> L.). <i>Agronomy</i> 11, 1304, DOI: 10.3390/agronomy11071304	IPK, UR
Zerssa, G., Feyssa, D., Kim, D.-G., Eichler-Löbermann, B. (2021) Challenges of smallholder farming in Ethiopia and opportunities by adopting climate smart agriculture: A review. <i>Agriculture</i> 11, 192, 1-25, DOI: 10.3390/agriculture11030192	UR
Zerssa, G., Kim, D.G., Koal, P., Eichler-Löbermann, B. (2021) Combination of compost and mineral fertilizers as an option for enhancing maize (<i>Zea mays</i> L.) yields and mitigating greenhouse gas emissions from a Nitisol in Ethiopia. <i>Agronomy</i> 11, 2097, 1-21, DOI: 10.3390/agronomy11112097	UR
Zocher, K., Gros, P., Werneburg, M., Brüser, V., Kolb, J.F., Leinweber, P. (2021) Degradation of glyphosate in water by the application of surface corona discharges. <i>Water Sci Technol</i> 84 (5), 1293-1301, DOI: 10.2166/wst.2021.320	INP, UR
2022	
Adzigi, L., Sokolov, E. P., Ponsuksili, S., Sokolova, I. M. (2022) Tissue- and substrate-dependent mitochondrial responses to acute hypoxia–re-oxygenation stress in a marine bivalve (<i>Crassostrea gigas</i>). <i>J Exp Biol</i> 225 (1), DOI: 10.1242/jeb.243304	FBN, IOW, UR
Adzigi, L., Sokolov, E.P., Wimmers, K., Sokolova, I.M., Ponsuksili, S. (2022) Effects of hypoxia and reoxygenation on mitochondrial functions and transcriptional profiles of isolated brain and muscle porcine cells. <i>Sci Rep</i> 12(1): 19881, DOI: 10.1038/s41598-022-24386-0	FBN, IOW, UR
Avilés-Tamayo, Y., Guarda-Puebla, Y., Valdesiguirre, L., Arias, Q., López, R., Morscheck, G., Eichler-Löbermann, B. (2022) Comparative characterisation of humic substances obtained from anaerobic digestate of horticultural residues. <i>Tropentag 2022</i> , Book of abstracts, S. 40.	UR
Bullaín Galardis, M.M., López Sánchez, R.C., Fall, F., Eichler-Löbermann, B., Pruneau, L., Bâ, A.M. (2022) Growth and physiological responses of ectomycorrhizal <i>Coccoloba uvifera</i> (L.) L. seedlings to salt stress. <i>Journal of Arid Environments</i> 196, art. no. 104650, DOI: 10.1016/j.jaridenv.2021.104650	UR
Bullaín, M., López, R., Fall, F., Eichler-Löbermann, B., Pruneau, L., Séne, S., Ba, A.M. (2022) Diversity and role of ectomycorrhizal fungi in improving the tolerance of see grape to salt stress. 19th Int. Conference of the Biological Nitrogen Fixation, Senegal, 29. Nov. - 1. Dez. 2022, Book of abstracts	UR
Chiba, A., Peine, M., Kublik, S., Baum, C., Schloter, M., Schulz, S. (2022) Complete genome sequence of <i>Psychrobacillus</i> sp. Strain INOP01, a phosphate-solubilizing bacterium isolated from an agricultural soil in Germany. <i>Microbiol. Resour. Announc.</i> 11, 4, DOI: 10.1128/mra.00207-22	UR
Dankert, F., Fischer, M., Hering-Junghans, C. (2022) Modulating the reactivity of phosphanylidenephosphoranes towards water with Lewis acids. <i>Dalton Trans.</i> 51, 11267-11276, DOI: 10.1039/D2DT01575G	LIKAT
Dankert, F., Fischer, M., Hering-Junghans, C. (2022) On the ambiphilic character of phosphanylidenephosphoranes and manipulation of phosphinidenoid reactivity with Lewis acids. DOI: 10.26434/chemrxiv-2022-drdkg (working paper)	LIKAT
Dankert, F., Gupta, P., Wellnitz, T., Baumann, W., Hering-Junghans, C. (2022) Deoxygenation of chalcogen oxides EO ₂ (E = S, Se) with phospho-Wittig reagents. <i>Dalton Trans.</i> , 51, 18642-18651, DOI: 10.1039/D2DT03703C	LIKAT
Dankert, F., Hering-Junghans, C. (2022) Heavier group 13/15 multiple bond systems: Synthesis, structure and chemical bond activation. <i>Chem. Commun.</i> 2022, 58, 1242-1262, DOI: 10.1039/D1CC06518A	LIKAT
Dankert, F., Siewert, J.-E., Gupta, P., Weigend, F., Hering-Junghans, C. (2022) Metal-free N-H bond activation by phospho-Wittig reagents. <i>Angew. Chem. Int. Ed.</i> 2022, 61, 1-6, DOI: 10.1002/anie.202207064	LIKAT
Dankert, F., Siewert, J.-E., Weigend, F., Hering-Junghans, C. (2022) Metal-free NH-oxidative addition at phospho-Wittig reagents. DOI: 10.26434/chemrxiv-2022-w5xvh (working paper)	LIKAT
Eichler-Löbermann, B., Koal, P., Hu, Yue, Dehmer, K.J. (2022) Nachhaltiges und effizientes Phosphor-Management im Pflanzenbau. In: <i>Kinder haften für ihre Eltern – Impulse aus dem Ökolandbau. KTBL-Tagung 2022</i> , S. 94-109	IPK, UR
Ekarth, F., Bärenwaldt, M., Heyl, K. (2022) The Paris target, human rights, and IPCC weaknesses: Legal arguments in favour of smaller budgets. <i>Environments</i> , 9(9), 112, DOI: 10.3390/environments9090112	UR
Ekarth, F., Heyl, K. (2022) The German constitutional verdict is a landmark in climate litigation. <i>Nature Climate Change</i> , 12, 697–699, DOI: 10.1038/s41558-022-01419-0	UR
Falfushynska, H., Khatib, I., Kasianchuk, N., Lushchak, O., Horyn, O., Sokolova, I.M. (2022) Toxic effects and mechanisms of common pesticides (Roundup and chlorpyrifos) and their mixtures in a	UR

Publication	involved institutes
zebrafish model (<i>Danio rerio</i>). Science of The Total Environment 833, 155236, DOI: 10.1016/j.scitotenv.2022.155236	
Fornara, D., Ball, E. M., Mulvenna, C., Reyer, H., Oster, M., Wimmers, K., Poulsen H.D., Rosemarin, A. (2022) Soil and Plant responses to phosphorus inputs from different phytase-associated animal diets. Agronomy, 12(1), 130, 1-16, DOI: 10.3390/agronomy12010130	FBN
Glaser, K., Van, A.T., Pushkareva, E., Barrantes, I., Karsten, U. (2022) Microbial communities in biocrusts are recruited from the neighboring sand at coastal dunes along the Baltic Sea. Front. Microbiol. 13, 859447, DOI: 10.3389/fmicb.2022.859447	UR
Gupta, P., Täufer, T., Siewert, J.-E., Reiß, F., Drexler, H.-J., Pospech, J., Beweries, T., Hering-Junghans, C. (2022) Synthesis, coordination chemistry, and mechanistic studies of P,N-type phosphalkene-based Rh(I) complexes. Inorg. Chem. 2022, 61, 30, 11639–11650, DOI: 10.1021/acs.inorgchem.2c01158	LIKAT
Hasan, M., Oster, M., Reyer, H., Ponsuksili, S., Murani, E., Wolf, P., Fischer, D.-C., Wimmers, K. (2022) Tissue-wide expression of genes related to vitamin D metabolism and FGF23 signaling following variable phosphorus intake in pigs. Metabolites 12, 729, DOI: 10.3390/metabo12080729	FBN, UR
Heyl, K., Ekardt, F. (2022) Barriers and methodology in transitioning to sustainability: Analysing web news comments concerning animal-based diets. Journal of Cleaner Production 330, 129857, DOI: 10.1016/j.jclepro.2021.129857	UR
Heyl, K., Ekardt, F., Roos, P., Garkse, B. (2022) Digitalisierte Präzisionsdüngung und EU-Agrarsubventionen im deutschen Recht: Ökologisch effektive Umsetzung von Farm-to-Fork-Strategie und Umweltvölkerrecht? Natur und Recht 44, 837–846, DOI: 10.1007/s10357-022-4114-5	UR
Heyl, K., Ekardt, F., Sund, L., Roos, P. (2022) Potentials and limitations of subsidies in sustainability governance: The example of agriculture. Sustainability 14, 15859, DOI: 10.3390/su142315859	UR
Hu, Yue, Jarisch, K.A., Kavka, M., Eichler-Löbermann, B. (2022) Fate of P from organic and inorganic fertilizers assessed by complementary approaches. Nutr Cycl Agroecosyst 124, 189–209, DOI: 10.1007/s10705-022-10237-x	IPK, UR
Iqbal, M.A., Reyer, H., Oster, M., Hadlich, F., Trakooljul, N., Perdomo-Sabogal, A., Schmucker, S., Stefanski, V., Roth, C., Camarinha Silva, A., Huber, K., Sommerfeld, V., Rodehutsord, M., Wimmers, K., Ponsuksili, S. (2022) Multi-omics reveals different strategies in the immune and metabolic systems of high-yielding strains of laying hens. Frontiers in Genetics 13, 1-20, DOI: 10.3389/fgene.2022.858232	FBN
Jarosch, K., Hu, Yue, Kavka, M., Eichler-Löbermann, B. (2022) Phosphorus fractions and availabilities in different soil depths after 20 years of continuous soil P management. 22nd World Congress of Soil Science, Glasgow, August 2022	UR
López, R., Medina, J., Eichler-Löbermann, B. (2022) Phenotypic plasticity of <i>Anacardium occidentale</i> seedlings to salt stress based on physiological indicators. Tropentag 2022, Book of abstracts, S. 86.	UR
Mulvenna, C.C., McCormack, U.M., Magowan, E., McKillen, J., Bedford, M.R., Walk, C.L., Oster, M., Reyer, H., Wimmers, K., Fornara, D.A., Ball, M.E.E. (2022) The growth performance, nutrient digestibility, gut bacteria and bone strength of broilers offered alternative, sustainable diets varying in nutrient specification and phytase dose. Animals 12, 1669, DOI: 10.3390/ani12131669	FBN
Pham, D. N., Sokolov, E. P., Falfushynska, H., Sokolova, I.M. (2022) Gone with sunscreens: Responses of blue mussels (<i>Mytilus edulis</i>) to a wide concentration range of a UV filter ensulizole. Chemosphere 309: 136736, DOI: 10.1016/j.chemosphere.2022.136736	IOW, UR
Protasiewicz, J.D., Hering-Junghans, C. (2022) Phosphanylidenephosphoranes. Encyclopedia of Inorganic and Bioinorganic Chemistry (EIBC). DOI: 10.1002/9781119951438.eibc2795	LIKAT
Prüter, J., Yongfeng Hu, Leinweber, P. (2022) Influence of sample pretreatment on P speciation in sediments evaluated with sequential fractionation and P K-edge XANES spectroscopy. Communications in Soil Science and Plant Analysis 53, 1712-1730, DOI: 10.1080/00103624.2022.2063317	UR
Ren, C., Spannenberg, A., Werner, T. (2022) Synthesis of bifunctional phosphonium salts bearing perfluorinated side chains and their application in the synthesis of cyclic carbonates from epoxides and CO ₂ . Asian J. Org. Chem. 11, 9, DOI: 10.1002/ajoc.202200156	LIKAT
Rojas, R., Fundora, O., Eichler-Löbermann, B., Gálvez, G. (2022) Weed control using environmentally friendly alternatives in smallholder agriculture in Cuba. Tropentag 2022, Book of abstracts, S. 90.	UR
Seyedalmoosavi, M. M., Mielenz, M., Görs, S., Wolf, P., Daş, G., Metges, C. C. (2022) Effects of increasing levels of whole Black Soldier Fly (<i>Hermetia illucens</i>) larvae in broiler rations on acceptance, nutrient and energy intakes and utilization, and growth performance of broilers. Poultry Science 101, 12, 1-15, DOI: 10.1016/j.psj.2022.102202	FBN, UR
Seyedalmoosavi, M.M., Mielenz, M., Veldkamp, T., Daş, G., Metges, C.C. (2022) Growth efficiency, intestinal biology, and nutrient utilization and requirements of black soldier fly (<i>Hermetia illucens</i>)	FBN

