

## **Ten years of Interdisciplinary Center for Neuroscience Frankfurt and the rise of Rhine Main Neuroscience**

Vortrag (geringfügig modifiziert und erweitert) gehalten aus Anlass des zehnjährigen Bestehens des Interdisziplinären Zentrums für Neurowissenschaft Frankfurt beim 4<sup>th</sup> Biennial Meeting des Rhine-Main Neuroscience Network am 22. Juni 2016 in Oberwesel

Prof. em. Dr. Herbert Zimmermann, Institut für Zellbiologie und Neurowissenschaft, Fachbereich Biowissenschaften, Goethe-Universität, Frankfurt am Main

This meeting provides an opportunity to celebrate ten years of Interdisciplinary Centre for Neuroscience Frankfurt (ICNF) and five years of *rmn*<sup>2</sup>, the Neuroscience Network of the universities of Frankfurt and Mainz and several additional institutions of the region. I have been asked to provide a short historical review of the ICNF and also relate to the rise of *rmn*<sup>2</sup>. New colleagues have come to Frankfurt and Mainz since these two institutions were installed, many new students have come to join us and new fields of science have either replaced or broadened existing fields of research. While in the following three days we shall turn our attention to novel fascinating achievements in neuroscience it might be worth to pause for a moment and look back onto how it all originated. After all it is the past which has guided us to where we stand now.

*Ten years ago Rainer Klinke from the Institute of Medical Physiology II had given a lecture on "Geschichte der Neurowissenschaften in Frankfurt am Main. Vortrag anlässlich der Errichtung des interdisziplinären Zentrums für Neurowissenschaften, Frankfurt, 10.11.2006". This lecture provides additional valuable insight into the history of neuroscience in Frankfurt and is available on the homepage of the ICNF.*

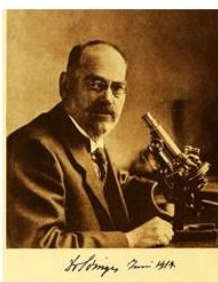
Limited time does not allow for a reasonably fair historical account and for highlighting important individual scientific contributions. *I shall place the focus on the more recent history of neuroscience in Frankfurt and - in this context - on collaborative research projects, a central aspect of the activities of both the ICNF and *rmn*<sup>2</sup>.* I am sure that in five years' time, 10 years of *rmn*<sup>2</sup> will be duly celebrated and that also the important contributions of the Interdisciplinary Centre for Neuroscience Research (Interdisziplinäres Forschungszentrum für Neurowissenschaften, IFZN) in Mainz and its follow up program, the Focus Program Translational Neuroscience (Forschungszentrum Translationale Neurowissenschaften, FTN) will be more fully honoured. I hope my colleagues from Mainz will agree to that.

Before I turn to the ICNF, let me very briefly allude to some of the origins of neuroscience in Frankfurt. As you might know, the Goethe University was founded in 1914 (then called Universität Frankfurt am Main). But the field of neuroscience was already active here before. The roots of the Medical Anatomy in Frankfurt reach back to the Anatomical Institute installed in the 18<sup>th</sup> century by the Dr. Senckenbergische Stiftung, a foundation made by the physician Johann Christian Senckenberg. Neuroscientific work was a topic of research even before the Anatomical Institute was integrated into the newly founded University in 1914. Amongst others Carl Weigert (1845-1904) published a respectable treatise on human neuroglia (1895) (**Slide 1**).

## The beginning of neuroscience in Frankfurt



**Carl Weigert**  
(\*March 19, 1845,  
Münsterberg,  
Silesia; † August 5,  
1904, Frankfurt am  
Main)  
*Anatomical Institute  
of the Dr. Sencken-  
bergische Stiftung*



**Ludwig Edinger**  
(\*April 13, 1855,  
Worms; † January  
26, Frankfurt am  
Main)  
*Edinger Institut,  
Neurological  
Institute*



**Albrecht Julius  
Theodor Bethe**  
(\*April 25, 1872,  
Stettin; † October  
19, 1954, Frankfurt  
am Main)  
*Institute of Medical  
Physiology*



**Hermann  
Giersberg** (\*1890,  
Saarbrücken; †  
March 9, 1981,  
Frankfurt am Main)  
*Institute of Zoology*

Slide 1

Ludwig Edinger (1855-1918) had come to Frankfurt in 1883 and opened his own practice for neurology (Practischer Arzt und Spezialist für Nervenheilkunde). He stated in his memoirs that he was the first in Germany to use this designation for his medical profession. Edinger was an eminent neurologist of his time and made many important contributions to human neuroembryology, human neuroanatomy, but also to comparative neuroanatomy and even behavioral physiology. He had the vision to build bridges between brain anatomy and psychology, being one of the first interdisciplinary neuroscientists and with his concept well ahead of his time. Edinger first had to do his research at his home and later obtained rooms in the Dr. Senckenbergische Anatomie in Frankfurt am Main in the Institute of Carl Weigert. He eventually became director of the Dr. Senckenbergische Neurologische Institut. Edinger was one of the benefactors and cofounders of the Goethe University and his institute was connected to the university, the still existing Edinger Institut or Neurological Institute, the oldest institute for Brain Research in Germany.

