

# NRW SPOTLIGHT

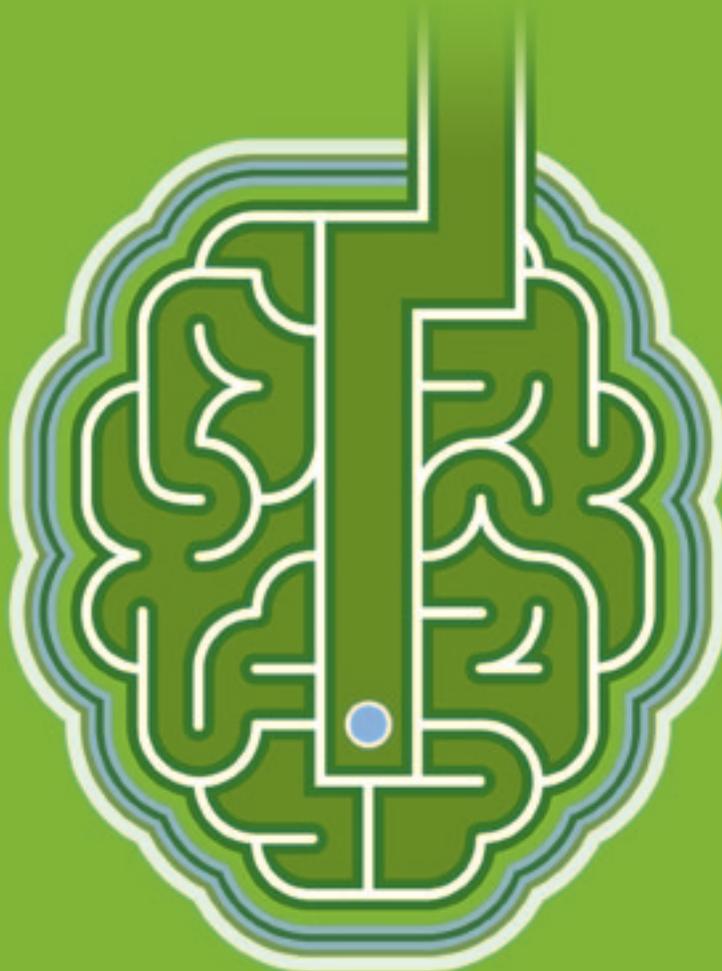
ON BIOTECHNOLOGY

Issue 2, November 2011

MEET THE MEN THAT LIGHT UP THE LIFE SCIENCES/  
HOW MILTENYI IS POWERING THE STEM CELL REVOLUTION/  
AGING RESEARCH HAS A HOTSPOT

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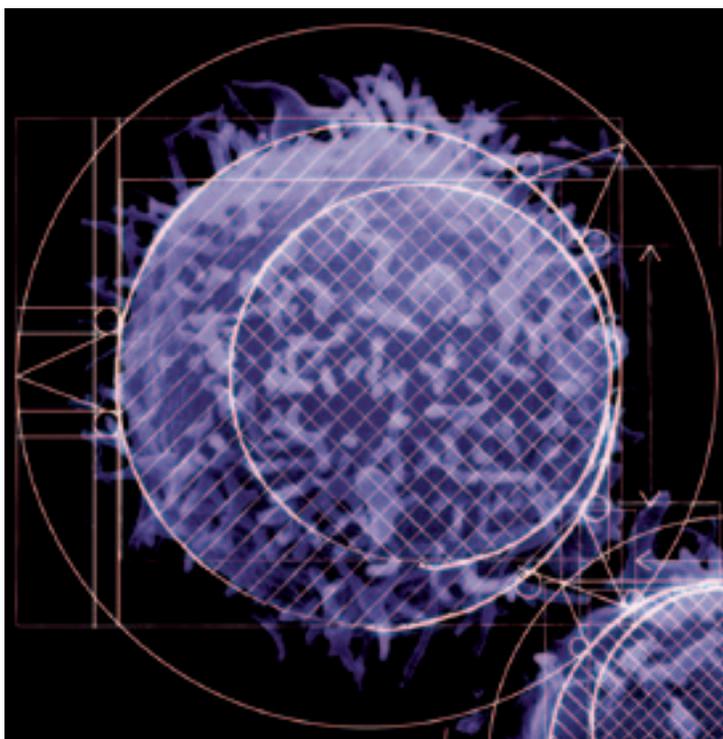
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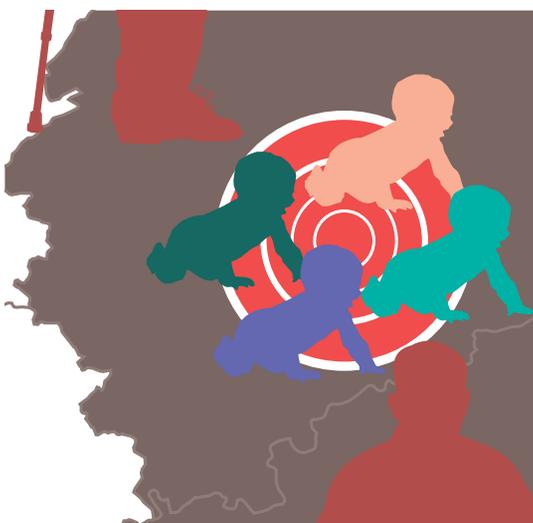