Publication	involved institutes
larvae compared to monogastric livestock species: A review. <i>Journal of Animal Science and Biotechnology</i> 13, 1-20, DOI: 10.1186/s40104-022-00682-7	
Shaheen, S.M., Wang, J., Baumann, K., Ahmed, A.A., Hsu, L.-C., Liu, Y.-T., Wang, S.-L., Kühn, O., Leinweber, P., Rinklebe, J. (2022) Stepwise redox changes alter the speciation and mobilization of phosphorus in hydromorphic soils. <i>Chemosphere</i> 288, DOI: 10.1016/j.chemosphere.2021.132652	UR
Steinfurth, K., Börjesson, G., Denoroy, P., Eichler-Löbermann, B., Gans, W., Heyn, J., Hirte, J., Huyghebaert, B., Jouany, C., Koch, D., Merbach, I., Mokry, M., Mollier, A., Morel, C., Panten, K., Peiter, E., Poulton, P.R., Reitz, T., Rubæk, G.H., Spiegel, H., van Laak, M., von Tucher, S., Buczko, U. (2022) Thresholds of target phosphorus fertility classes in European fertilizer recommendations in relation to critical soil test phosphorus values derived from the analysis of 55 European long-term field experiments. <i>Agric. Ecosyst. Environ.</i> 332, DOI: 10.1016/j.agee.2022.107926	UR
Steinfurth, K., Holton Rubæk, G., Hirte, J., Buczko, U. (2022) Yield response of grass and grass-clover leys in crop rotations to phosphorus fertilization. <i>Grassland Science in Europe</i> , 27, 731-733.	UR
Stubenrauch, J. (2022) Innovative phosphorus governance: How to address recurring regulatory shortfalls - The example of Germany, Costa Rica and Nicaragua. In: Ginzky, H. et al. (eds.) <i>International Yearbook of Soil Law and Policy 2020/2021</i> , 435-462, DOI: 10.1007/978-3-030-96347-7_17	UR
Stubenrauch, J., Ekardt, F., Hagemann, K., Garske, B. (2022) <i>Forest governance. Overcoming trade-offs between land-use pressures, climate and biodiversity protection.</i> Springer (Book), DOI: 10.1007/978-3-030-99184-5	UR
Stubenrauch, J., Garske, B., Ekardt, F., Hagemann, K. (2022) European forest governance: Status quo and optimising options with regard to the Paris climate target. <i>Sustainability</i> , 14(7), 4365, DOI: 10.3390/su14074365	UR
Suhrbier, T., Bresien, J., Villinger, A., Schulz, A. (2022) A four-membered heterocyclic prevented biradical that can be described as a zwitterion or masked N-heterocyclic phosphinidene. <i>Cell Reports Physical Science</i> 3, 100777, DOI: 10.1016/j.xcrp.2022.100777	UR
Terazzi, C., Laatz, K., von Langermann, J., Werner, T. (2022) Synthesis of cyclic carbonates catalyzed by Ca_2-Et_3N and studies on their biocatalytic kinetic resolution. <i>ACS Sustainable Chem. Eng.</i> 10, 40, 13335–13342, DOI: 10.1021/acssuschemeng.2c03210	LIKAT, UR
Vento, R., Pérez, E., García, M., Eichler-Löbermann, B. (2022) Environmental education programme based on agroecological techniques to act against climate change in Pinar del Río, Cuba.	UR
Wu, F., Sokolov, E. P., Khomich, A., Fettkenhauer, C., Schnell, G., Seitz, H., Sokolova, I.M. (2022) Interactive effects of ZnO nanoparticles and temperature on molecular and cellular stress responses of the blue mussel <i>Mytilus edulis</i> . <i>Science of The Total Environment</i> 818: 151785, 15 p., DOI: 10.1016/j.scitotenv.2021.151785	IOW, UR
Zacher, A., Leinweber, P., Panten, K. (2022) Sulfur-enriched bone char enhances P uptake by maize in a perennial pot experiment. <i>Journal für Kulturpflanzen</i> , 74 (05-06), 124-133, DOI: 10.5073/JfK.2022.05-06.03	UR
Zerssa, G., Eichler-Löbermann, B. (2022) Combining mineral fertilisers with compost for sustainable maize production and reduction of greenhouse gas. <i>Tropentag 2022, Book of abstracts</i> , S. 29.	UR
Zerssa, G., Kim, D.G., Koal, P., Eichler-Löbermann, B. (2022) Mixed application of compost and inorganic fertilizers increases maize (<i>Zea mays</i> L.) yields, grain minerals, and nutrient use efficiency and mitigates greenhouse gas emissions in Southwestern Ethiopia. <i>Global Symposium on soils for nutrition.</i> FAO. July 2022	UR
2023	
Ahmed, A.A., Leinweber, P., Kühn, O. (2023) Advances in understanding the phosphate binding to soil constituents: A Computational Chemistry perspective. <i>Science of The Total Environment</i> 887, DOI: 10.1016/j.scitotenv.2023.163692	UR
Al Methyeb, M., Ruppel, S., Eichler-Löbermann, B., Vassilev, N. (2023) The combined applications of microbial inoculants and organic fertilizer improve plant growth under unfavorable soil conditions. <i>Microorganisms</i> 11, 1721, DOI: 10.3390/microorganisms11071721	UR
Avila, C., Argente-Martínez, L., Campos-Posada, R., Campos-Posada, G., Eichler-Löbermann, B., Lopez, R. (2023) Efecto del estrés salino en el régimen hídrico, concentración de compuestos osmóticamente activos y pigmentos fotosintéticos en cultivares de tomate. <i>Rev. Investig. Agropecuarias</i> , 49 (1), pp. 32-40. DOI: 10.58149/a09g-wv36	UR
Belov, F., Mildner, A., Knaus, T., Mutti, F., von Langermann, J. (2023) Crystallization-based downstream processing of ω -transaminase- and amine dehydrogenase-catalyzed reactions. <i>Reaction Chemistry & Engineering</i> , 8, 1427-1439, DOI: 10.1039/D2RE00496H	UR
Bullaín-Galardis, M., Campos-Posada, R., Campos-Posada, G., Eichler-Löbermann, B., Pruneau, L., Bâ, A., López-Sánchez, R. (2023) Morphological and physiological responses of <i>Coccoloba uvifera</i> (L.) L. seedlings of different origin to salt stress. <i>Terra Latinoamericana</i> 41, 1-15, DOI: 10.28940/terra.v41i0.1655	UR

Publication	involved institutes
Daş, G., Seyedalmoosavi, M.M., Schleifer, K., Mielenz, M., Metges, C.C. (2023) The validity of the bioaccumulation index versus the bioaccumulation factor for assessment of element accumulation in black soldier fly larvae. <i>Journal of Insects as Food and Feed</i> , DOI: 10.3920/JIFF2023.0021	FBN
Debicka, M., Morshedizad, M., Leinweber, P. (2023) The effects of dissolved organic matter derived from agricultural waste materials on phosphorus sorption in sandy soils. <i>Agriculture</i> 13, 2164, DOI: 10.3390/agriculture13112164	UR
Ekardt, F., Günther, P., Hagemann, K., Garske, B., Heyl, K., Weyland, R. (2023) Legally binding and ambitious biodiversity protection under the CBD, the global biodiversity framework, and human rights law. <i>Environmental Sciences Europe</i> 35, 80, DOI: 10.1186/s12302-023-00786-5	UR
Galardis, M.M.B., Sánchez, R.C.L., Pruneau, L., Eichler-Löbermann, B., Fall, F., Bâ, A. (2023) Using the ectomycorrhizal symbiosis between <i>Coccoloba uvifera</i> L. and <i>Scleroderma bermudense</i> Coker to restore a degraded coastal sand dune in Cuba. <i>Trees - Structure and Function</i> , DOI: 10.1007/s00468-023-02470-w	UR
Garske, B., Ekardt, F. (2023) Phosphor-Düngung und Wasserrecht auf internationaler, europäischer und nationaler Ebene - Zugleich zu Gewässer-Implikationen des BVerfG-Klima-Beschlusses. <i>Natur und Recht</i> 45, 152–162, DOI: 10.1007/s10357-023-4151-8	UR
Garske, B., Ekardt, F., Stubenrauch, J. (2023) Phosphorus, Human Rights, and Distributive Justice. Working Paper, https://www.nachhaltigkeit-gerechtigkeit-klima.de/files/texts/Phosphorus-Justice-WorkingPaper.pdf	UR
Gasser, S. A. A., Nielsen, K., Eichler-Löbermann, B., Armbruster, M., Merbach, I., Franko, U. (2023) Simulating the soil phosphorus dynamics of four long term field experiments with a novel phosphorus model. <i>Soil Use and Management</i> 39, 867-880, DOI: 10.1111/sum.12881	UR
Geist, L., Wolfer, R., Thiem, R., Thielicke, M., Eichler-Löbermann, B., Eulenstein, F., Müller, M. (2023) Alternative starter fertilization strategies in maize (<i>Zea mays</i> L.) cultivation: Agronomic potential of microgranular fertilizer and plant growth-promoting microorganisms and their impact on the soil native microbial community. <i>Agronomy</i> 13, 2900, DOI: 10.3390/agronomy13122900	UR
Glaser, K., Kammann, S., Plag, N., Dressler, M. (2023) Ecophysiological performance of terrestrial diatoms isolated from biocrusts of coastal sand dunes. <i>Front. Microbiol.</i> 14:1279151, DOI: 10.3389/fmicb.2023.1279151	UR
Hasan, M., Oster, M., Reyer, H., Wimmers, K., Fischer, D.-C. (2023) Efficacy of dietary vitamin 3 and 25(OH)D3 on reproductive capacities, growth performance, immunity and bone development in pigs. <i>British Journal of Nutrition</i> 28;130(8):1298-1307, DOI: 10.1017/S0007114523000442	FBN, UR
Heyl, K. (2023) Reducing Phosphorus Input into the Baltic Sea—An assessment of the updated Baltic Sea action plan and its implementation through the Common Agricultural Policy in Germany. <i>Water</i> 15(2), 315, DOI: 10.3390/w15020315	UR
Heyl, K., Ekardt, F., Roos, P., Garske, B. (2023) Achieving the nutrient reduction objective of the Farm to Fork Strategy. An assessment of CAP subsidies for precision fertilization and sustainable agricultural practices in Germany. <i>Front. Sustain. Food Syst.</i> 7:1088640, DOI: 10.3389/fsufs.2023.1088640	UR
Heyl, K., Garske, B., Ekardt, F. (2023) Using bone char as phosphate recycling fertilizer: an analysis of the new EU Fertilising Products Regulation. <i>Environmental Sciences Europe</i> 35:109, DOI: 10.1186/s12302-023-00819-z	UR
Hu, Y., Dehmer, K., Willner, E., Eichler-Löbermann, B. (2023) Specific and intraspecific P efficiency of small-grain legumes as affected by long-term P management. <i>Agronomy</i> 13, 900, DOI: 10.3390/agronomy13030900	IPK, UR
Iqbal, M.A., Hadlich, F., Reyer, H., Oster, M., Trakooljul, N., Murani, E., Perdomo-Sabogal, A., Wimmers, K., Ponsuksili, S. (2023) RNA-Seq-based discovery of genetic variants and allele-specific expression of two layer lines and broiler chicken. <i>Evolutionary Applications</i> 16, 6, 1135-1153, DOI: 10.1111/eva.13557	FBN
Kammann, S., Karsten, U., Glaser, K., Schiefelbein, U., Dolnik, C., Mikhailuyk, T., Demchenko, E., Leinweber, P. (2023) Cryptogamic Vegetation and Soil Development on Holocene Deposits on the Baltic Sea Coast. <i>Book of Abstract of 3rd Global Soil Biodiversity Conference</i> , p. 82	UR
Kammann, S., Schiefelbein, U., Dolnik, C., Mikhailuyk, T., Demchenko, E., Karsten, U., Glaser, K. (2023) Successional development of the phototrophic community in biological soil crusts on coastal and inland dunes. <i>MDPI Biology</i> , 12, 58, DOI: 10.3390/biology12010058	UR
Kanwischer, M., Klintzsch, T., Schmale, O. (2023) Stable isotope approach to assess the production and consumption of methylphosphonate and its contribution to oxic methane formation in surface waters. <i>Environ. Sci. Technol.</i> 57 (42), 15904 pp., DOI: 10.1021/acs.est.3c04098	IOW
Kim, D.-G., Kirschbaum, M.U.F., Eichler-Löbermann, B., Gifford, R.M., Liang, L.L. (2023) The effect of land-use change on soil C, N, P, and their stoichiometries: A global synthesis. <i>Agriculture, Ecosystems & Environment</i> 348, DOI: 10.1016/j.agee.2023.108402	UR
Kirchgesser, J., Hazarika, M., Bachmann-Pfabe, S., Dehmer, K. J., Kavka M., Uptmoor, R. (2023) Phenotypic variation of root-system architecture under high P and low P conditions in potato (<i>Solanum tuberosum</i> L.). <i>BMC Plant Biology</i> 23, 68, DOI: 10.1186/s12870-023-04070-9	IPK, UR