Whilst Ludwig Edinger and his follower Kurt Goldstein (1878-1965) can already be regarded as neurologists in a modern sense, the growing institutional emancipation of neurology in German Universities and hospitals after World War I was rolled back between 1933 and 1945 by the integration of neurology in psychiatric institutions. This was also the case in Frankfurt. It was not before the 1970ies that neurology again became institutionally independent under its chairman Peter-Alexander Fischer, a specialist in Parkinson's disease. His clinic subsequently joined the neurosurgical department in a new building, today's Center for Neurology and Neurosurgery. In 1998 Helmuth Steinmetz was appointed new director of the neurological department with a focus on vascular neurology and cognitive neuroscience. In 2003, the Brain Imaging Center Frankfurt was opened as a cooperative effort between the clinical neurosciences (mainly neurology, psychiatry, neuroradiology) and the Max-Planck-Institute for Brain Research - very important for the further development of cognitive neuroscience in Frankfurt.

The Institute of Medical Physiology in Frankfurt was another cornerstone in the development of the neuroscience scenery in Frankfurt. It was founded in 1915 by Albrecht Bethe. Bethe had a deep interest in neurophysiology. But in 1937 he was expelled from University by the Nazis. After some interruptions the topic neurophysiology was revived in the medical physiology by Rainer Klinke in 1977.

Very important for the development of the neurosciences in Frankfurt was also the Max-Planck-Institute for Brain Research. It is the follower institute of the Kaiser Wilhelm Institute that was founded in Berlin in 1914. After the war and after some interim solutions the Institute was re-founded in 1962 in Frankfurt as the Max-Planck-Institute for Brain Research, next to the University Clinics. It was relocated to its new building on the campus Riedberg with new directorship and officially re-opened in 2013.

Already in the middle of the 19<sup>th</sup> century lessons covering zoological topics were given within the frame of the Senckenbergische Naturforschende Gesellschaft. When the University was founded in 1914, the director of the Senckenberg-Museum was appointed in personal union first chair holder of Zoology at the University. The Institute of Zoology (which does not exist in its original form any more) eventually emanated from the Senckenbergische Naturforschende Gesellschaft. Hermann Giersberg (1890-1981) obtained the first chair of the independent University institute in 1936. His research had a focus on developmental biology and hormone physiology. His transspecies transplantations of entire brain regions between larvae of frogs and toads (1935, in order to find out how this would affect species-specific behavior) had raised considerable public interest. Behavioral physiology was strengthened particularly by Martin Lindauer (1918-2008), a pupil of Nobel prize-winning Karl von Frisch and internationally renowned in social communication and orientation in bees. He attracted excellent young animal physiologists to Frankfurt.

Under his aegis the first Collaborative Research Center (CRC, Sonderforschungsbereich) in the field of neuroscience in Frankfurt was set up in 1969 by a group of excellent young scientists from the Institute of Zoology and denominated "Comparative Sensory and Nerve Physiology (Vergleichende Sinnes- und Nervenphysiologie)". Sensory physiology and behavior were very important and internationally renowned research topics of the institute at the time. Soon later groups from the Technical University (then named Technische Hochschule) Darmstadt joined. These pioneers deserve some special appreciation. Important leaders of the CRC were the two insect sensory physiologists Dietrich Burkhardt and Jürgen Boeckh. After their early move to Regensburg Wilfried Hanke, a neuroendocrinologist, took over as spokesman (**Slide 2**). Most of these young scientists have become internationally very renowned, just to name (from Darmstadt) Hubert Markl [who later became president of the German Research Foundation (Deutsche Forschungsgemeinschaft) and of the Max-Planck Society (Max-Planck-Gesellschaft)] and Randolph Menzel (one of the world leading scientists in the field of sensory and nerve physiology of honey bees) or (from Frankfurt) Dietrich Burckhardt [who made very important technical contributions to electrophysiology and pioneered the physiology of vision and stimulus excitation coupling in insect sensory cells], Jürgen Boeckh [an electrophysiologist and pioneer in insect olfaction], Werner Rathmayer (who studied the mechanisms of neuromuscular transmission in arthropods and later became president of the German Zoological Society), Bert Hölldobler (a world expert in the social communication of insects

who later became professor at Harvard University), Marin Lindauer (a pioneer in bee behavioral physiology), or also Wolfgang Wiltschko (the discoverer of magnetic sense in birds).

### Neuroscience CRCs in Frankfurt

1969 - 1971: **CRC 45**, Comparative Sensory and Nerve Physiology (discontinued)



**Dietrich Burkhardt**  
(\*May 17, 1928,  
Wiesbaden; † May 3,  
2010 Regensburg)  
*Institute of Zoology,  
Frankfurt*



**Jürgen Boeckh**  
(\*October 11,  
1934) *Institute of  
Zoology, Frankfurt*



**Wilfried Hanke** (\*June  
9, 1927, Frankfurt am  
Main; † June 14, 2010)  
*Institute of Zoology,  
Frankfurt*

Slide 2

The group was very successful. Thus it was not surprising that many of them became professors at other universities within a very short period of time. It was the time when academic education was rapidly expanded in Germany and many new universities were set up; but also, when ideological-political discussions paralyzed science and teaching in Frankfurt. The German Research Council made the very wise decision not to close this CRC down after its first funding period in 1971 but to interrupt it for a while until new personnel was installed.

