PERSONAL INFORMATION

Name	**Cordula Maria Netzer**
Birth Date	24. October 1973, maiden name: Peterle
Marital status	Married, 4 step children
Citizenship	German
Work address	Clinic of Spine Surgery, University Hospital Basel, Spitalstrasse 21, 4031 Basel, Switzerland, Phone: +41 (0) 61 328 7675, E-mail: cordula.netzer@usb.ch https://scholar.google.com/citations?user=axUKk7kAAAAJ

EDUCATION

2020	**PD Venia Docendi für Spinale Chirurgie, University of Basel, Switzerland**
2012	Medical License Orthopaedic Surgery and Traumatology of the Musculoskeletal System, Board of Orthopaedic Surgery and Traumatology, Berlin, Germany
2007	Medical License General Medicine, Board of General Medicine, Karlsruhe, Germany
2002	Doctor of Medicine, University of Ulm, Germany
2000	Research Associate/Internship Case Western Reserve University/ Cleveland/ Ohio/USA
1997 – 1998	Medical school, Case Western Reserve University, Cleveland, Ohio, USA
1993 – 1996	Medical school, University Ulm, Germany

PROFESSIONAL EXPERIENCE

Since 10/2017	**Deputy Head of the Spine Center, University Hospital Basel, Basel, Switzerland**
Since 2011	**Spine Surgery Senior Consultant, University Hospital Basel, Basel, Switzerland**
2010 – 2011	Fellow Spine Surgery, Swiss Paraplegic Center Nottwil/ Switzerland
2009 – 2010	Fellow Orthopaedic Surgery and Traumatology Helios Klinik Berlin Buch/ Germany
2007 – 2009	Residency Orthopaedic Surgery and Traumatology/ Berlin/ Germany
2006 – 2007	Residency Pain Medicine/ Rommelklinik Bad Wildbad/ Germany
2005 – 2006	Residency General Medicine/ Loßburg and Freudenstadt/ Germany
2004 – 2005	Residency Orthopaedic Surgery and Traumatology/ Traunreut/ Germany
2003 – 2004	Residency Psychosomatics/ Klinikum Berchtesgadener Land/ Schönau/ Germany
2002 – 2003	Residency Orthopaedic Rehabilitation/ Klinikum Berchtesgadener Land/ Schönau/ Germany
2001 – 2002	Residency Sleep Medicine/ Hospital for sleep disorders/ Bayerisch Gmain/ Germany
2000 – 2001	Research Associate, Walter Reed Army Medical Center, Washington DC/USA

CLINICAL FELLOWSHIPS: FOCUS ON SPINE TUMOR SURGERY

2015 (Sept/Oct)	Peter Varga, Budapest, Hungary, National Center for Spinal Disorders
2016 (Sept/Oct)	Prof. Stefano Boriani MD, Bologna, Italy, Rizzoli Istitutio Ortopedico

QUALIFICATIONS

Degree in Orthopaedic and Trauma Surgery/ Degree in General Medicine/ Degree in Manual Therapy/ Degree in Special Pain Medicine/ Degree in Sports Medicine/ Degree for Alpine and Expedition Medicine/ Degree in Diving Medicine

ACADEMIC AWARDS

2021	SGS-Preis des 21. Kongress der Schweizer Gesellschaft für Spinale Chirurgie Differences in kinematics and electromyographic patterns during walking between patients with symptomatic lumbar spinal stenosis and healthy controls
2017	1. Posterpreis (DWG- German Spine Society) Phosphotungstic acid-enhanced micro computed tomography for three-dimensional visualization and analysis of collagen distribution in human osteochondral tissues
2016	Georg- Schmorl-Preis (DWG – German Spine Society) Comparison of in vitro osteogenic potential of iliac crest and degenerative facet joint bone autografts for intervertebral fusion in lumbar spinal stenosis - an in vitro- comparison
2003	Förderpreis der Mitteldeutschen Gesellschaft für Pneumologie Low Dose Theophylline Improves Ventilation at Night and Reduces Symptoms of Acute Mountain Sickness at High Altitude

COMPETITIVE FUNDING

Current Projects

2022-2026 RoLSSroice - Role of spinal load in the pathophysiology of lumbar spinal stenosis: a translational approach combining clinical, functional and radiological parameters, in vivo biomechanical experiments and advanced in silico musculoskeletal modeling. SNF Grant **CHF 908'000 PI**