Publication	involved institutes
Koch, S., Lederer, H., Kahle, P., Lennartz, B. (2023) Linking transport pathways and phosphorus distribution in a loamy soil: a case study from a North-Eastern German Stagnosol. <i>Environmental Monitoring and Assessment</i> 195, 933, DOI: 10.1007/s10661-023-11456-6	UR
Koch, S., Rosewig, E.I., Lennartz, B. (2023) Legacy Phosphorus in Sediments of Lowland Waterways. <i>Environments</i> 10, 1-15, DOI: 10.3390/environments10030043	UR
Koczorski, P., Furtado, B.U., Baum, C., Weih, M., Ingvarsson, P., Hulisz, P., Hrynkiewicz, K. (2023) Large effect of phosphate-solubilizing bacteria on the growth and gene expression of <i>Salix</i> spp. at low phosphorus levels. <i>Front. Plant Sci.</i> 14:1218617, DOI: 10.3389/fpls.2023.1218617	UR
Krieg, J., Stalljohann, G., Oster, M., Pfuhl, R., Reckels, B., Preissinger, W., Weber, M., Meyer, A., Feuerstein, D., Schneider, S. (2023) Stepwise reduction of dietary phosphorus in diets for piglets and fattening pigs of different genetic origin housed under various station environments—A Ringtest. <i>Animals</i> 13, 1774, DOI: 10.3390/ani13111774	FBN
Li, S., Siengdee, P., Oster, M., Reyer, H., Wimmers, K., Ponsuksili, S. (2023) Transcriptome changes during osteogenesis of porcine mesenchymal stem cells derived from different types of synovial membranes and genetic background. <i>Scientific Reports</i> 13, DOI: 10.1038/s41598-023-37260-4	FBN
Medina-Leyva, J., Eichler-Löbermann, B., Campos-Posada, R., Campos-Posada, G., López-Sánchez, R.C., Benavides-Mendoza, A., Rodríguez-Larramendi, L.A. (2023) Phenotypic plasticity of <i>Anacardium occidentale</i> L. seedlings exposed to salt stress based on physiological indicators. <i>Terra Latinoamericana</i> 41, 1-11, e1556, DOI: 10.28940/terra.v41i0.1556	UR
Müller, J., Mahnke, B. (2023) Effects of different P-fertilisers on the forage value of grass-clover mixtures. <i>Proceedings of the 22nd Symposium of the European Grassland Federation, Grassland Science in Europe 28</i> , pp. 85-87	UR
Nees, S., Beer, H., Just, P., Teichmeier, L. M., Christoffer, L. E., Guljam, A., Kushik, Braunschweig, H., Hering-Junghans, C. (2023) On the reactivity of Mes*P(PMe3) towards aluminum(I) compounds – Evidence for the intermediate formation of phosphaalumenes (invited contribution). <i>ChemPlusChem</i> 88, 8, e202300078, DOI: 10.1002/cplu.202300078	LIKAT, UR
Nees, S., Wellnitz, T., Dankert, F., Härterich, M., Dotzauer, S., Feldt, M., Braunschweig, H., Hering-Junghans, C. (2023) On the Reactivity of Phosphaalumenes towards C–C Multiple Bonds. <i>Angew. Chem. Int. Ed.</i> 62, DOI: 10.1002/anie.202215838	LIKAT
Neuburger, J.E., Gazizova, A., Tiedemann, S., von Langermann, J. (2023) Chemoenzymatic Synthesis of Enantiopure Amino Alcohols from Simple Methyl Ketones. <i>European Journal of Organic Chemistry</i> , 26, DOI: 10.1002/ejoc.202201471	UR
Neuburger, J.E., Tiedemann, S., Michalik, D., von Langermann, J. (2023) Development of a Rare Earth Element-based Recovery Concept for Cofactors from Aqueous Solutions. <i>Chemical Engineering & Technology</i> , 46, 766-775, DOI: 10.1002/ceat.202200393	LIKAT, UR
Omotoso, A.O., Reyer, H., Oster, M., Maak, S., Ponsuksili, S., Wimmers, K. (2023) Broiler physiological response to low phosphorus diets at different stages of production. <i>Poultry Science</i> 102, 2, DOI: 10.1016/j.psj.2022.102351	FBN
Omotoso, A.O., Reyer, H., Oster, M., Ponsuksili, S., Wimmers, K. (2023) Jejunal microbiota of broilers fed varying levels of mineral phosphorus. <i>Poultry Science</i> 102 (12), DOI: 10.1016/j.psj.2023.103096	FBN
Pilopp, Y., Bresien, J., Gschwind, D., Villinger, A., Michalik, D., Schulz, A. (2023) Access to Benzo- and Naphtho-Azaphospholes via C–H BondActivation of Aryl-Substituted Isonitriles. <i>Chem. Eur. J.</i> 29, 33, DOI: 10.1002/chem.202300764	UR
Ponsuksili, S., Hadlich, F., Perdomo-Sabogal, A., Reyer, H., Oster, M., Trakooljul, N., Iqbal, M.A., Schmucker, S., Stefanski, V., Roth, C., Camarinha Silva, A., Huber, K., Sommerfeld, V., Rodehutsord, M., Wimmers, K. (2023) The dynamics of molecular, immune and physiological features of the host and the gut microbiome and their interactions before and after onset of laying in two hen strains. <i>Poultry Science</i> 102, 1, DOI: 10.1016/j.psj.2022.102256	FBN
Prüter, J., McLaren, T.I., Pätzig, M., Hu, Y., Leinweber, P. (2023) Phosphorus speciation along a soil to kettle hole transect: sequential P fractionation, P XANES, and 31P NMR spectroscopy. <i>Geoderma</i> 429, 116215 DOI: 10.1016/j.geoderma.2022.116215	UR
Prüter, J., Schumann, R., Klysubun, W., Leinweber, P. (2023) Characterization of Phosphate Compounds along a Catena from Arable and Wetland Soil to Sediments in a Baltic Sea lagoon. <i>Soil Syst.</i> 2023, 7, 15, DOI: 10.3390/soilsystems7010015	UR
Santoro, M., Hassenrück, C., Labrenz, M., Hagemann, M. (2023) Acclimation of <i>Nodularia spumigena</i> CCY9414 to inorganic phosphate limitation - Identification of the P-limitation stimulon via RNA-seq. <i>Front. Microbiol.</i> 13:1082763, DOI: 10.3389/fmicb.2022.1082763	IOW, UR
Schleyken, J., Gumpert, F., Tränckner, S., Palm, H., Tränckner, J. (2023) Enhanced chemical recovery of phosphorus from residues of recirculating aquaculture systems (RAS). <i>Int. J. Environ. Sci. Technol.</i> , 1-14, DOI: 10.1007/s13762-023-05226-8	UR
Seyedalmoosavi, M. M., Dannenberger, D., Pfuhl, R., Görs, S., Mielenz, M., Maak, S., Wolf, P., Daş, G., & Metges, C. C. (2023) Lipid metabolism, fatty acid composition and meat quality in broilers	FBN, UR