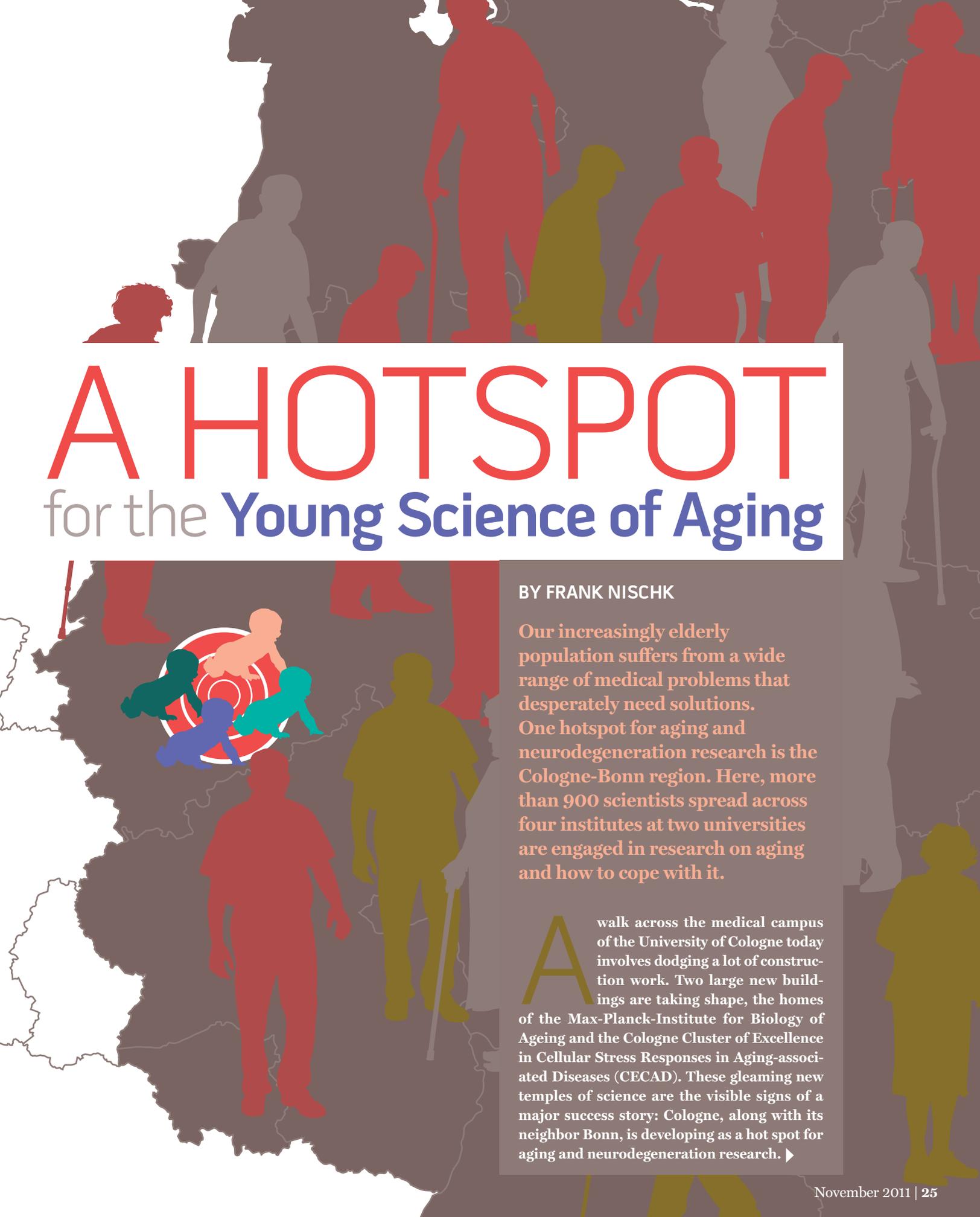
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# A HOTSPOT