Important new acquisitions to neuroscience in Frankfurt were Gerhard Neuweiler in 1972 to the Institute of Zoology, an internationally renowned specialist in the neurobiology of bat echolocation, Henning Scheich in Darmstadt, who made very important contributions to the central processing of auditory information and who, trained as a medical doctor, had taken the chair of Zoology at the Technical University in 1974, and Rainer Klinke in 1977 to the Institute of Medical Physiology II in Frankfurt, an excellent auditory physiologist (**Slide 3**). These three revived the previously discontinued CRC 45, now entitled “Comparative Neurobiology of Behavior (Vergleichende Neurobiologie des Verhaltens)”. This CRC was active throughout the maximal funding period from 1979 to 1993. Manfred Neuweiler was spokesman initially. After his move to Munich in 1980, Rainer Klinke took over and later Henning Scheich, until he became the founding director of the Leibniz-Institute for Neurobiology in Magdeburg. This time, the institutional impact of the CRC was broadened. During the period of 14 years the CRC included several groups from the Institutes of Zoology in Frankfurt and Darmstadt, the Medical Anatomy (Heiko Braak, a pioneer in the pathoanatomie of the central nervous system, in particular of Alzheimer’s disease and Parkinson’s disease) and Medical Physiology (Rainer Klinke’s group) in Frankfurt and also from the Max-Planck-Institute for Brain Research, including Wolf Singer (a flagship of Frankfurt neuroscience whose research focuses on the analysis of neuronal processes in the mammalian cerebral cortex that underlie higher cognitive functions). After my move to Frankfurt I was fortunate to become member of this consortium. *This CRC 45 really was the*

starting point for interdisciplinary and collaborative neuroscience research between the various institutions in Frankfurt and neighboring universities.

### Neuroscience CRCs in Frankfurt

- **1979 - 1993: CRC 45**, Comparative Neurobiology of Behavior (revived)
- **1993 - 2004: CRC 269**, Molecular and Cellular Basis of Neuronal Organization Processes
- **1997 – 2006: RTG 361**, Neuronal Plasticity: Molecules, Structures and Functions



**Gerhard Neuweiler** (\*May 18, 1935, Nagold; † August 15, 2008, Munich)  
*Institute of Zoology, Frankfurt*



**Henning Scheich** (\* May 12, 1942, Wuppertal)  
*Institute of Zoology, Darmstadt*



**Rainer Klinke** (\* March 8 1936, Landsberg, Upper Silesia; † September 8, 2008, Frankfurt am Main)  
*Institute of Physiology II, Frankfurt*



**Eckhard Friauf** (\* February 4 1956, Treysa/Hessen)  
*Institute of Physiology II, Frankfurt*

Slide 3

Researchers come and go - and even more important - science moves on rapidly and technical innovations and new paradigms are being established. There was not enough support left for behavioral neuroscience after the CRC 45 had come to an end in 1993. Cellular and molecular neuroscience came into focus. Rainer Klinke had envisaged that and set out for a new topic. The new CRC 269 “Molecular and Cellular Basis of Neuronal Organization Processes (Molekulare und zelluläre Grundlagen neuronaler Organisationsprozesse)” started immediately after the CRC 45 had come to an end. It again comprised groups from the Medical Anatomy and Physiology in Frankfurt, the Zoology in Frankfurt and Darmstadt, and the Max-Planck Institute for Brain Research, with all three departments represented. Also this CRC was very successful and reached its maximal funding time in 2004.

Another important cornerstone for interdisciplinary exchange in the Frankfurt neurosciences was the Research Training Group 361 (Graduiertenkolleg) “Neuronal Plasticity: Molecules, Structures, Functions (Neuronale Plastizität: Moleküle, Strukturen, Funktionen)”. It was set up - in the context of the CRC 269 - in 1997 by a group of neuroscientists from Medical School, the Institute of Zoology, and the Max-Planck-Institute for Brain Research, with Eckhard Friauf from the Institute of Medical Physiology II as the spokesman. After his move to Kaiserslautern a year and a half later I took over and ran the group until the end of the maximal funding period in 2006.

I should mention that Frankfurt neuroscientists made important contributions to a number of other research consortia which were successfully run in the fields of biochemistry and cell biology (**Slide 4**). Neuroscience was part of the CRC 169 “Structure and function of membrane proteins (Struktur und Funktion membranständiger Proteine)” which was installed

in 1984 with the biochemist Hugo Fasold as spokesman. It was the advent of membrane proteomics and this CRC had much of a protein biochemical focus. Besides several groups from the biochemical and biophysical institutions at the newly erected Biocenter at the campus Riedberg (including two projects from my own group) and from the medical campus there were groups from Darmstadt and Mainz, from the Max-Planck Institute of Biophysics and later two projects from the Max-Planck-Institute for Brain Research (Heinrich Betz's department). It run for the maximal funding period until 1996.

### **CRCs with important neuroscience contribution in Frankfurt**

- **1984 - 1996: CRC 169**, Structure and Function of Membrane Proteins
- **1997- 2001: CRC 474**, Intracellular Organization of Regulation and Transport Processes
- **2003 - 2007: CRC 628**, Functional Membrane Proteomics. From Transport Machineries to Dynamic Assemblies and Networks
- **2008 - : CRC 807**, Transport and Communication across Biological Membranes
- **2009 - : CRC 815**, Redox-Regulation

Slide 4

Following the retirement of Hugo Fasold, Lutz Nover, a plant biochemist, initiated a new CRC, CRC 474 "Intracellular organization of regulation and transport processes" in 1997. It also included neurochemical projects from my group and from the Max-Planck-Institutes of Brain Research and Biophysics. The consortium was rather heterogeneous, however, and after the end of the first funding period this CRC was discontinued. Robert Tampé who had come from Marburg as Fasold's successor guided a new initiative and in 2003 the new CRC 628 „Functional Membrane Proteomics. From Transport Machineries to Dynamic Assemblies and Networks" was established. This CRC brought together mainly groups from the Biocenter but also from the Max-Planck-Institute of Biophysics and neurochemical groups from the Max-Planck-Institute of Brain Research and my group from the Institute of Zoology. While excellent from my point of view, the reviewers turned it down next time. Yet Robert Tampé was able to soon revive it in 2008 with the CRC 807 "Transport and Communication across Biological Membranes", a CRC still running successfully today.