Publication	involved institutes
supplemented with increasing levels of defrosted black soldier fly larvae. <i>Journal of Insects as Food and Feed</i> 9(5), 583-598, DOI: 10.3920/JIFF2022.0125	
Seyedalmoosavi, M. M., Mielenz, M., Schleifer, K., Görs, S., Wolf, P., Tränckner, J., Hüther, L., Dänicke, S., Daş, G., Metges, C.C. (2023) Upcycling of recycled minerals from sewage sludge through black soldier fly larvae (<i>Hermetia illucens</i>): impact on growth and mineral accumulation. <i>Journal of Environmental Management</i> 344, 1-12, DOI: 10.1016/j.jenvman.2023.118695	FBN, UR
Siebers, N., Kruse, J., Jia, Y., Lennartz, B., Koch, S. (2023) Loss of subsurface particulate and truly dissolved phosphorus during various flow conditions along a tile drain-ditch-brook continuum. <i>Science of the Total Environment</i> 866, DOI: 10.1016/j.scitotenv.2023.161439	UR
Siewert, J.-E., Puerta Lombardi, B. M., Jannsen, N., Roesler, R., Hering-Junghans, C. (2023) Synthesis and ligand properties of chelating bis(N-heterocyclic carbene)-stabilized bis(phosphinidenes). <i>Inorg. Chem.</i> 62, 16832-16841, DOI: 10.1021/acs.inorgchem.3c02264	LIKAT
Siewert, J.-E., Schumann, A., Wellnitz, T., Dankert, F., Hering-Junghans, C. (2023) Triphosphiranes as phosphinidene-transfer agents – synthesis of regular and chelating NHC phosphinidene adducts (invited contribution, HOT Article Collection). <i>Dalton Trans.</i> 52, 15747-15756, DOI: 10.1039/D3DT02690F	LIKAT
Täufer, T., Dankert, F., Michalik, D., Pospech, J., Bresien, J., Hering-Junghans, C. (2023) Photochemical formation and reversible base-induced cleavage of a phosphagallene. <i>Chem. Sci.</i> 14, 3018-3023, DOI: 10.1039/D2SC06292E	LIKAT, UR
Terazzi, C., Spannenberg, A., von Langermann, J., Werner T. (2023) Chemoenzymatic Synthesis of Chiral Building Blocks Based on the Kinetic Resolution of Glycerol-Derived Cyclic Carbonates. <i>ChemCatChem</i> 2023, 15, e202300917, DOI: 10.1002/cctc.202300917	LIKAT, UR
Thielicke, M., Ahlborn, J., Eichler-Löbermann, B., Eulenstein, F. (2023) On the negative impact of mycorrhiza application on maize plants (<i>Zea mays</i>) amended with mineral and organic fertilizer. <i>Microorganisms</i> , 11 (7), No. 1663, DOI: 10.3390/microorganisms11071663	UR
Zander, E., Bresien, J., Zhivonitko, V.V., Fessler, J., Villinger, A., Michalik, D., Schulz, A. (2023) Rational Design of Persistent Phosphorus-Centered Singlet Tetraradicals and Their Use in Small-Molecule Activation. <i>J. Am. Chem. Soc.</i> 2023, 145, 26, 14484–14497, DOI: 10.1021/jacs.3c03928	UR
Zerssa, G.W., Kim, D.-G., Koal, P., Eichler-Löbermann, B. (2023) Grain mineral concentrations in maize (<i>Zea Mays</i> L.) and nutrient use efficiency as affected by fertilizer management on a Nitisol in Southwestern Ethiopia. <i>Comm Soil Sci. Plant Anal.</i> 54 (14), 1939-1954, DOI: 10.1080/00103624.2023.2211107	UR
January 2024 to March 2024	
Beer, H., Siewert, J.-E., Schröder, M., Fischer, M., Corzilius, B., Hering-Junghans, C. (2024) Phosphaarsenes – Combining Phospha- and Arsa-Wittig-Reagents. <i>ChemPlusChem</i> , DOI: 10.1002/cplu.202400120	LIKAT
Chiba, A., Vitow, N., Baum, C., Zacher, A., Kahle, P., Leinweber, P., Schloter, M., Schulz, S. (2024) Earthworm activities change phosphorus mobilization and uptake strategies in deep soil layers. <i>Applied Soil Ecology</i> , 193, 105168, DOI: 10.1016/j.apsoil.2023.105168	UR
Garske, B., Heyl, K., Ekardt, F. (2024) The EU Communication on ensuring availability and affordability of fertilisers—a milestone for sustainable nutrient management or a missed opportunity? <i>Environmental Sciences Europe</i> 36:19, DOI: 10.1186/s12302-024-00842-8	UR
Hasan, M., Reyer, H., Oster, M., Trakooljul, N., Ponsuksilli, S., Magowan, E., Fischer, D.-C., Wimmers, K. (2024) Exposure to artificial ultraviolet-B light mediates alterations on the hepatic transcriptome and vitamin D metabolism in pigs. <i>The Journal of Steroid Biochemistry and Molecular Biology</i> 236, 106428, DOI: 10.1016/j.jsbmb.2023.106428	FBN, UR
Kammann, S., Leinweber, P., Glaser, K., Schiefelbein, U., Dolnik, C., Mikhailyuk, T., Demchenko, E., Heilmann, E., Karsten, U. (2024) Successional development of the phototrophic community in biological soil crusts and soil development on Holocene deposits at the Baltic Sea coast. <i>Front. Ecol. Evol.</i> 11:1266209, DOI: 10.3389/fevo.2023.1266209	UR
Kong, H., Sokolova, I.M. (2024) Oxidative phosphorylation rather than glycolysis is the primary energy source for sperm motility in the mussels <i>Mytilus edulis</i> . <i>Comparative Biochemistry and Physiology Part B: Biochemistry and Molecular Biology</i> 270, 110909, DOI: 10.1016/j.cbpb.2023.110909	UR
Vogel, H.-J., Bonkowski, M., Blagodatsky, S., Müller, C., Wachendorf, C., Kiese, R., Schulz, S., Herbst, M., Siebers, N., Lennartz, B., Koch, S., Baum, C., Leinweber, P., König, S., Pagel, H., Amelung, W., Grosch, R., Vetterlein, D., Kuhwald, M., Rillig, M. C., Weller, U., Schnepf, A., Rüschoff, J., Russell, D. Wollschläger, U. How to adequately represent biological processes in modeling multifunctionality of arable soils. <i>Biology and Fertility of Soils</i> . DOI: 10.1007/s00374-024-01802	UR

Table A7 Theses and dissertations supervised by P-Campus members

Type	Amount during funding period	Comment if necessary
Qualification for doctorates (diploma, master, state examination, bachelor)	Total: 65 (2019-2023)	BA and MA theses, which were supervised by P-Campus members, who supervised doctoral students of PGS 1 or PGS 2
	Co-supervised by scientists of a Leibniz institute: 6	
Doctorates	Total: 31 (3 submitted included)	7 financed by PGS 1 5 financed by PGS 2 completed (3 more submitted by April 2024)
	Co-supervised by scientists of a Leibniz institute: 15+2	
Habitations	Total: 1	
	Supervised by scientists of a Leibniz institute: 0	

Table A8 Raised third-party funds

Funders/ sponsors	Project title	Amount of third-party funds	Funding period
DFG	Baltic Transcoast	10,221,650 €	01/2016 – 12/2024
BMBF	KataPlasma: Hydroformulierung mit homogenen Katalysatoren geträgert auf Plasma funktionalisierten Materialien	1,177,750 €	06/2016 – 12/2019
North Sea Region Programme (EU)	NuReDrain: Innovative Nutrient Catching Reactive Barrier and Controlled Drainage Technologies for Sustainable Growth of the Agriculture Sector	88,072 €	09/2016 – 04/2020
BMELV	Biomasse-Asche-Monitoring (BAM): Teilvorhaben 2: Agronomische Bewertung	118,546 €	11/2016 – 10/2019
DFG	SPP1685: Untersuchungen zum Verständnis des Phosphorzyklus in Wald-Ökosystemen auf molekularer Ebene	174,618 €	11/2016 – 10/2019
BMBF	Dach-KüNO II: Wissens- und Datentransfer in der Küstenmeerforschung	284,208 €	01/2017 – 12/2019
Europäischer Sozialfonds	WETSCAPES: Stoffumsetzungsprozesse an Moor- und Küstenstandorten als Grundlage für Landnutzung, Klimawirkung und Gewässerschutz	2,690,000 €	01/2017 – 03/2021
DFG	CRUSTFUNCTION II: Biodiversität und funktionelle Rolle von biologischen Bodenkrusten	230,000 €	02/2017 – 01/2020
DFG	CLIMARCTIC: Einfluss des Klimawandels auf arktische Boden- und See-Mikrobiome	302,700 €	03/2017 – 02/2020
BONUS	OPTIMUS: Optimierung von Muschelfarmen zur Eutrophierungsvermeidung und zur Fischfutterproduktion in der Ostsee	503,231 €	04/2017 – 03/2020
BONUS	INTEGRAL: Integrated carbon and trace gas monitoring for the Baltic Sea	743,354 €	07/2017 – 06/2020
ERA-Net SusAn	PeGaSus: Phosphorus efficiency in <i>Gallus gallus</i> and <i>Sus scrofa</i> : Bridging the gaps in the phosphorus value chain	300,000 €	09/2017 – 08/2020
BMBF	InFertRes: Innovative Fertilizers and Resource Efficiency in Agriculture	99,764 €	03/2018 – 04/2024
BMBF	InnoSoilPhos II: Innovative solutions to sustainable soil phosphorus management	2,540,000 €	03/2018 – 02/2021
DFG	Characterizing endocrine and transcriptional determinants of P utilization mediated by the environment-host-microbiota interaction in laying hens and quails, Teilprojekt in FOR 2601	300,000 €	06/2018 – 11/2021

Final Report of Leibniz ScienceCampus
Phosphorus Research Rostock W19/ 2018

DFG	Data integration to derive biological networks of host gut expression and microbiota variation related to inositol phosphates, myo-inositol and P utilization in laying hens and quails, Teilprojekt in FOR 2601	300,000 €	10/2018 – 05/2022
Continental Reifen Deutschland GmbH	Wissenschaftliche Begleitung Taraxagum	29,900 €	12/2018 – 11/2019
DAAD	DiveCropS: Diversifying cropping systems - Traditional knowledge and innovative approaches	265,936 €	01/2019 – 12/2022
DFG	MitoBOX: The mitochondrial basis of hypoxia tolerance in marine mollusks	179,351 €	02/2019 – 09/2023
BMBF	RePhoR-MV: Regionales Phosphor-Recycling aus Klärschlämmen in Mecklenburg-Vorpommern	125,000 €	02/2019 – 07/2019
FNR	Züchterische Verbesserung der Phosphor-Aneignungseffizienz von Stärkekartoffeln für eine ressourcenschonende Rohstoffproduktion	118,908 €	03/2019 – 12/2022
DFG, ERA-Net SusCrop	AC/DC-weeds – Applying and combining disturbance and competition for an agro-ecological management of creeping perennial weeds	427,600 €	04/2019 – 03/2022
BMWi	Kombination von Biokatalyse und Kristallisation für die Synthese chiraler Amine	370,000 €	04/2019 – 03/2022
BMBF	PNC-Processing: Stoffkreisoptimierung durch Fraktionierung von Gülle in Phosphor, Stickstoff und organischen Kohlenstoff	545,045 €	07/2019 – 06/2022
Continental Reifen Deutschland GmbH	Wissenschaftliche Begleitung des Projekts Taraxagum Nährstoffgehalt am Standort Anklam - Bereich Pflanzenbau	45,618	02/2020 – 07/2021
BMEL	Selektion und Züchtung nährstoffeffizienter, <i>Phytophthora</i> -resistenter Kartoffelzuchtstämmen für einen nachhaltigen ökologischen Landbau	382,471 €	03/2020 – 02/2024
DFG	Crustfunction III – Landnutzung als Treiber der Struktur und Funktionalität biologischer Bodenkrusten	197,000 €	08/2020 – 12/2023
BMWi, AIF	Baclofen: Entwicklung effizienter Produktionsverfahren für die Darstellung von Baclofen und hiermit verwandter pharmazeutischer Produkte	630,000 €	10/2020 – 09/2023
Continental Reifen Deutschland GmbH	Wissenschaftliche Begleitung des Projekts Taraxagum - Unkrautbekämpfung	25,210 €	03/2021 – 06/2021
BMBF	InnoSoilPhos III	1,600,000 €	04/2021 – 04/2024
BMEL	MikroMais: Reduzierung des Grundwasser-relevanten Stickstoff- und Phosphor-Überschusses durch kombinierte Mikrogranulat-Mikroorganismen-Ausbringung auf Gärrest-gedüngten Flächen im Energiemaisanbau; Teilvorhaben 2: Nährstoffverfügbarkeit und Nährstoffverlagerung im Boden	165,233 €	04/2021 – 03/2024
BMEL	Erhöhung der Anbauwürdigkeit von Luzerne (<i>Medicago sativa</i> L.) als Futterpflanze - Neue Impulse für die Königin der Futterpflanzen	312,261 €	04/2021 – 04/2024
FNR	HyGreen: Genom-basierte Strategien zur Züchtung von Hybridsorten bei Grünroggen als nachwachsender Rohstoff für die	238,247 €	12/2021 – 11/2024

	energetische Nutzung: TV 1: Genotypisierung und Phänotypisierung		
BMBF	Innovationsraum: BaMS-RüBio - Blaue Bioökonomische Kreislaufwirtschaft für Rügen (Teilprojekt 3) - Umsetzungsphase. "Welsaquaponik am Standort Bergen auf Rügen"	335,185 €	01/2022 – 12/2024
DFG	P-FOWL: Characterization of mineral utilisation by functional genomics in two contrasting high-yielding laying hen strains	299,867 €	09/2022 – 08/2025
DFG	P-FOWL: Epigenetics, molecular pathways, and data integration to derive biological networks related to myo-inositol and P utilization in two contrasting high-yielding laying hen strains	292,950 €	10/2022 – 09/2025
EU-Kommission	EU-Conexus Plus	1,594,512 €	11/2022 – 10/2026
DFG	VitD-Pig: Functional signals for vitamin D-mediated mineral utilization and related physiological determinants in pigs	348,959 €	11/2022 – 10/2025
FWF, DFG	UVISION: Erforschung des Potenzials von Sekundärmetaboliten aus marinen Ressourcen für den UV-Schutz des menschlichen Auges	620,000 €	01/2023 – 12/2025
WGL	BioAdvan: Advanced Biomass-Treatment for Value-Added Refinement	994,534 €	03/2023 – 02/2026
BMBF	MicroFunction: Aufwertung von Restbiomasse durch Anreicherung mit nützlichen Mikroorganismen - neue Ansätze für die Produktion von Recycling-Düngern	50,000 €	05/2023 – 04/2025
DAAD SDG-partnerships	UnderPlaNet: Underutilized plants in agroecosystems – Transnational teaching and research network for regional development	385,000 €	01/2024 – 2027
EU-Kommission	EU-CONEXUS Enables - Promoting excellence through innovative eco-systems	370,000 €	02/2024 – 01/2029
BMBF	BioactMOs_b: Optimization of legume-based production processes by integrating microbial products and plant based bioactive materials, Sub-project: Soil Nutrient Cycles	30,000 €	04/2024 – 2026