for the **Young Science of Aging**

BY FRANK NISCHK

Our increasingly elderly population suffers from a wide range of medical problems that desperately need solutions. One hotspot for aging and neurodegeneration research is the Cologne-Bonn region. Here, more than 900 scientists spread across four institutes at two universities are engaged in research on aging and how to cope with it.

**A**walk across the medical campus of the University of Cologne today involves dodging a lot of construction work. Two large new buildings are taking shape, the homes of the Max-Planck-Institute for Biology of Ageing and the Cologne Cluster of Excellence in Cellular Stress Responses in Aging-associated Diseases (CECAD). These gleaming new temples of science are the visible signs of a major success story: Cologne, along with its neighbor Bonn, is developing as a hot spot for aging and neurodegeneration research. ▶

The industrialized world is facing a massive demographic problem: societies are getting older and older. Life expectancy in Western Europe has reached eighty-plus years and by 2050 there will be twice as many people in Germany over sixty than under twenty years old. Where, one might ask, is the problem with that? After all, everyone wants to live as long as possible. The problem is that aging societies are driving detrimental socio-cultural changes. Pension systems, the economy, and the infrastructures of cities and communes are among the many facets of society that must be adapted to meet the requirements of the

**“We are not looking to find the secret of immortality, what we are aiming for is an understanding of the mechanisms of aging, to help keep older people fit and healthy.”**

growing portion of senior citizens. Health and care systems are especially burdened. Take neurodegenerative diseases such as Alzheimer’s, for example. Already, 1.3 million people in Germany suffer from dementia and the number of cases is set to double by 2060. And neurodegenerative diseases are not the only concern: cancer, diabetes and many other ailments will play a much bigger role in aging societies, too. Hence the urgent need for research.

“Research on aging and aging-related diseases isn’t totally new,” says Thomas Krieg, Dean of the medical faculty of the

University of Cologne, “but scientists who work in the field are experiencing more interest and support for their work, because many societies face the same problems. We are not looking to find the secret of immortality, what we are aiming for is an understanding of the mechanisms of aging, to help keep older people fit and healthy.”