After the end of the CRC 269 in 2004, the Frankfurt neuroscience community ran into somewhat shallow waters with its attempts to set up a follower CRC. At that time turnover in personnel was imminent in the University and also in the Max-Planck-Institute for Brain Research with the retirement of the three directors. Possibly our reviewers treasured the views that Frankfurt had been pretty well off with its funding in the past and could pause for a while. Nevertheless the Frankfurt neuroscience community had even further grown. A very important addition was the Frankfurt Institute for Advanced Studies (FIAS) which was established at the Campus Riedberg in 2004 and finally moved into its new building in 2007. This institution, which was initiated by the theoretical physicist Walter Greiner und by Wolf Singer, set up renowned groups in computational neuroscience and related neuroscience topics, very important additions to modern neuroscience.

Later - after founding the ICNF - important additions to the neuroscience scene in Frankfurt included the foundation in 2008 of the Ernst Strüngmann Institute (ESI) for Neuroscience in

Cooperation with the Max-Planck-Society and the appointment (beginning in 2008) of the new directorship of the Max-Planck-Institute for Brain Research, now located at the campus Riedberg and very recently the Max-Planck-Institute for Empirical Aesthetics at the Campus Westend.

Obviously neuroscience in Frankfurt had become large but rather heterogeneous - not only in terms of contents and technical approaches. The institutions were distributed all over the city, in Niederrad, the preclinical institutes and the Neurological Clinics at the clinical campus, at the Campus Riedberg, the science institutes in the Biocenter, the Max-Planck-Institutes for Brain Research and Biophysics, and the FIAS, and, near the main Bockenheim campus of the University, Psychology. It therefore appeared very important to keep the scientific discourse and collaboration going. After all - by now - CRCs and other collaborative research programs had become important lighthouse projects in intra- and inter-university competition for both national and international recognition and resources. The Präsidium of the University expected the large Frankfurt neuroscience community to deliver.

To foster scientific excellence, the university had established the concept of Scientific Centers (Schwerpunkte). These were to bring together scientists from highly successful fields to create an environment for excellent research and teaching – with the final goal of founding new collaborative research projects. The university provided financial support. I had some experience with this. Together with Robert Tampé and Michael Karas at the Biocenter I had previously set up the “Center for Membrane Proteomics (CMP)” which was officially opened in 2002 and whose founding director I had become. Another Scientific Center was the “Center for Drug Research, Development and Safety, the ZAFES (Zentrum für Arzneimittelforschung, Entwicklung und Sicherheit)” founded by our pharmacologically and pharmaceutically active colleagues, also in 2002. The CMP obtained substantial funding from the University which helped to considerably improve its infrastructure and which eventually functioned as an important catalyst for winning the Cluster of Excellence Macromolecular Complexes (CEF-MC).

My suggestion to also apply for a University Center in the field of Neuroscience was met with great acceptance by the Frankfurt neuroscience community. This center should be the umbrella for all types of neuroscience activities in Frankfurt and should have an interdisciplinary or transdisciplinary character. We named it “Interdisciplinary Center for Neuroscience (Interdisziplinäres Zentrum für Neurowissenschaften, later changed into Interdisciplinary Center for Neuroscience Frankfurt)” (**Slide 5**). It comprised four faculties. The inaugural session took place on January 20<sup>th</sup> 2006 in the assembly room of the senate of the medical faculty. The formal opening of the ICNF was held on November 10<sup>th</sup> 2006 in the Biocenter of the University with a press conference, a welcoming speech of the university president Werner Müller-Esterl, a symposium including eight excellent international speakers, and a plenary lecture by Nobel Prize winning Bert Sakmann. Rainer Klinke (emeritus at the time) gave a talk on the history of neuroscience in Frankfurt. This was also the occasion of the first meeting of our advisory board consisting of six excellent scientists from different fields of neuroscience who gave us important advice and support during the years following. We did receive financial support from the university which was used to support collaborative research projects with the aim to develop and apply for consortia in the field of neuroscience, to maintain an office, to support our public lecture series and also to

support the master program for interdisciplinary neuroscience. I have to say, though, that this money is nearly used up by now.

## ICNF, Interdisciplinary Center for Neuroscience Frankfurt

Inaugural Session: January 20<sup>th</sup> 2006

Kick-Off Symposium: November 10<sup>th</sup> 2006



### Directors

2006 - 2011: **Herbert Zimmermann** (Institute of Cell Biology and Neuroscience);  
2011 - present: **Manfred Kössl** (Institute of Cell Biology and Neuroscience)

### Deputy directors

2006 - present: **Helmut Steinmetz** (Neurological Clinics)  
2006 - 2011, 2016 - present: **Thomas Deller** (Institute of Clinical Neuroanatomy)  
2006 - 2008: **Monika Knopf** (Institute of Developmental Psychology)  
2008 - present: **Jochen Triesch** (Frankfurt Institute for Advanced Studies, FIAS)  
2011 - 2016: **Jochen Roeper** (Institute of Physiology II)

Slide 5

I was elected acting director with the deputy directors Thomas Deller (Clinical Neuroanatomy), Monika Knopf (Institute of Developmental Psychology) and Helmut Steinmetz (Neurological Clinics), representing a broad coverage of the neurosciences in Frankfurt. By the end of 2011 I retired from the acting directorship of the ICNF together with Thomas Deller and we were replaced by Manfred Kössl (Institute of Cell Biology and Neuroscience) and Jochen Röper (Institute of Medical Physiology II), respectively. Jochen Triesch (FIAS) took over from Monika Knopf in 2008 (**Slide 6**).