2019-2022 "Preclinical evaluation of disease-modifying drugs in a novel ex vivo human spine OA explant model" Gottfried and Julia Bangerter-Rhyner Foundation, 50.000 CHF, PI Cordula Netzer

Completed Projects

2015-2017 "Targeting the perturbed bone marrow niche and pathological bone remodelling in human osteoarthritis". Gottfried and Julia Bangerter-Rhyner Foundation, 60.000 CHF, PI Cordula Netzer MD, Jeroen Geurts PhD

OTHER FUNDING

Public Institutions

2015 Inauguration meeting of the „Wirbelsäulenzentrum", Basel, Switzerland 226'000 CHF, Responsibility Scientific Board, Organization and Financial Management

2016/2019 "BBB Spine Meeting on Tumors & Osteoporosis", Basel, Switzerland, 250'000 CHF, Responsibility Scientific Board, General Concept, Realization, Organization and Application for funding

TEACHING ACTIVITIES

University Basel

- Orthopaedics Bachelor and Master courses each semester since 2013
- Clinical Skills/ Examination/ Rater-training since 2013
- Effective Leadership Skills Workshop (2016)
- CAS Sport physiotherapy (Spine Injuries) since 2019

Donau Universität Krems/Austria:

- Sports medicine, Spine Injuries (2019/2022)

PUBLICATIONS

H-Index 11, i10-index 12; RG-Index 26.13, Citations 3987

REVIEWER ACTIVITIES

Review of Journal Articles and of Conference Publications

Spine Journal, Global Spine Congress (Since 2016)

SUPERVISION AND EXAMINATION

MD Thesis University Basel

Doria Juric (start 2022), Yuancheng Chang (2021), Helen Bumann (2019), Stefan Loske (2018), KarinUrech (2014)

Co-/Supervision Master Med Thesis

Valentina Tovo (2021), Pascal Distel (2017)

Co-/Supervision Master MSc Thesis

David Koch (2022), Arik Musagara (2019), Sara Kimberly Byrnes (2017), Caroline Aubry 2017), Anja Schraknepper; (2016), Geneviève Schmid (2016)

PROFESSIONAL MEMBERSHIPS

AO Spine (Arbeitsgemeinschaft für Osteosynthese – Wirbelsäule)/ DGOU (Deutsche Gesellschaft für Orthopädie und Unfallchirurgie)/ BVOU (Berufsverband für Orthopädie und Unfallchirurgie)/ BexMed (Gesellschaft für Berg- und Expeditionsmedizin)/ DWG (Deutsche Wirbelsäulengesellschaft)/ SGS (Schweizer Gesellschaft für Spinale Chirurgie)/ EuroSpine (Europäische Gesellschaft für Spinale Chirurgie)/ NASS (Nordamerikanische Gesellschaft für Spinale Chirurgie)/ FMH (Swiss Medical Association). PIOA (Pacific Island Orthopedic Association).

OTHER PROFESSIONAL ACTIVITIES

General Secretary SGS (Schweizer Gesellschaft für Spinale Chirurgie) since 2021
Associate Member AO Spine Knowledge Forum Tumor since 2016

ORGANZIATION OF INTERNATIONAL CONFERENCE "BMB SPINE MEETING" ANNUALLY SINCE 2016

Scientific Committee/ Chair/ Co-Chair Spine Meeting on Tumors and Osteoporosis

Major scientific achievements – 2017 until today

Description of my own research area within the subject area lumbar spinal stenosis

My research spans the spectrum from understanding the pathogenesis to surgical treatment and its outcome with the long-term goal of developing strategies for predicting surgical outcome and defining customized treatment concepts with positive effect on the course of the disease and reducing or preventing the risk for recurrent symptoms and complaints. Lumbar spinal stenosis is the most common reason for surgery on the spine in older people. Because of the ongoing demographic change, this clinical picture is and will be of increasing clinical and tremendous economic relevance.

The goal of my research in the last decade was to build a bridge from the development of lumbar spinal stenosis, with a special focus on facet osteoarthritis through its operative care and molecular and cellular aspects, to surgical outcome regarding patient reported outcome measures and in vivo biomechanical parameters.