Table A9 Posters and presentations (external conferences) June 2019 – March 2024; contributions resulting from: **PGS 2: PhD student purple**, **PGS 1: PhD student blue**, **seed projects lead author green**), abbreviations: P = poster; oP = oral presentation; Agrar = Tagung des Dachverbands Agrarforschung; DBG = Jahrestagung der Deutschen Bodenkundlichen Gesellschaft; GCET21 = 21st Global Conference on Environmental Taxation; GPW = Jahrestagung der Gesellschaft für Pflanzenbauwissenschaften; IPW9 = 9th International Phosphorus Workshop; VDLUFA = Frühjahrstagung der VDLUFA Fachgruppen "Pflanzenernährung, Produktqualität und Ressourcenschutz" & "Bodenuntersuchung"; PhosWaM = PhosWaM-Abschluss-Workshop; Kata 55 = 55. Jahrestreffen Deutscher Katalytiker

Event	Type	Authors / Title
June 2019 – December 2019		
IPW9	P	Ahmed, A., Gypser, S., Leinweber, P., Freese, D., Kühn, O. (2019): New insights into IR spectroscopic characterization of phosphate binding at the goethite-water interface.
IPW9	P	Garske, B., Stubenrauch, J. , Ekardt, F. (2019): Governance of sustainable phosphorus management.
IPW9	P	Kavka, M., Wacker, K. , Eichler-Löbermann, B., Dehmer, K.J., Uptmoor, R. (2019): Root system architecture of potato after cultivation in different phosphorus fertilizer treatments.

Event	Type	Authors / Title
IPW9	P	Koal, P., Eichler-Löbermann, B. (2019): Replacing conventional phosphorus fertilisers with biomass ashes: fertilisation effect of straw ashes on different crops.
IPW9	P	Leinweber, P., Zacher, A., Panten, K. (2019): Weathering of bone char particles and P-release in a perennial pot experiment.
IPW9	P	Nausch, M., Bitschofsky, F. (2019): Phosphorus composition along a lowland river in a northeast German catchment discharging to the Baltic Sea.
IPW9	P	Rönspeiß, L., Nausch, G., Schulz-Bull, D. (2019): Different phosphorus fractions – how bioavailable are they?
IPW9	P	Steinfurth, K., Buczko, U., van Laak, M., Nawotke, C., Peiter, E., Reitz, T., Wacker, K., Zimmer, D. (2019): Comparability of the Calcium-Acetate-Lactate and Double-Lactate extraction methods to assess soil phosphorus fertility sowie Yield response to omitted phosphorus fertilization – results of a meta-study.
IPW9	P	Zicker, T., Kavka, M., Eichler-Löbermann, B. (2019): Long-term application of biogas digestates affects phosphorus pools in the soil profile.
IPW9	P	Zimmer, D., Leinweber, P., Brüser, V., Dehmer, K.J., Kanwischer, M., Karsten, U., Werner, T., Wimmers, K., Bathmann, U. (2019): Leibniz-ScienceCampus Phosphorus Research Rostock.
DBG	P	Peine, M., Vitow, N.E., Zacher, A., Chiba, A., Koch, S., Kahle, P., Schloter, P., Baum, C., Leinweber, P. (2019): Einfluss von Bioporen auf die P-Mobilisierung in Ackerböden.
DBG	P	Prüter, J., Leinweber, P. (2019): Umsetzungsprozesse und Reaktionen von Phosphorverbindungen entlang verschiedener Transekte von Böden und Sedimenten in der nordostdeutschen Küstenregion.
DBG	P	Zimmer, D., Leinweber, P., Brüser, V., Dehmer, K.J., Kanwischer, M., Karsten, U., Werner, T., Wimmers, K., Bathmann, U. (2019): Forschung im Leibniz-WissenschaftsCampus Phosphorforschung Rostock.
21. Fachtagung des VHE-Nord e.V.	oP	Eichler-Löbermann, B. (2019): Wirkungen von Kompost – Ergebnisse eines Dauerversuchs.
DGAW Regionalveranstaltung	oP	Nelles, M. et al. (2019): Optionen für die künftige Entsorgung von Klärschlamm in Mecklenburg-Vorpommern.
IPW9	oP	Eichler-Löbermann, B., Winklhofer, P., Zicker, T., Freitag, F. (2019): Phosphorus pools in the soil profil – results of different fertilizer practices over 20 years.
IPW9	oP	Ekardt, F., Garske, B., Stubenrauch, J. (2019): Animal food, land use governance, and P governance.
IPW9	oP	Oster, M., Reyer, H., Gerlinger, C., Wubuli, A., Ball, E., Poulsen, H.D., Wolf, P., Wimmers, K. (2019): Molecular determinants of phosphorus utilization in pigs.
IPW9	oP	Pallentin, M., Schumann, R., Leujak, W., Nausch, G. (2019): Determination of atmospheric phosphorus deposition in the German part of the Baltic Sea.
IPW9	oP	Stubenrauch, J., Garske, B., Ekardt, F. (2019): Phosphorus governance from a cross-national perspective.
DBG	oP	Baumann, K., Jung, P., Lehnert, L.W., Achilles, S., Schermer, M., Bendix, J., Büdel, B., Leinweber, P. (2019): Biocrusts - The Atacama Desert's unexpected living skin.
DBG	oP	Zacher, A., Vitow, N., Peine, M., Chiba, A., Zicker, T., Eichler-Löbermann, B., Schloter, M., Baum, C., Leinweber, P. (2019): Einfluss des Anbaus von Serradella als Zwischenfrucht auf die P-Mobilisierung im Boden.
EAAP - 70th annual meeting	oP	Reyer, H., Oster, M., Wittenburg, D., Murani, E., Ponsuksili, S., Wimmers, K. (2019): Molecular drivers of the phosphorus homeostasis in pigs.
European Environmental Law Forum conference	oP	Stubenrauch, J., Ekardt, F. (2019): Agriculture-related Climate Policies – Law and Governance Issues on European and Global Level.
12. Rostocker Abwassertagung	oP	Tränckner, S. et al. (2019): Phosphorelimination in kleinen Kläranlagen durch nachgeschaltete alkalische Fällungsfiltration.

Event	Type	Authors / Title
PhosWaM	oP	Buczko, U. et al. (2019): Evaluation of the impact of agronomic measures on agricultural P-discharge with a P index approach.
PhosWaM	oP	Nausch, M. et al. (2019): Phosphorus concentrations along the river Warnow discharging to the Baltic Sea.
PhosWaM	oP	Neumann, D. et al. (2019): Modelling processing and transport of phosphorus compounds from the Warnow river in the bay of Mecklenburg.
PhosWaM	oP	Rönspeiß, L. et al. (2019): Estuarine phosphorus transformation, retention and bioavailability: an example from the southern Baltic Sea.
PhosWaM	oP	Tränckner, J. et al. (2019): Determination of P-discharge and optimization possibilities for P retention in small sewage treatment plants.
DOK-Monte Verità	oP	Eichler-Löbermann, B., Koal, P., Winklhofer, P., Zicker, T., Freitag, F. (2019): Yield development and soil fertility – results of different phosphorus fertilizer practices over 20 years.
Agrar	oP	Baum, C. (2019): Perspektiven für die verbesserte Nutzung der Mykorrhizierung: Chancen und Grenzen.
Agrar	oP	Buczko, U. (2019): Düngewirkung von Phosphat auf Basis einer Metastudie über langjährige P-Düngungsversuche.
Agrar	oP	Ekardt, F. (2019): Phosphor als Problem von Politik und Recht.
Agrar	oP	Leinweber, P. (2019): Phosphor im System „Boden Pflanze Gewässer: Grundlagen und aktuelle Forschungsprobleme“.
Agrar	oP	Lennartz, B. (2019): P-Verlagerung in Böden und Landschaften des Norddeutschen Tieflands.
Urania Berlin	oP	Wimmers, K. (2019): Tiere verstehen - Was unsere Nutztiere können, wollen und brauchen.
Die Zukunft der interdisziplinären Forschung (600-Jahr-Feier Uni Rostock)	oP	Bathmann, U. (2019): Begrenzte Ressourcen und wie wir mit ihnen umgehen sollten.
15. Tagung Schweine- und Geflügelernährung	oP	Oster, M., Reyer, H., Gerlinger, C., Wubuli, A., Vollmar, B., Wolf, P., Wimmers, K. (2019): Effekte einer differentiellen Phosphorversorgung bei Monogastriern.
2020		
BonaRes-Statusseminar	P	Buczko, U., Steinfurth, K., van Laak, M., Nawotke, C., Peiter, E., Reitz, T., Wacker-Fester, K., Zimmer, D. (2020): Comparability of the Calcium-Acetate-Lactate and Double-Lactate extraction methods to assess soil phosphorus fertility.
BonaRes-Statusseminar	P	Garske, B., Stubenrauch, J., Ekardt, F. (2020): Regulatory and Economic Instruments of Phosphorus Governance. How to achieve a sustainable P management by combining policy instruments.
BonaRes-Statusseminar	P	Steinfurth, K., Buczko, U. (2020): Validation of a CART and MLR analysis for the estimation of yield response to P-fertilization.
BonaRes-Statusseminar	P	Winklhofer, P., Andert, S., Hüttel, S., Gerowitt, B. (2020): Why to look at phosphorus fertilization at the farm level?
European Society for Agronomy	P	Erlinghagen, R.L., Dehmer, K.J., Bachmann-Pfabe, S. (2020): Screening for Nitrogen and Phosphorus Efficiency in Potato. (Online-Congress)
European Society for Agronomy	P	Hazarika, M., Kavka, M., Buhrand, L., Dehmer, K.J., Bachmann-Pfabe, S. (2020): Screening for Phosphorus Efficiency in Potato Genetic Resources. (Online-Congress)
Workshop FBN-CREA	oP	Oster, M., Reyer, H., Gerlinger, C., Wubuli, A., Rosemarin, A., Sckokai, P., Ball, E., Damgaard Poulsen, H., Wolf, P., Wimmers, K. (2020): Molecular determinants of phosphorus utilization in pigs.
VDLUFA	oP	Buczko, U. (2020): Neubewertung der P-Düngeempfehlung auf Basis einer Meta-Analyse von Ergebnissen von Langzeit-Feldversuchen.
Frühjahrsveranstaltung der Deutschen Vereinigung für Geflügelwissenschaft e.V.	oP	Oster, M., Reyer, H., Wimmers, S., Trakooljul, N., Camarinha-Silva, A., Bennewitz, J., Rodehutsord, M., Wimmers, K. (2020): P-FOWL: Effekte einer differentiellen Phosphorversorgung bei Geflügel.