From UniReport,  
October 11,  
2006, p. 3-4

Herbert  
Zimmermann (left),  
Thomas Deller  
(right)

11. Oktober 2006



THEMA | 3

## Reine Nervensache – die Erforschung des Gehirns als biomedizinische Herausforderung

Das neu gegründete Zentrum für Interdisziplinäre Neurowissenschaft (ICN) nimmt seine Arbeit auf

Frankfurt hat eine große und ungebrochene Tradition in der Erforschung der Anatomie und Funktionsweise des Gehirns. Mit innovativen Ansätzen haben die jeweiligen Forscherpersönlichkeiten, allen voran Ludwig Edinger, zu ihrer Zeit Maßstäbe gesetzt. Langst sind die Forscher in die Bereiche von Molekülen und Zellen einerseits und die Welt komplexer Hirnaktivitäten andererseits vorgestoßen, um zu verstehen, wie unser Gehirn funktioniert, wie sich Zellen oder Hirnareale vernetzen, wie Wissen entsteht.

Anfang November nimmt das Frankfurter Zentrum für Interdisziplinäre Neurowissenschaft (ICN) im Rahmen eines wissenschaftlichen Symposiums in Anwesenheit von hochkarätigen Forscherpersönlichkeiten einschließlich des Heidelberger Medizinobergenerzgrüßers Bert Sakmann, offiziell die Arbeit auf. Präsentiert werden aktuelle Entwicklungen aus einem weiten Spektrum neurowissenschaftlicher Forschung. Prof. Herbert Zimmermann (IZM) und Prof. Thomas Deller (IZM) sind Mitglieder des Direktoriums des neu gegründeten universitären Zentrums, das sich an der Vortrefflichkeit der Erkenntnisse erheutliche und große Ziele gesetzt hat.

einem Patienten zu verstehen, um damit die Chancen auf Heilung zu verbessern. Diese Art der Forschung, von der Laborbank bis hin zum Krankenbett, gilt als der schärfste Weg zu neuen Therapieansätzen und Medikamenten. Ganz konkret beschäftigen sich Wissenschaftler des Zentrums im Zusammenhang mit der Regenerationsforschung mit den Ursachen des Nervenzellverlustes und untersuchen die daran beteiligten Moleküle und molekularen Interaktionen. Andere Forscher analysieren die Reaktionen des Nervensystems auf eine Schädigung und die damit verbundenen natürlichen Heilungsprozesse des Gehirns, um diese gezielt stärken zu können. Wiederum andere gehen der Frage nach, ob auch im Gehirn Erwachsener aus Stammzellen neue Nervenzellen entstehen können, die schließlich die verlorenen Nervenzellen ersetzen könnten. Klinische und psychologische Arbeitsgruppen, wie zum Beispiel die Forscher des Brain Imaging Center, schlagen die Brücke zum Klinikum und unterstützen mit Hilfe moderner bildgebender Verfahren die Veränderungen des Nervensystems nach einem Schlaganfall und bei der Alzheimerischen Krankheit. Weitere Forschungsbereiche befassen sich etwa mit neuronalen Kommunikationsmechanismen, der Steuerung



Im Dialog mit dem Nerven Prof. Herbert Zimmermann (links) und Prof. Thomas Deller arbeiten daran, die Funktionsweise des Gehirns zu ergründen. Ziel ist es zu verstehen, wie Wissen entsteht.

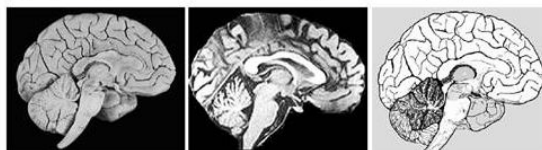
evolution. Dies ist nach kein Wunder, wenn es um das komplexeste Organ geht, das die Evolution je hervorgebracht hat. Neurowissenschaftliche Forschung fragt nach der geistlichen Steuerung von Entwicklungsprozessen oder pathologischen Prozessen ebenso wie nach der Struktur und Funktion von Molekülen, die wichtige Funktionen des Nervensystems kontrollieren oder nach den Prinzipien komplexer