To achieve this goal, I have focused on the following subject areas:
• Research of the pathogenesis of facet osteoarthritis
• Investigation of the osteogenic potential of the body's own stem cells / allografts
• Biomechanical analysis of the effect of surgery on the ability to walk and on everyday mobility

Research into the pathogenesis of facet osteoarthritis

As spine surgeon, the very limited research on the molecular and cellular basis of degenerative changes in the spine in general and of facet osteoarthritis and the cellular properties of autologous bone in particular is astounding. The lumbar vertebral joints (facet joints) are undoubtedly one of the most common pain-producing structures in the aging spine. In the advanced stages of osteoarthritis and due to their hypertrophy, the fact joints can be a decisive factor in the development of lumbar spinal stenosis. To date, there is still no therapy for osteoarthritis, and treatment options (analgesia, infiltration, surgery) address symptoms rather than the origin of the disease.

In an interdisciplinary study design, the imaging, biochemical and histomorphological characteristics of facet arthrosis were examined and correlated. We describe these changes at the cellular and molecular level and compare them with those of osteoarthritis of peripheral joints. To determine fundamental information, we analyzed the histopathological parameters of facet joint biopsies from patients symptomatic spinal stenosis who were treated with a transforaminal lumbar interbody fusion (TLIF). We found that the histopathological results did not correlate with the radiological severity of the osteoarthritis or with the clinical picture. In general, there was bone marrow infiltration with tissue, rich in macrophages and increased "de novo" bone formation. These results indicated that possible treatment target for osteoarthritis should focus on the subchondral bone.

A comparative analysis of healthy and arthritically altered bone structure parameters showed resorption of the subchondral plate and an increase in trabecular bone remodeling in facet arthrosis. The remodeling processes of the subchondral bone in lumbar facet arthrosis was characterized by an increase in the trabecular bone volume, accompanied by an increase in the number of trabeculae and a decrease in the thickness of the cortical plate. These changes are sex-independent and most evident at an age over ≥ 60 years. The therapeutically targeted influence on the increased subchondral bone metabolism and remodeling in the elderly may slow the progression of the lumbar facet arthrosis. Obviously, the subchondral bone plays a key role in the development and progression of human and experimental osteoarthritis and is therefore a focus as a potential treatment target.

In another series of experiments, we compared the properties of subchondral sclerosed bone of knee and facet joints with non-sclerotic bone of the iliac crest. For manifested osteoarthritis, several recent studies have shown an increased subchondral immigration of multipotent stem cells or bone precursor cells. Our analyzes of the osteogenic potential of bone progenitor cells showed disorders of the cells associated with increased subchondral sclerosis. The pathomechanism of osteoarthritis could possibly be controlled by influencing these changed functions, which contribute to the development and progression of osteoarthritis.

By characterizing the osteoarthritis pathogenesis at the facet joint and comparing it with osteoarthritis elsewhere, we were able to identify key pathogenetic processes and test the first possible disease-modulating agents in a further pilot study. Part of the challenge in drug development is to create appropriate preclinical models that accurately reflect the clinical phenotype of the disease. In an innovative series of tests, we have designed a so-called "ex vivo" human osteochondral explantation model that records the effects of inflammation and medication in knee and facet arthrosis. Intact explanted osteochondral human tissue was prepared and the catabolic reaction to a pro-inflammatory stimulus was documented. We were able to show the general feasibility of the model. In further test series, we showed by pharmacological inhibition of the receptors (TGF-β receptor) relevant in the pathogenesis of osteoarthritis that the effect differs between osteoarthritis and non-osteoarthritis specimen as well as between knee and facet joint tissue. This is a

first essential step towards further research into defining and validating so-called DMOAD targets (Disease-Modifying-Osteo-Arthritis Drugs). The next step will be to answer the question whether there are joint- or phenotype-specific DMOADs and whether these correlate with image pathomorphological changes (MRI / SPECT-CT, etc.). I have been and am the clinical expert advisor of our multicenter multidisciplinary research group focusing on this specific area.