Event	Type	Authors / Title
Phosphor-Workshop (Wissenschaftszentrum Umwelt)	oP	Ekardt, F., Stubenrauch, J. (2020): Phosphor: Problem, Transformation, Governance.
SETAC Europe SciCon	oP	Wirth, M.A. , Schulz-Bull, D.E., Kanwischer, M. (2020): Detection of the herbicide Glyphosate and its metabolite Aminomethylphosphonic acid in the Marine Environment.
Vortrag Universität Stuttgart	oP	Werner, T. (2020): Innovative Catalytic and Synthetic Methods for Material and Life Sciences.
GDCh-Kolloquium (Webinar)	oP	Werner, T. (2020): New Twists in Organocatalysis.
Vortrag Universität Paderborn	oP	Werner, T. (2020): Be Green! Innovative catalytic and synthetic methods for material and life sciences.
European Society for Agronomy	oP	Eichler-Löbermann, B., Lange, C., Kavka, M., Hu, Yue, Uptmoor, R., Zicker, T. (2020): (Little) short-term impacts of P fertilizer management in a long-term field experiment. (Online-Congress)
European Society for Agronomy	oP	Hazarika, M., Kavka, M., Buhrand, L., Dehmer, K.J., Uptmoor, R., Bachmann-Pfabe, S. (2020): Screening for phosphorus efficiency in potato genetic resources. (Online-Congress)
Tropentag 2020	oP	Guardia-Puebla, Y., Olivera, Y., Arias, Q., Morscheck, G., Eichler-Löbermann, B. (2020): Chemical pretreatments of rice straw for anaerobic digestion.
Tropentag 2020	oP	López, R., Saiz, L., Guardia-Puebla, Y., Arias, Q., Eichler-Löbermann, B. (2020): Nutrient recycling with sugar cane ash in urban agriculture.
Tropentag 2020	oP	Vazquez-Glaría, A., Kavka, M., Fernández, L., Ortega, E., Eichler-Löbermann, B. (2020): Root architecture of rice as affected by phosphorus starvation and salt stress.
GCET21	oP	Ekardt, F. (2020): Livestock Products and Transnational Economic Instruments.
GCET21	oP	Garske, B. (2020): Economic Instruments for Phosphorus Governance – How Taxes and Cap-and-Trade Systems Achieve a Sustainable Phosphorus Management.
Online-Abchlussstagung "Protein Paradoxes"	oP	Oster, M., Reyer, H., Ball, E., Mulvenna, C., Fornara, D., Keiler, J., Arata, L., Chakrabarti, A., Sckokai, P., Poulsen, H.D., Wimmers, K. (2020): Beinwell als alternative Proteinquelle in der Hühnerernährung und Bestandteil landwirtschaftlicher Kreisläufe.
Online-Seminarvortrag University of Maryland, Baltimore County	oP	Sokolova, I. (2020): How to survive without oxygen: Mitochondrial bioenergetics, oxidative stress and cellular stress response in hypoxia-tolerant marine bivalves.
2021		
OWPC 2021	P	Tönjes, J. , Longwitz, L., Werner, T. (2021): Poly(methylhydrosiloxane) as a Green Reductant in the Catalytic Base-Free Wittig Reaction via PIII/PV Catalysis.
PERM4	P	Hu, Yue , Dehmer, K.J., Eichler-Löbermann, B. (2021): P utilisation capacity of forage legumes from recycling products.
PERM4	P	Schleyken, J. , Tränckner, J., Palm, H. (2021): Aquaculture-applied phosphorus recycling in animal husbandry.
PERM4	P	Seyedalmoosavi, S.M.M. , Das, G., Mielenz, M., Metges, C.C. (2021): Black Soldier Fly larvae reared on feed mixed with recycled sewage sludge accumulate Ca and P.
Biotrans 2021	P	Terazzi, C. , Werner, T., von Langemann, J. (2021): Pig Liver Esterase-Catalyzed Kinetic Resolution of Cyclic Carbonates.
Tropentag 2021	P	Vento, R., Días, V., Cabrera, E., Pérez, E., Eichler-Löbermann, B. (2021): Twenty years of agroecological practices on a family farm in Pinar del Río, Cuba.
Tropentag 2021	P	Fundora, O., De La Fé, P., Rodríguez, K., Gálvez, G., Eichler-Löbermann, B. (2021): Plant Promoting or inhibiting effect of sugarcane ashes applied with mycorrhizal fungi to Cuban soils.

Event	Type	Authors / Title
Tropentag 2021	P	Bullaín, M., López, R., Fall, F., Eichler Löbermann, B., Pruneau, L., Bâ, AM. (2021): Ectomycorrhizal fungus <i>Scleroderma bermudense</i> for improve the salt tolerance in <i>Coccoloba uvifera</i> (L.).
GPW	P	Müller, J., Liermann, R., Mahnke, B., Dittmann, L. (2021): Effekte unterschiedlicher P-Dünger auf den Futterwert von Klee grasgemengen.
GPW	P	Kirchgesser, J., Kavka, M., Hazarika, M., Bachmann-Pfabe, S., Dehmer, K.J., Uptmoor, R. (2021): Genotype and P-dependent variability of root-system architecture in potato (<i>Solanum tuberosum</i> L.).
GPW	P	Hu, Yue, K.J. Dehmer, E. Willner, S. Bachmann-Pfabe, B. Eichler-Löbermann (2021): P utilisation capacity of forage legumes from recycling products.
CIBEN	P	López, R., Eichler-Löbermann, B., Vigoa, Y., Gomes, E., Rodríguez, L. (2021): Phenotypic plasticity and response to saline stress of seven pasture legumes. First international congress in biotechnology and neotropical ecosystems.
Ringvorlesung AgriCoast	oP	Kavka, M. (2021): Nachhaltiger Umgang mit der endlichen Ressource Phosphor durch effiziente Kulturpflanzen.
DWA Web-Forum	oP	Tränckner, J. (2021): P-Strategie Mecklenburg-Vorpommern.
75th Digital Conference of the Society of Nutrition Physiology	oP	Seyedalmoosavi, M.M., Daş, G., Metges, C.C. (2021): Influence of different amounts of black soldier fly larvae (BSFL) in the ration on nutrient and energy utilization and growth of broilers.
Wasser 2021 - Jahrestagung der Wasserchemischen Gesellschaft	oP	Wirth, M.A., Schulz-Bull, D.E., Kanwischer, M. (2021): Detektion des Herbizides Glyphosat und seines Metaboliten Aminomethylphosphonsäure in Meerwasser.
Fachgespräch FNR	oP	Eichler-Löbermann, B. (2021): Agronomische Effekte von Biomasse-Aschen in Kombination mit unterschiedlichen Fruchtarten.
EUCARPIA General Congress	oP	Hazarika, M. (2021): Screening of potato genetic resources for phosphorus stress tolerance.
EUCARPIA-Meeting	oP	Hu, Yue (2021): Phosphorus utilisation capacity of forage legumes from recycling products.
Rostock's Eleven	oP	Wirth, M.A. (2021): Nicht da oder nur gut versteckt? Auf der Suche nach Glyphosat im Meer. [Siegerin des Wettbewerbs]
GPW	oP	Kavka, M., Kirchgesser, J., Hazarika, M., Korn, K., Paap, V., Bachmann-Pfabe, S., Dehmer, K.J., Uptmoor, R. (2021): Kartoffelpflanzen unter Phosphormangel – eine Untersuchung der Wurzelsysteme und Phosphataseaktivitäten
GPW	oP	Baum, C., Peine, M., Vitow, N., Zacher, A., Eichler-Löbermann, B., Leinweber, P. (2021): Düngungseinflüsse auf die funktionelle Diversität des Bodenmikrobioms.
1st International Conference on Sustainable Resource Society	oP	Heyl, K., Göring, T., Garske, B., Stubenrauch, J., Ekardt, F. (2021): Sustainable phosphorus management under the future common agricultural policy: common agricultural policy, phosphorus, soil management, Paris Agreement, convention on biological diversity.
Day of Doctoral Students (FBN)	oP	Seyedalmoosavi, S.M.M., Daş, G., Mielenz, M., Schleifer, K., Wolf, P., Tränckner, J., Metges, C.C. (2021): Growth performance, body composition and mineral bio-accumulation of black soldier fly larvae reared on a fly diet supplemented with sewage sludge recyclates.
2022		
Era-Net SusAn Final Conference	P	Reyer, H., Oster, M., Ball, E., Mulvenna, C., Fornara, D., Poulsen, H.D., Rosemarin, A., Arata, L., Sckokai, P., Wimmers, K. (2022): Untapped potential – A multifaceted phosphorus management can maintain nutrient balance.
Annual Conference of the VAAM 2022	P	Santoro, M., Hassenrück, C., Labrenz, M., Hagemann, M. (2022): A multi level approach to study cyanobacterial summer blooms in the Baltic Sea.
29th EGF general meeting	P	Stein furth, K., Holton Rubæk, G., Hirte, J., Buczko, U. (2022): Yield response of grass and grass-clover leys in crop rotations to phosphorus fertilization.

Event	Type	Authors / Title
Kata 55	P	Tönjes, J., Longwitz, L., Werner, T. (2022): Poly(methylhydrosiloxane) as a Green Reductant in the Catalytic Base-Free Wittig Reaction via P(III)/P(V) Catalysis.
Kata 55	P	Terazzi, C., Laatz, K., von Langermann, J., Werner T. (2022): Cyclic Carbonates Synthesis Catalyzed by CaI ₂ ·Et ₃ N
Kata 55	P	Sebode, H., Schirmer, M.-L., Spannenberg, A., Werner, T. (2022): Acid-catalyzed Reduction of Tertiary Phosphine Oxides Giving Facile Access to Phosphine Boranes.
Kata 55	P	Ren, C., Spannenberg, A., Werner, T. (2022): Synthesis of Bifunctional Phosphonium Salts Bearing Perfluorinated Side Chains and Their Application in the Synthesis of Cyclic Carbonates from Epoxides and CO ₂ .
GPZ-Tagung 2022	P	Kirchgesser, J., Kavka, M., Hazarika, M., Bachmann-Pfabe, S., Dehmer K. J., Uptmoor, R. (2022): Phenotypic variation of potato root-system architecture in contrasting P environments
EWPC-18	P	Sebode, H., Schirmer, M.-L., Spannenberg, A., Werner, T. (2022): Brønsted acid-catalyzed reduction of phosphine oxides & direct conversion into air-stable borane adducts.
Wöhler Tagung	P	Dankert, F. (2022): N-H oxidative addition of NH ₃ and other small molecules with phospho-Wittig reagents.
Era-Net SusAn Final Conference	oP	Reyer, H., Oster, M., Ball, E., Mulvenna, C., Fornara, D., Poulsen, H.D., Rosemarin, A., Arata, L., Sckokai, P., Wimmers, K. (2022): PEGaSus - Phosphorus efficiency in Gallus gallus and Sus scrofa – Bridging the gaps in the phosphorus value chain.
76th Conference of the Society of Nutrition Physiology	oP	Seyedalmoosavi, S.M.M., Daş, G., Dannenberger, D., Maak, S., Mielenz, M., Wolf, P., Metges, C.C. (2022): Whole black soldier fly larvae in broiler rations: impact on carcass characteristics, blood metabolites and fatty acids profiles in plasma, muscle and fat tissues.
76th Conference of the Society of Nutrition Physiology	oP	Seyedalmoosavi, S.M.M., Daş, G., Maak, S., Mielenz, M., Metges, C.C., Wolf, P. (2022): Effects of different levels of whole black soldier fly larvae in broiler rations on bone characteristics.
First Annual Meeting of the Phosphorus Chemistry Working Group	oP	Hering-Junghans, C. (2022): Shutteling Phosphinidenes – The chemistry of Phospanylideneboranes.
Chemiedozententagung	oP	Hering-Junghans, C. (2022): Isolable Pnictaalumenes and -gallenes.
CSC CCCE 2022	oP	Hering-Junghans, C. (2022): Isolable Pnictaalumenes and -gallenes.
CSC CCCE 2022	oP	Siewert, J.-E., Hering-Junghans, C., Schumann, A. (2022): Phosphine-catalysed reductive coupling of Dihalophosphanes.
ESPC4	oP	Heyl, K. (2022): Sustainable phosphorus management under the future Common Agricultural Policy (?)
ICORS27	oP	Sowoidnich, K., Oster, M., Wimmers, K., Maiwald, M., Sumpf, B. (2022): Animal Feedstuff Inspection using Shifted Excitation Raman Difference Spectroscopy.
73rd European Federation of Animal Science	oP	Seyedalmoosavi, S.M.M., Mielenz, M., Daş, G., Metges, C.C. (2022): Broiler eating rate suggests preference for black soldier fly larvae (BSFL) over regular feed.
ICYMARE 2022 (International Conference for Young Marine Researchers)	oP	Santoro, M., Hassenrück, C., Labrenz, M., Hagemann, M. (2022): Blooms in the Baltic Sea: insights into acclimation strategies of toxic diazotrophic cyanobacteria to limiting nutrients
EWPC-18	oP	Ahmed, A. (2022): Advances in understanding of P binding in soil: A molecular modeling perspective.
EWPC-18	oP	Hu, Yue (2022): Effects of recycling products on P efficiency of forage legumes in a two-year field trial.
EWPC-18	oP	Tönjes, J., Longwitz, L., Werner, T. (2022): Poly(methylhydrosiloxane) as a Green Reductant in the Catalytic Base-Free Wittig Reaction via P(III)/P(V) Redox Cycling.
EWPC-18	oP	Zimmer, D. (2022): The Leibniz ScienceCampus Phosphorus Research Rostock.