In wieweit sind die skizzierten Arbeitsstrukturen heute schon in dem Frankfurter Neurowissenschaftszentrum realisiert? Ziel Die Neurozone in Frankfurt ist außerordentlich aktiv und vielfältig. Dies wird reflektiert durch die Einbindung von Instituten aus vier Fachbereichen der Universität – FB 5 Psychologie und Sportwissenschaft, FB 14 Biochemie, Chemie und Pharmazie, FB 15 Biowissenschaften, FB 16 Medizin – aller drei Abteilungen des Max-Planck-Instituts für Hirnforschung und des FIAS. Die Bildung etablierter Einrichtungen bilden einen Forschungsschwerpunkt von hoher Sichtbarkeit und bieten exzellente Voraussetzungen, um sich den geschäftigsten Herausforderungen zu stellen. Es besteht kein Zweifel daran, dass unter Berücksichtigung aller Stand-

das auf dem Universitätsklinikumgelände neu errichtete "Brain Imaging Center". Diese Forschungsfelder werden erweitert durch psychologische Ansätze, in denen die Entwicklung und Pathologie kognitiver Prozesse analysiert werden, in der frühkindlichen Entwicklung ebenso wie bei Alterungsprozessen. Im Verlaufe der vergangenen Jahre ergaben sich bereits wichtige Verbindungen zwischen einzelnen Gruppen, z.B. bei der Erweiterung von Sonderforschungsbereichen oder Graduiertenkollegs. Die neuen Multidisziplinären und beste institutionelle Zuordnung erfordert zusätzliche Mechanismen, um Interaktionen zu stimulieren und die Herausbildung neuer Konsortien zu fördern. Das ICN will Forum und Schrittmacher sein.

Auf welchen Wurzeln gründet die Frankfurter Neurowissenschaft – es fiel ja bereits mehrfach der Name Edinger?

Ziel in der Tat sind die Frankfurter Neurowissenschaften ohne ihn nicht denkbar. Denn der jüdische Neurologe Ludwig Edinger (1855-1918) gründete in Frankfurt das Neurologische Institut als altes Institut für



Schnittsichten: Das Gehirn im sogenannten medianen Sagittalschnitt in Forschung, Klinik und Lehre (von links). Die Abbildung ganz links stammt aus dem Institut für Klinische Anatomie; die mittlere Abbildung ist eine mittels Magnetresonanztomographie (MRT) in der Klinik für Neurologie (Brain Imaging Center) von Dr. Christian Keil erstellte Aufnahme; die Zeichnung rechts mit der Hervorhebung einzelner Hirnareale stammt von Dr. Tobias Seebach; Institut für Klinische Neuroanatomie

Slide 6

While the ICNF was a University Center, the bylaws encouraged to co-opt members from institutions outside University. We were very fortunate that all directors and also other project



leaders from the Max-Planck-Institute for Brain Research and also the FIAS immediately accepted co-membership. In 2006 the ICNF comprised 36 professors and project leaders from 21 institutions with over 300 postdocs and PhD students. Gabi Lahner became the coordinator – switching to the ICNF from the “Research Training Group on Synaptic Plasticity” which just had come to an end (**Slide 7**).

### Institutions belonging to the ICNF in 2006

From UniReport, October 11, 2006, p. 3-4



**Gabi Lahner**, Coordinator of RTG 361 Neuronal Plasticity, ICNF, Master Program Interdisciplinary Neuroscience, and rmn<sup>2</sup>

Slide 7

### Das ICN - Organisation des Zentrums

Dem ICN gehören insgesamt 36 ProfessorenInnen und ArbeitsgruppenleiterInnen aus Universität, Max-Planck-Institut, FIAS und Frankfurter Pharmaforschung an. Die Zahl der MitarbeiterInnen und DoktorandInnen dürfte bei über 300 liegen dürfte.

#### Beteiligte Institutionen (Zahl beteiligter Professoren / Arbeitsgruppenleiter)

##### FB 16, Medizin, Klinikum der Johann Wolfgang Goethe-Universität

- Klinik für Neurologie (3)
- Klinik für Neurochirurgie (2)
- Klinik für Psychiatrie und Psychotherapie (1)
- Zentrum für Kinderheilkunde und Jugendmedizin (1)
- Zentrum der Radiologie, Neuroradiologie (1)
- Institut für Klinische Pharmakologie Anatomie I (4)
- (Institut für Klinische Neuroanatomie) Anatomie II (3)
- (Institut für Experimentelle Neurobiologie) Anatomie III (2)
- (Institut für Molekulare Neuroendokrinologie) (1)
- Neurologisches Institut (Etinger Institut) (1)
- Institut für Medizinische Psychologie (1)

##### Biowissenschaften (FB 15)

- Institut für Zellbiologie und Neurowissenschaft (3)

##### Biochemie, Chemie und Pharmazie (FB 14)

- Pharmakologisches Institut für Naturwissenschaftler (1)
- Institut für Biochemie (1)

##### Psychologie und Sportwissenschaften (FB 5)

- Institut für Psychologie (2)

#### Assoziierte Institutionen

##### Max-Planck- Institut für Hirnforschung

- Abt. für Neurochemie (2)
- Abt. für Neurophysiologie (1)
- Abt. für Neuroanatomie (2)
- Independent Hertie Research Group (1)

##### Frankfurt Institute for Advanced Studies (FIAS)

- Cognitive Science, Neural Computation (2)

##### Merz Pharmaceuticals GmbH

- Department of Preclinical Research and Development (1)

Certainly, one of our most important aims was to coordinate research projects between individual labs and eventually install consortia for acquisition of third party funds (**Slide 8**). To foster interaction we organized annual meetings (Minisymposia) where new members of the Frankfurt neuroscience community would introduce themselves and get to know the spectrum of our activities and where postdocs and PhD students could present and exchange their data and ideas with poster sessions. We also set up a separate autonomous seminar program for junior scientists, the Young Investigator's Colloquium (YIC) which still runs successfully today.