Scientific output: 1 PD Thesis, 1 MD Theses, 2 Master Thesis, 17 peer-reviewed congress proceedings, 3 original publications, 1 scientific award

Investigation of the osteogenic potential of the body's own stem cells / allografts

In case of unsuccessful symptomatic and conservative treatment of lumbar, surgical treatment is often warranted by fusion of the affected segment in addition to decompression surgery. For this procedure, the gold standard in addition to instrumentation with a screw-rod implant (primary stability) is the use of autologous bone material (to achieve osseous fusion). Usage of autologous bone material is a central problem due to the limited availability and the additional morbidity of removal (rite from the iliac crest). Our first investigations focused on the quality of the material to be used. The results of the “in vitro analysis” showed comparable suitability of material obtained intraoperatively from the lumbar facets and material obtained from the iliac crest. Specifically, we made intra-individual comparisons of the osteogenic potential with the properties of isolated stem cells from both donor sites. Because of the novelty and the high clinical relevance of these results for optimizing segmental operative spinal fusion, we were awarded with the “Georg Schmorl Prize” in 2016. Because we discovered a negative correlation of the colony-forming and osteogenic potential with the age of the patient, we are currently building a database with the aim to formulate an age-related indication aid for the use of autologous bone graft in the future. Moreover, by means of test series using osteo-anabolic or osteo-active substances, we are searching for factors that have a positive or negative influence on the fusion. The expected results of this continuing line of research are highly clinically relevant.

Scientific output: 3 peer-reviewed congress proceedings, 1 original publications, 1 scientific award

Biomechanical analysis of the effects of surgery for symptomatic lumbar spinal stenosis on the ability to walk and on everyday mobility

Despite the high number of surgical interventions, there are considerable uncertainties regarding the diagnosis in terms of optimal treatment choice for any particular patient and regarding the value of decompression in symptomatic lumbar spinal stenosis. Our clinical-biomechanical studies are intended to investigate the effect of operative decompression with regard to its influence on everyday abilities and the ability to walk. We used an innovative portable gait analysis (the RehaGait System) comprising wearable sensors and PROMS (patient-related outcome scores – the recording of outcome parameters on the basis of patient questionnaires) to assess patients before and after decompression surgery and were thus able to demonstrate their efficiency. We have published two peer-reviewed articles on methodological aspects of this inertial sensor-based gait analysis and two papers on their application in a clinical study in patients with lumbar spinal stenosis. Only few groups worldwide have published inertial sensor based gait data on spine diseases populations, and hence our published and current work represents a major scientific achievement with a projected high impact as it allows assessing detailed biomechanical function in large cohorts in clinical settings. In a recent study we described the association between fat infiltration of paraspinal muscle, sagittal pelvic alignment and stenosis grade in patients with degenerative lumbar spinal stenosis. In the proposed project, we build upon this experience and knowledge to further explore the interrelationship among clinical, radiographic and in vivo data on biomechanical function in patients with lumbar spinal stenosis in a holistic approach.

Scientific output: 1 PD Thesis, 3 MD Theses, 5 Master Thesis, 13 peer-reviewed congress proceedings, 6 original publications

Cross-disciplinary understanding of functional biomechanics, sagittal respectively global spinal balance, imaging parameters and patient reported outcome measures are the key factors in translating clinical knowledge to mechanistic approaches to unravel the pathogenesis and course of the disease back to clinical practice

Understanding the surgical impact on functional biomechanics, sagittal respectively global spinal balance, imaging parameters and patient reported outcome measures will help to develop disease specific treatment concepts. Assembling now all the puzzle pieces of our basic research and pilot studies is a promising project, which will fell on fertile ground because we have established a close and efficient collaboration with the necessary specialties over the past years. In addition, the departmental biostatistician is involved in all aspects of our research projects from brain storming research ideas to defining study designs to data analysis and interpretation. One of my main (scientific) accomplishments in the past five years has been to network within and beyond our department, faculty and university and form productive teams to realize research projects in basic research, clinical research and innovation and technology. Our unique research group has grown from one research associate to a team of a full-time biomedical engineer, a full-time clinical research fellow, three MSc students in movement science, 3 medical doctoral candidates and five medical master candidates. The project teams are formed by these personnel and me as the leader of the spine research clinical team representing the link to the spine surgeons. My extensive experience with such complex experimental frameworks represents a major scientific achievement that only few other research groups in my field of research have effectuated. The clinical and economic importance of such results is obvious.