Event	Type	Authors / Title
DGFZ/GfT-Jahrestagung 2022	oP	Hasan, M., Oster, M., Reyer, H., Ponsuksili, S., Murani, E., Wolf, P., Fischer, D.-C., Wimmers, K. (2022): Tissue-specific expression of genes of the vitamin D and FGF23 signaling pathways at variable phosphorus supply in pigs.
Cyano2022 - 7th Early Career Researcher Symposium on Cyanobacteria	oP	Santoro, M., Hassenrück, C., Labrenz, M., Hagemann, M. (2022): Blooms in the Baltic Sea: insights into acclimation strategies of toxic diazotrophic cyanobacteria to limiting nutrients.
2023		
BonaRes Conference 2023	P	Hu, Yue, Dehmer, K., Willner, E., Bachmann-Pfabe, S., Eichler-Löbermann, B. (2023): Recycling products affect phosphorus efficiency of forage legumes in a two-year field trial.
22nd Symposium European Grassland Federation	P	Müller, J., Mahnke, B. (2023): Effects of different P-fertilisers on the forage value of grass-clover mixtures.
Biotrans 2023	P	Neuburger, J., Tiedemann, S., Belov, F., Gazizova, A., von Langermann, J. (2023): Preparative implementation of in situ-product crystallization in semi-continuous amine transaminase-catalyzed reactions.
Biotrans 2023	P	Belov, F., Bork, H., Gröger, H., von Langermann, J. (2023): Transaminase-catalyzed crystallization-assisted synthesis of enantiopure β -methylphenethylamine.
SEB Centenary conference 2023	P	Adzibli, L., Sokolov, E.P., Ponsuksili, S., Sokolova, I. (2023): Effects of hypoxia and reoxygenation (H/R) on mitochondrial functions and transcriptional profiles of isolated brain and muscle porcine cells.
Sustainable Future: Dream Reactions with (and without) Hydrogen	P	Terazzi, C., Spannenberg, A., von Langermann, J., Werner T. (2023): From Glycerol to Pharmaceuticals: Enzymatic Kinetic Resolution of Cyclic Carbonates.
Tropentag 2023	P	Vento, R., Perez, E., Eichler-Löbermann, B., Gonzáles, M., Rodríguez, R., Pelegrín, B., Milagros, I., Sánchez, D. (2023): Local agricultural innovation system for rural producers in Consolación del Sur, Pinar del Río, Cuba.
Tropentag 2023	P	Torres-Gutierrez, R., Valencia, S., Ona, E., Eichler-Löbermann, B. (2023): Microbiota and metabolites in the spontaneous fermentation of agricultural products in the Ecuadorian Amazon.
Tropentag 2023	P	Lopez, R., Eichler-Löbermann, B., Rodríguez, L. (2023): Phenotypic plasticity and response to saline stress of seven pasture legumes.
GPW-Tagung 2023	P	Kirchgesser, J., Kavka, M., Hazarika, M., Stetter, K., Bachmann-Pfabe, S., Dehmer K. J., Uptmoor, R. (2023): Root-system architecture and P-acquisition efficiency of two contrasting potato (<i>Solanum tuberosum</i> L.) genotypes in various P-environments.
BonaRes Conference 2023	oP	Mohammed, G., Siebers, N., Hardelauf, H., Merbach, I., Eichler-Löbermann, B., Seidel, S., Herbst, M. (2023): Implementation of a Phosphorus Module in the AgroC Model to Predict the Dynamics of Phosphorus Fertilization in Crop-Soil Systems.
III Convención Científica y Tecnológica	oP	Arias, Q., Valdés, L., Hidalgo, A., Eichler-Löbermann, B. (2023): Actividad antioxidante de extractos acuosos de hojas de <i>Morus alba</i> adaptadas en el oriente de Cuba.
SEB Centenary conference 2023	oP	Adzibli, L., Sokolov, E.P., Ponsuksili, S., Sokolova, I. (2023): Metabolic fuel alters responses to hypoxia-reoxygenation stress in marine bivalves.
Symposium on Aquatic Microbial Ecology - SAME17	oP	Santoro, M., Mari Vanharanta, Villena-Aleman, C., Grossart, H.-P., Piiparinen, J., Spilling, K., Hassenrück, C., Piwosz, K., Labrenz, M. (2023): Insights into adaptational strategies of blooming Cyanobacteria to nutrient limiting conditions and natural perturbation events: a mesocosm study in the Baltic Sea.
Swiss-German-Japanese Workshop on Biocatalysis	oP	Tiedemann, S., Belov, F., Neuburger, J., Gazizova, A., von Langermann, J. (2023): Application of crystallization techniques for downstream processing and in situ-product removal in biocatalysis.
Vortragstagung der Deutschen Gesellschaft für Züchtungskunde e.V.	oP	Li, S., Siengdee, P., Oster, M., Reyer, H., Handlich, F., Trakooljul, N., Sarais, F., Wimmers, K., Ponsuksili, S. (2023): Transcriptome and epigenetics changes during osteogenesis of porcine mesenchymal stem cells derived from different genetic background.

Event	Type	Authors / Title
Vortragstagung der Deutschen Gesellschaft für Züchtungskunde e.V.	oP	Hasan, M., Oster, M., Reyer, H., Ponsuksili, S., Murani, E., Trakooljul, N., Magowan, E., Fischer, D.-C., Wimmers, K. (2023): Molecular determinants of vitamin D metabolism for improved phosphorus efficiency in pigs.
FULLRECO4US	oP	Seyedalmoosavi, M.M., Mielenz, M., Görs, S., Daş, G., Metges, C.C. (2023): Upcycling of recycled minerals from sewage sludge through black soldier fly larvae (<i>Hermetia Illucens</i>): impact on growth and mineral accumulation.
3rd Global Soil Biodiversity Conference	oP	Kammann, S., Karsten, U., Glaser, K., Schiefelbein, U., Dolnik, C., Mikhailyuk, T., Demchenko, E., Leinweber, P. (2023): Cryptogamic vegetation and soil development on holocene deposits on the Baltic Sea Coast.
Allianz für Gewässerschutz in SH	oP	Leinweber, P. (2023): Phosphor im System Boden - Pflanze - Gewässer: Neue Erkenntnisse und Entwicklungen.
January 2024 – March 2024		
78th Conference of the Society of Nutrition Physiology	P	Seyedalmoosavi, M.M., Daş, G., Mielenz, M., Metges, C.C. (2024): Recycled-mineral enriched whole black soldier fly larvae in broiler diets: impact on nutrient intakes, growth performance, blood metabolites and bone characteristics.
Boden- und Düngungstag MV	oP	Leinweber, P., Eichler-Löbermann, B. (2024): Ergebnisse aus acht Jahren Phosphorforschung am P-Campus Rostock.
Boden- und Düngungstag MV	oP	Baum, C. (2024): Gestaltung von Fruchtfolgen zur verbesserten P-Mobilisierung aus dem Bodenpool durch das Bodenmikrobiom.

Table A10 Events of the P-Campus, scientific public relations

Event (Place)	Date	Success/Objective	Assessment of the impact
Visit of the Wissenschaftspressekonferenz (WPK) at FBN, IOW, UR	24./25.09.2019	two published articles about the P-Campus	Public attention to the element P and related environmental issues
International P-Campus Symposium (IOW)	12./13.11.2019	65 participants, members of SAC attendant; TV report in NDR-Nordmagazin	Expectation exceeded by the contribution in the Nordmagazin, since additionally the regional public was addressed
Start-Workshop P-Analytics for new P-Campus PhD students (Biological Station Zingst)	26.-29.11.2019	five PhD students of the PGS 2 and one new PhD students of the P-Campus	Very important and successful, in addition to the professional side, the doctoral students were also able to get to know each other personally and exchange ideas, networking
Annual meeting with ministry officials (LM-MV and WM-MV) about the status of the P-Campus (Schwerin)	11.12.2019	four presentations: (1) D. Zimmer "Entwicklung des P-Campus: Phase 1 und 2"; (2) T. Werner "Cluster III: Phosphor in der Synthese und Katalyse - Ausgewählte Beispiel für P-basierte Katalysatoren und deren Anwendung"; (3) M. Kanwischer, M. Wirth "Cluster I: Phosphor in der Umwelt - Analyse des Herbizides Glyphosat in der Ostsee"; (4) K. Wimmers "Cluster II/ IV: P-Effizienz und -Suffizienz - P-Effizienz in der Tierfütterung"	Very significant, since not only transfer of current research results to ministry officials, but also direct response to the P-Campus about the perception of research
P breakfast for PhD students (UR)	17.12.2019	Networking of the PhD students	Crucial, especially also for non-subject specific and interdisciplinary networking for the PhD students