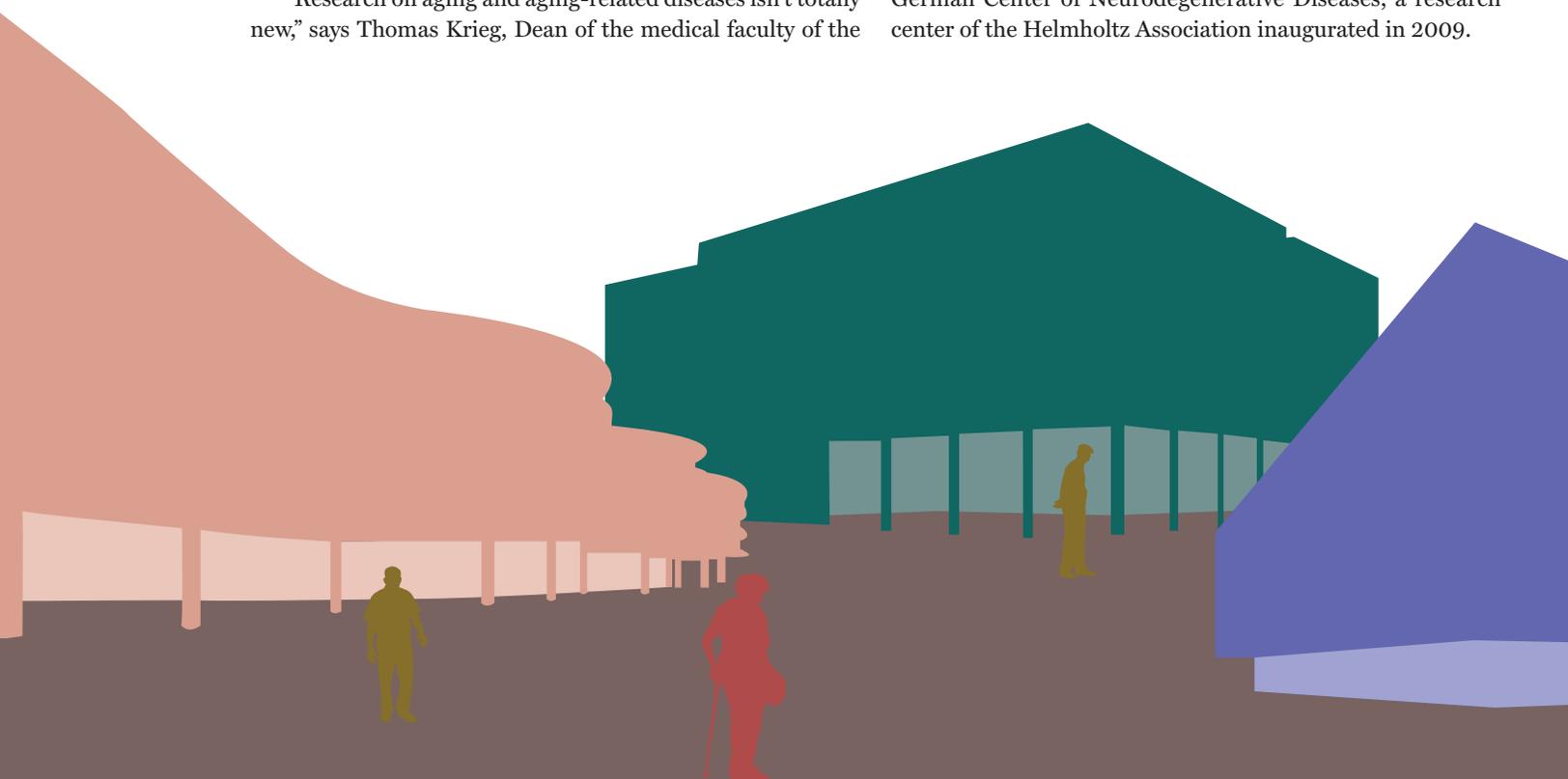
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## FOUR YOUNG INSTITUTIONS

Aging research is a relatively young scientific field that has hit a growth spurt. And nowhere is this new dynamism more visible than in the Cologne-Bonn region of southern North Rhine-Westphalia. Close by the river Rhine, the density of experts in aging research is unmatched elsewhere in Europe. Here, four major institutes employ 900 staff who are focused on aging in general or on neurodegenerative diseases like Alzheimer’s or Parkinson’s in particular.

Development has been rapid. It was as recently as 2007 that the Max Planck Society decided to base its Institute for Biology of Ageing in Cologne. That same year, the University of Cologne won major funding for aging research from the German Research Foundation (DFG) through an initiative on research excellence funded by the German federal and state governments. From this support CECAD, the Cologne Cluster of Excellence in Cellular Stress Responses in Aging-associated Diseases, was born.

In nearby Bonn two other institutes sprang up: caesar, the center for advanced european studies and research, funded in 1994 by the Federal Republic of Germany and the federal state North Rhine-Westphalia; and the headquarters of DZNE, the German Center of Neurodegenerative Diseases, a research center of the Helmholtz Association inaugurated in 2009.