### Major aims of ICNF

- Identification of scientific foci and strengths of neuroscience activities in Frankfurt
- Coordination of research projects between neuroscience labs in Frankfurt
- Installing consortia for acquisition of third-party funds
- Aligned hiring strategy between faculties
- Annual (mini)symposia for introducing new members and fostering exchange between laboratories
- Young Investigator's Colloquium (YIC), separate autonomous seminar program for junior scientists
- Public lectures given in German and held in the auditorium of the medical campus
- Master program for Interdisciplinary Neuroscience
- PhD and postdoctoral programs with international participation (GRADE Brain; Understanding the brain: from molecules to networks and computer models)

Slide 8

Moreover, we aimed to inform the public of recent progress in neuroscience and to create public understanding for neuroscience research. From the beginning we launched four public lectures a year - given in German and held in the auditorium of the medical campus. They have become very popular and attract a large audience.

We soon installed a Master Program for Interdisciplinary Neuroscience. A steering committee led by Manfred Kössl managed to bring this program to life. It is officially associated with the Faculty of Biosciences and by now this four semester program is running successfully in its seventh year – with about 25 students entering every year and with Gabi Lahner as the coordinator. Maybe one or the other of our junior researches here have passed through this program.

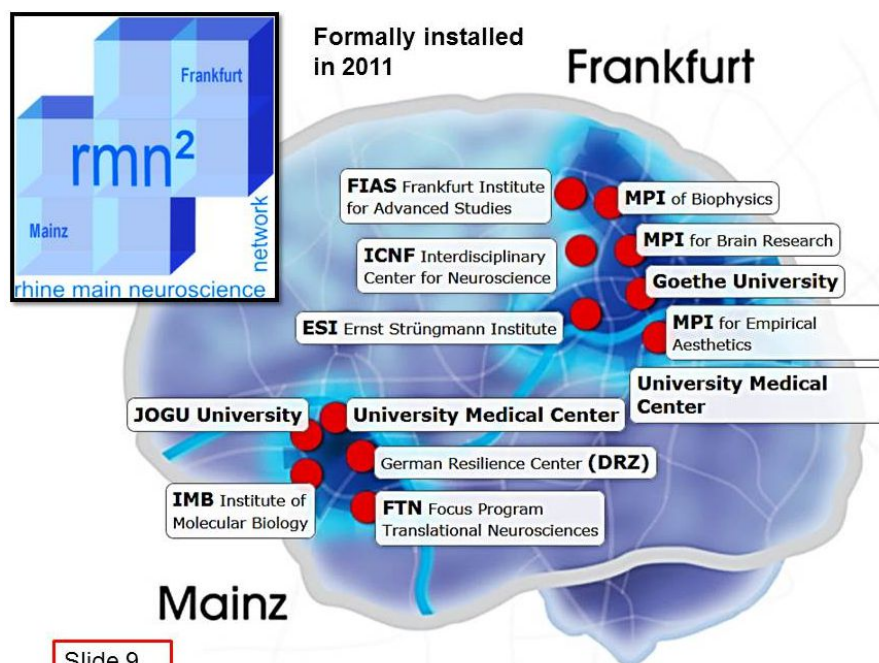
One of the major gains of ICNF members during the following years was the acquisition of the so-called LOEWE-Program Forschungsschwerpunkt Frankfurt NeFF – Neuronal Coordination (Neuronale Koordination) (2011-2014), with the neurologist Ulf Ziemann as spokesman and later, after his move to Tübingen, Michael Wibral. Its major aim was to apply modern neurophysiological, imaging and mathematical methods for analyzing the role of neuronal coordination for important neurological diseases. LOEWE is an initiative installed in 2008 for supporting the development of scientific and economic excellence in Hesse. Neuroscientists from Frankfurt were also participating in additional LOEWE programs, the LOEWE-Schwerpunkt “LiFF – Lipid Signaling” (2008-2011) and the LOEWE-Schwerpunkt “Applied Pharmaceutical Research (Anwendungsorientierte Arzneimittelforschung)” (2012 – 2014), from 2015 onwards: LOEWE Center “Translational Medicine and Pharmacology (Translationale Medizin und Pharmakologie, TMP)”.

Mainz also had a strong neuroscience community. A tandem appointment in 2009 brought two further excellent neuroscientists to Mainz. Robert Nitsch took the chair of Anatomy and Neurobiology and Frauke Zipp became director of the Department of Neurology at the University Medical Center. The neuroscience community in Mainz was organized in form of the Interdisciplinary Research Center Neuroscience (Interdisziplinärer Forschungsschwerpunkt Neurowissenschaften, IFSN). This Center was soon reorganized to obtain more of a clinical and translational focus and in autumn 2010 the Focus Program Translational Neuroscience, FTN (Forschungsschwerpunkt Translationale Neurowissenschaft) was launched. Regarding new CRCs, however, Mainz was in a similar situation as Frankfurt at the time. We soon started talks to discuss the possibility of setting up a new network that would considerably enhance the strengths of the two neighboring neuroscience communities, increase critical mass and bundle synergies.

The new consortium was to be named Rhine Main Neuroscience Network (rmn<sup>2</sup> - as Robert Nitsch suggested, the synergies were to be exponentiated). To formally establish this, a contract was concluded in 2010 between the two universities. It co-opted the Max-Planck-Institutes for Brain Research and for Biophysics equally as well as the FIAS and the Max-Planck-Institute for Heart and Lung Research in Bad Nauheim. An additional contract was filed between the medical faculties of the two universities (**Slide 9**).