Final Report of Leibniz ScienceCampus
Phosphorus Research Rostock W19/ 2018

Event (Place)	Date	Success/Objective	Assessment of the impact
P-Campus Lecture Series 2020/21; 10 presentations, except Nov. 2020 biweekly (online via DFN/ Webex)	Start: 15.10.2020 End: 25.03.2021	About 10 to 30 participants each, P-Campus members, external interested parties (also state agencies, ministries)	especially important for interdisciplinary networking within the P-Campus and external distribution of research results
International P-Campus Symposium (online via Webex)	16./17.11.2020	70 participants	particularly important for interdisciplinary networking within the P-Campus and external distribution of research results
Annual meeting with ministry officials (LM-MV and WM-MV) about the status of the P-Campus (online via Webex)	16.12.2020	five presentations: (1) D. Zimmer, U. Bathmann "Entwicklung P-Campus: Phase 2"; (2) P. Gros „Netzwerkanalyse P-Campus“; (3) S. Kammann: Doktorandenprojekt IV. Gene expression in biogeochemical cycling of phosphorus in biological soil crusts of sand dunes of the Baltic Sea; (4) V. Brüser: Anschlagprojekt PIAG – Plasmaintuzierte Abbaureaktionen in Glyphosat-haltigen Substraten; (5) K. Wimmers: Anschlagprojekt EpiPTG - Dietary effects on DNA methylation in porcine parathyroid glands	See above Annual meeting
P-Campus Lecture Series 2021; 12 presentations (online via Webex)	Start: 20.05.2021 End: 20.01.2022	About 5 to 35 participants each, P-Campus members, external interested parties (also state agencies, ministries)	See above Lecture series
P coffee for PhD students (online via Wonder.me)	27.05.2021 22.06.2021	Networking of the PhD students	See above P Breakfast
Annual meeting with ministry officials (LM-MV and WM-MV) about the status of the P-Campus (online via Webex)	08.12.2021	Four presentations: (1) D. Zimmer, K. Wimmers "Entwicklung P-Campus + Zukunft nach 2023"; (2) M. Seyedalmoosavi „PhD project II.2“; (3) M. Kanwischer „Seed project: Synthese von Isotopenmarkiertem AMPA und Glyphosatnachweis in der Ostsee“; (4) J. Kirchgesser „Das P-Stärke-Projekt: Verbesserung der Phosphor-Effizienz bei Stärke-Kartoffeln“	See above Annual meeting
International P-Campus Symposium 2021 (online via Webex)	06./07.01.2022	58 participants	See above P-Campus Symposium
P-Campus Lecture Series 2022; 6 presentations (online via Webex/UR)	Start: 05.05.2022 End: 20.10.2022	About 6 to 30 participants each, P-Campus members, external interested parties (also state agencies, ministries)	See above lecture series
Summer School "Scientific Writing and	06.- 09.09.2022	9 PhD student	Important for PhD students to learn more about

Final Report of Leibniz ScienceCampus
Phosphorus Research Rostock W19/ 2018

Event (Place)	Date	Success/Objective	Assessment of the impact
Successful Publishing” for PhD students			publishing of their research in high quality
European Workshop of Phosphorus Chemisry (EWPC18)	14.- 16.09.2022	More than 120 international participants, presented their research in P chemistry, additional P-Campus Session, were diversity in P research of the P-Campus was presented by P-Campus members	Both the research on P-chemistry at the Rostock site and the breadth of P-research at the P-Campus were presented to the international research community.
International P-Campus Symposium 2022 (hybrid)	24./25.11.2022	49 participants	See above P-Campus symposium
Annual meeting with ministry officials (LM-MV and WM-MV) about the status of the P-Campus (on-site: IOW)	05.12.2022	Three presentations: (1) D. Zimmer, K. Wimmers “Aktuelle Entwicklungen + Zukunft P-Campus nach 2023“; (2) S. Tränckner „Phosphor-Stickstoff-Kohlenstoff aus Gülle getrennt nutzen: PNC-Processing“; (3) A. Zacher „Freund oder Feind? - Zur Rolle von Unkräutern im P-Kreislauf“	See above Annual meeting
P-Campus Lecture Series 2023; 8 presentations (online via Webex)	Start: 27.04.2023 End: 16.11.2023	About 3 to 13 participants each, P-Campus members, external interested parties (also state agencies, ministries)	See above Lecture series
P-Kolloquium “Perspektiven der P-Forschung in Rostock“ (Uni Rostock)	24.05.2023	33 participants; Research from 8 years of P-Campus and vision for future of P-Campus was presented to represantatives of ministries, state offices, directoros of Leibniz Institutes,...	Possibility to present current P research in different fields to stakeholders
Schülerschnuppertag 11. Juli 2023	11.07.2023	More than 40 11th grade pupils were introduced to the degree programs of the Faculty of Agriculture and Environmental Sciences and the Institute of Chemistry as well as the current (P)- research in both institutes.	This day gave the pupils an insight into the possibilities of the degree programs and enables them to make a better decision for studing.
International P-Campus Symposium 2023	09./10.10.2023	48 participants, including 3 mebers of the SAC	See above P-Campus Symposium
Annual meeting with ministry officials (LM-MV and WM-MV) about the status of the P-Campus for 2023 (on-site: department LL&M, UR)	18.01.2024	4 presentations: (1) D. Zimmer, U. Bathmann „Aktuelle Entwicklungen im P-Campus 2023“; (2) C. Baum „Gemischte Baumbestände: Wie können sie die P-Nutzungseffizienz im Forst steigern? – Mykorrhizierungsuntersuchungen im Rahmen des DFG-Projektes MixForChange“; (3) V. Brüser „Plasmaunterstützte Prozesse zur Biomassebehandlung“; (4) M. Oster „P-bedingte Veränderungen des Transkriptoms und der	See above Annual meeting

Final Report of Leibniz ScienceCampus
Phosphorus Research Rostock W19/ 2018

Event (Place)	Date	Success/Objective	Assessment of the impact
		Morphologie der Nebenschilddrüsen beim Schwein“	
P-Campus Lecture Series; 7 presentations (online via Webex)	Start 07.03.2024 End: 27.06.2024	3 to 14 participants each (first 3 presentations by April 2024), P-Campus members, external interested parties (also state agencies, ministries)	See above lecture series

Tab. A11-1a Planned total resources (in €) of the Leibniz institutes, the University of Rostock and the ministries, according to the proposal

Year	1	2	3	4	1 to 4
FBN	29.350	141.300	176.300	99.250	446.200
IOW	220.000	212.000	194.000	164.000	790.000
LIKAT	44.466	133.400	133.400	88.934	400.200
INP	16.500	16.800	17.200	17.500	68.000
IPK	10.900	38.200	48.750	77.150	175.000
UR	431.144	436.644	442.244	448.444	1.758.476
Sum Leibniz institutes + UR	752.360	978.344	1.011.894	895.278	3.637.876
LM MV	0	0	0	0	0
BM MV	112.500	114.625	116.500	149.750 [§]	493.375
Total Co-finances	864.860	1.092.969	1.128.394	1.045.028	4.131.251

Tab. A11-1b Realised total resources (in €; rounded to full euros) of the Leibniz institutes, the University of Rostock and both ministries MV

Report period	01.06.2019- 31.12.2019	01.01.2020- 31.12.2020	01.01.2021- 31.12.2021	01.01.2022- 31.12.2022	01.01.2023- 31.12.2023	01.01.2024- 31.03.2024	total 2019-2024
FBN	11.358	65.558	149.655	145.459	168.513	35.828	576.371
IOW	80.663	248.491	210.390	151.934	78.384	8.040	777.902
LIKAT	3.677	110.028	160.339	147.170	73.864	23.400	518.478
INP	2.000	9.300	5.280	3.680	14.306	380	34.946
IPK	10.900	36.700	38.971	49.835	17.808	750	154.964
UR	275.112	337.077	406.741	457.734	248.842	50.827	1.776.334
Sum Leibniz institutes + UR^a	383.711	807.154	971.375	955.812	601.717	119.225	3.838.995
LM MV ^b	0	0	0	0	77.975	65.000	142.975
WM MV ^b	120.025	132.000	100.636	109.900	38.996	0	501.557
Total Co-finances	503.736	939.154	1.072.011	1.065.712	718.688	184.225	4.483.527

^a Da der Projektstart erst am 01.06.2019 war, konnten für 2019 maximal 7 Monate für Eigenmittel angerechnet werden. Für die einzelnen Jahre wurden Eigenmittel spezifisch für die Laufzeiten der Doktorandenprojekte bzw. Anschubprojekte auch monatsanteilig kalkuliert. Betreuungskosten für Doktoranden wurden ggf. bis zur Einreichung der Dissertation (maximal bis 31.03.2024) kalkuliert.

^b: Förderungen liefen insgesamt vom 01.01.2019 bis 30.06.2024. Die erste Finanzierung des WM MV (endete ursprünglich 31.12.2020) wurden kostenneutral bis 28.02.2021 verlängert, so konnten Anfang 2021 noch Restmittel genutzt werden. Die nächste Bewilligung des WM MV lief vom 01.01.2021 bis 30.04.2023 (1 Monat kostenneutrale Verlängerung). Die Bewilligung des LM MV lief vom 01.05.2023 bis 31.12.2023. Es folgte eine Bewilligung vom 01.01.2024 bis 30.06.2024, um die Fertigstellung des Abschlussberichts für die WGL und den Übergang in die Folgeförderung zu gewährleisten. Da die Abrechnung der Mittel aus der Förderung des LM-MV für 2024 erst nach Juni 2024 möglich ist, wurden hier die für 2024 bewilligten Mittel eingetragen.

A11-2 In-kind resources (in €; rounded to full euros) by institutes in detail (project period: 01.06.2019 to 31.03.2024)

Institute		FBN	IOW	LIKAT	INP	IPK	UR	
Consumables ^a	2019	1.755	0	3.028	300	500	8.389	
	2020	19.350	1.762	12.780	800	2.000	57.001	
	2021	23.000	34.500	15.539	0	10	31.887	
	2022	19.000	19.325	15.458	0	0	39.621	
	2023	22.094	10.000	4.140	551	2.500	23.533	
	2024	0	0	0	0	250	4.150	
Travel expenses ^b	2019	0	0	0	0	0	3.957	
	2020	0	0	152	0	0	1.860	
	2021	50	100	215	0	225	1.205	
	2022	1900	620	200	0	0	3.570	
	2023	0	0	1.411	0	0	1.580	
	2024	0	0	0	0	0	500	
Publication costs ^c	2019	0	0	0	0	0	0	
	2020	0	0	0	0	0	1.178	
	2021	0	1.000	0	0	0	2.000	
	2022	6.402	0	0	0	0	5.800	
	2023	0	0	0	0	0	6.000	
	2024	1.700	0	0	0	0	2.000	
Staff	direct ^d	2019	0	7.979	0	0	0	155.310
		2020	0	32.473	20.099	0	0	127.531
		2021	48.378	16.360	30.147	0	14.336	138.359
		2022	46.917	4.922	26.072	0	39.335	132.200
		2023	51.786	0	13.994	0	3.808	100.600
		2024	21.390	2.700	0	0	0	26.00
	Super- vision ^e	2019	9.603	33.951	430	1.700	9.400	107.457
		2020	33.496	147.049	19.042	8.500	28.700	149.507
		2021	78.227	92.632	22.690	5.280	24.400	200.820
		2022	71.241	69.899	21.924	1.840	10.500	276.543
		2023	94.633	30.560	10.320	2.185	11.500	106.448
		2024	12.738	2.570	0	380	500	18.177
Overheads ^f	2019		38.733	219		1.000		
	2020	13.462	57.207	57.955		6.000		
	2021		65.798	160.339				
	2022		57.169	83.516				
	2023		37.824	44.000	11.570		10.681	
	2024		2.770	23.400				
Sum	2019	11.358	80.663	3.677	2.000	10.900	275.112	
	2020	65.558	248.491	110.028	9.300	37.200	337.077	
	2021	149.655	210.390	160.339	5.280	38.971	406.741	
	2022	145.459	151.934	147.170	1.840	49.835	457.734	
	2023	168.513	78.384	73.864	14.306	17.808	248.842	
	2024	35.828	8.040	23.400	380	750	50.827	
	total	576.371	777.902	518.478	34.946	154.964	1.776.334	

^a Consumables such as chemicals, filters

^b from 2020 to 2022, conferences (or research visits) were restricted due to the pandemic, which meant that there were no or hardly any travel expenses

^c e.g. for open access of peer-reviewed publications

^d direct staff costs e.g. for PhD students in projects

^e proportionate staff costs for scientific and/or technical supervision in projects

^f proportionate costs of an institute e.g. for providing office, administration, device usage, these costs are not calculated by all partners or for all years, therefore these costs were not indicated as zero in the table