“Max Planck Society wouldn’t have decided in favor of Cologne if aging-related research hadn’t already been strong at our University,” Krieg points out. In particular, innovative research on model organisms pointed towards general mechanisms for aging. This expertise was Cologne’s ace in the hole when the Max Planck Society was looking for the right spot for its Institute for Biology of Ageing. “That decision meant that there was critical scientific mass to attract CECAD, too,” says Krieg.

Bonn, just 30 kilometers away, underwent a similar change. “The story began here in the mid 1990s,” reports Thomas Klockgether, Director of Clinical Science at DZNE. “The scientific output from the Medical Faculty of the University was relatively low at that time. Medical science in Bonn needed re-orientation.” The faculty wanted to focus on particular research fields, and the neurosciences were selected. “Right from the beginning of the process,” Klockgether says, “clinical and fundamental research were interconnected and, over the course of a decade, neurosciences at Bonn’s medical campus developed successfully. Bonn became a research center for diseases related to the brain.”

In 1994, the so-called Berlin-Bonn Act was introduced, strengthening Bonn as center of science and research. A year later, caesar was founded with support from the Federal Republic of Germany and the state of North Rhine-Westphalia. caesar is largely self-financing through earnings from the foundation assets and it is scientifically connected to the Max Planck Society (MPG). In 2006, a commission of the Max Planck Society recommended that caesar should focus on neurosciences. “The growth of neurosciences at Bonn University was instrumental in that decision,” says Thomas Klockgether.

As was the case in Cologne, success bred success: Bonn was selected as one of nine sites of the German Center for Neurodegenerative Diseases (DZNE). The DZNE comprises multiple advanced research sites with the largest site in Bonn and others in Berlin, Dresden, Göttingen, Tübingen, München, Rostock/Greifswald, Magdeburg and Witten. At each site,

DZNE is strongly linked with the Universities in a symbiotic partnership to translate blue-sky research into applications.

The core of the DZNE research in Bonn will be to translate fundamental discoveries into clinical applications and to link advanced clinical and population studies to understanding of molecular mechanism of disease pathogenesis. Pierluigi Nicotera, a renowned scientist and leading international expert in the field of neuronal cell death, is Scientific Director and Chairman of the Board.

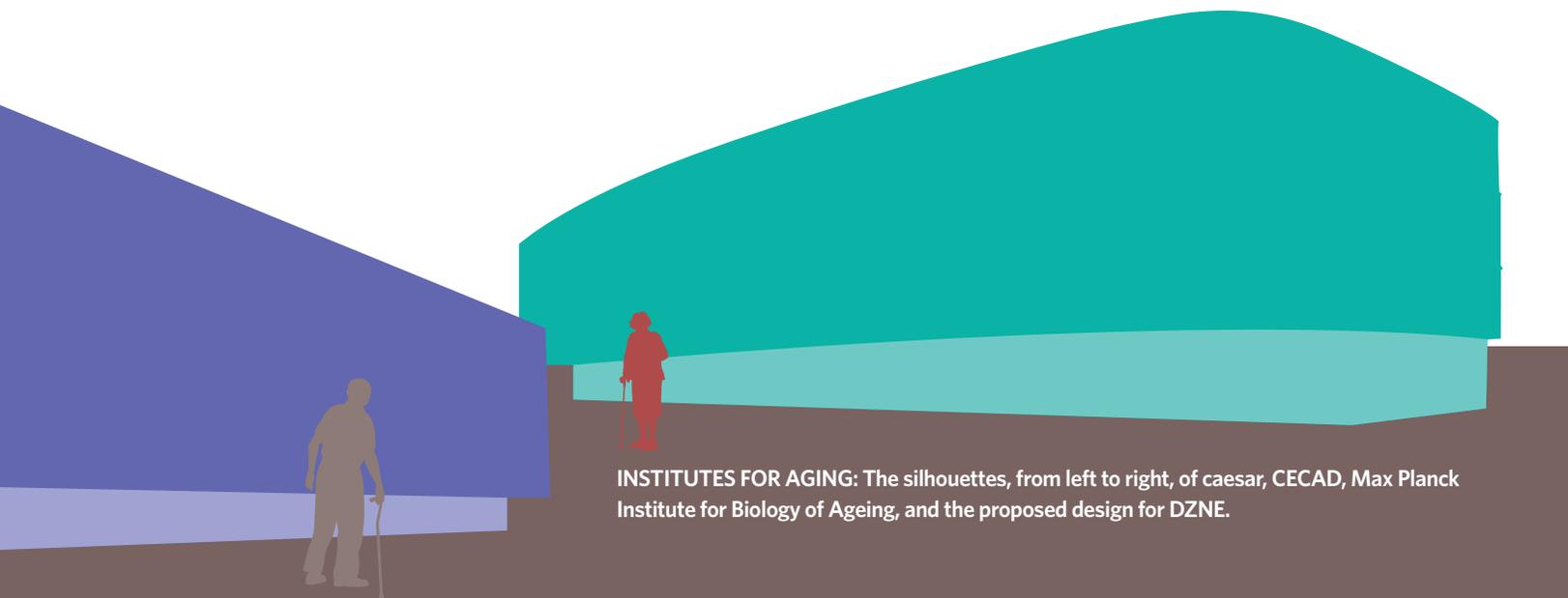
That’s how the region has developed as a center for aging research so far, and we may not yet have reached the end of the story. Earlier this year, a Bonn-based team applied for a DFG cluster of excellence, equivalent to CECAD in Cologne. The scientific field is innate immunity, which is known to play a major role in the development of neurodegeneration. The result of that application will be known in early 2012.