Besides joint CRC activities the aims of rmn<sup>2</sup> included open teaching courses and facilities to all rmn<sup>2</sup> students, including the MD/PhD program “Translational Biomedicine” in Mainz,

biennial retreats (the first one was held here in Oberwesel in November 2010), common seminar and lecture programs and a common hiring strategy in the neurosciences. Robert Nitsch (Mainz) became the first spokesman of  $rmn^2$ , followed by Helmuth Steinmetz (Frankfurt) and, since 2016, it is directed by Jochen Röper (Frankfurt).



Even before  $rmn^2$  was formally installed in 2011, intensive activities had started between neuroscientists in Mainz and Frankfurt to set up a new CRC. Finally, in January 2013 the CRC 1080 “Molecular and cellular mechanisms of neural homeostasis (Molekulare und zelluläre Mechanismen der neuralen Homöostase)” could begin its work, with Robert Nitsch (Mainz) as spokesperson and with Thomas Deller (Frankfurt) and subsequently Amparo Acker-Palmer (Frankfurt) as deputy spokespersons (**Slide 10**). This was a first and central step forward for the Rhine Main Neuroscience Network. For me this was great satisfaction. But since I was already retired I had to watch from outside.

$$M + F = rmn^2$$

2013 : **CRC 1080**

Molecular and Cellular Mechanisms of Neural Homeostasis



Robert Nitsch  
Mainz



Thomas Deller  
Frankfurt



Amparo Acker-Palmer  
Frankfurt

Slide 10

As you all know,  $rmn^2$  has undergone a splendid development. By now, neuroscience in Frankfurt and Mainz has obtained much of a biomedical and translational focus. I do not have the time to go into further details. The next two slides highlight some of the recent acquisitions by  $rmn^2$  members (**Slide 11, 12**).

### Consortia with Neuroscience Contribution 1

- **2005- 2017: CRC / Transregio 23**, Vascular Differentiation and Remodeling
- **2010 – 2017: DFG Research Unit, For 1332**, Physiological Functions of the APP Gene Family in the Central Nervous System
- **2011 - : IMPRS**, Max Planck Research School for Neural Circuits
  
- **2016 - : Priority Program 1926**, Next Generation Optogenetics - Tools and Applications
- **2016 - : Priority Program 2041**, Computational Connectomics
- **2016 - : CRC**, Neurobiology of Resilience to Stress-Related Mental Dysfunction: from Understanding Mechanisms to Promoting Prevention
  
- **2006 - : Cluster of Excellence**, Macromolecular complexes
- **2006 - : Cluster of Excellence**, Cardio-Pulmonary Systems

Slide 11

### Consortia with Neuroscience Contribution 2

- **2011 - 2014: LOEWE research cluster**, Neuronal Coordination (NeFF)
- **2008 - 2011: LOEWE research cluster**, Lipid Signaling (LIFF)
- **2012 - 2014: LOEWE research cluster**, Applied Pharmaceutical Research, (from 2015: **LOEWE Center**, Translational Medicine and Pharmacology)
- **2012 - : CRC-TR 128**, Effector versus Regulatory Mechanisms in Multiple Sclerosis
- **2008 - 2015: RG 926**, DFG-funded network on Endocannabinoids
- **2010 - 2012: RG 1341**, DFG-funded network on Barrel Cortex Function
- **2004 - 2013: RTG 1044**, Research Training Group on Developmental and Disease-induced Modifications in the Nervous System

Slide 12

Let me just pick a few of the recent consortia. These include the CRC Transregio 128: Effector versus Regulatory Mechanisms in Multiple Sclerosis (spokespersons Heinz Wiendl, Neurological Clinics Münster; Frauke Zipp, Department of Neurology at the University Medical Center, Mainz), the Priority Program 1926, Next Generation Optogenetics - Tools and Applications (spokesperson Alexander Gottschalk, Buchmann Institute of Molecular Life Sciences and Institute of Biochemistry, Frankfurt), Priority Program 2041, Computational Connectomics (spokesperson Jochen Triesch, FIAS, Frankfurt) and the most recent acquisition, the CRC “Neurobiology of Resilience to Stress-Related Mental Dysfunction: from Understanding Mechanisms to Promoting Prevention” (spokesperson Beat Lutz, Institute of Physiological Chemistry, Mainz). Neuroscientists in Frankfurt also contribute to two Clusters of Excellence (Macromolecular Complexes and Cardio-Pulmonary systems) and four members of  $rmn^2$  have won ERC advanced grants which are awarded to highly innovative and risky research projects in Europe - solely based on the criterion of excellence: Peter Mombaerts, Max-Planck-Institute of Biophysics; Erin Schuman and Gilles Laurent, Max-Planck-Institute for Brain Research; Robert Nitsch, Institute of Microscopic Anatomy and

Neurobiology at the University Medical Center, Mainz; and Amparo Acker-Palmer, Institute of Cell Biology and Neuroscience and Buchmann Institute of Molecular Life Sciences, Frankfurt)

You may have noticed that recently (in December 2015) a much wider and trilateral alliance has been formed for fostering strength in science and teaching comprising a very broad spectrum of disciplines. It includes in addition to Frankfurt and Mainz the Technical University of Darmstadt. This might also revive the old links in the field of neuroscience with the Technical University Darmstadt.

No doubt, Rhine-Main neuroscience has become one of the leading locations for neuroscience research not only in Germany but also in Europe.

I wish you all exciting scientific discussions  
and the neuroscientific activities in Mainz and Frankfurt the best of  
success and a prosperous future



Slide 13