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### MAKING A MARK INTERNATIONALLY

“Cologne-Bonn is now recognized as one of the leading clusters of aging and neurodegeneration research in Europe,” Klockgether believes. Krieg, a member of CECAD, has a similar impression. “We realized the attraction of Cologne when the three directors of the new Max-Planck-Institute were appointed,” he says. “All of them were outstanding candidates attracted to Cologne from abroad.” One of the founding directors is Linda Partridge from the UK, who has received multiple honors for her fundamental research on the biological mechanisms of aging. Partridge’s work is aimed at discovering genes and mechanisms that determine the rate of aging using model organisms like fruit flies, nematodes and mice, focusing on the role of insulin/IGF-like growth factors in the aging processes.

Another topic of interest to Partridge is the effect of nutrition on the lifespan and fertility of organisms. Studies have shown that a low calorie diet extends lifespan in mice and fruit flies, ▶



INSTITUTES FOR AGING: The silhouettes, from left to right, of caesar, CECAD, Max Planck Institute for Biology of Ageing, and the proposed design for DZNE.

while it has a negative effect on fertility. Partridge found that both lifespan and fertility can be maximized by including a higher portion of the amino acid methionine in the low calorie diet. CECAD scientists are looking for mechanisms, genes or molecules that will help to transfer these findings from model organisms to human beings. “In CECAD’s second funding period, translational aspects of research will play a much bigger role,” Krieg says. His hope is that one day biologically active molecules will be found by scientists in Cologne or Bonn that will help to cure or slow down ailments like cancer, diabetes mellitus or Alzheimer’s. “My dream is that the Rhine region will be a center of spin-off companies that will try to use these molecules to develop new pharmaceuticals,” he says. Since Max-Planck-Institutes are permanent institutions, research in the MPI can be much more focused on the long term. “At CECAD we have to apply every five years for the next funding period. So research needs to have a medium-term focus,” says Krieg.

for instance, all of the directors of the Max-Planck-Institute for Biology of Ageing are members of CECAD. Cooperation among each of the four institutes CECAD, MPI, caesar and DZNE is being strengthened in the same way.

Cross-institute cooperation is not limited to the sharing of staff. Ralf Petri, Scientific Coordinator at the MPI, explains that “Good relations and proximity promote cooperate in many ways. MPI and CECAD share infrastructure, such as genomics and proteomics labs. Purchases can be coordinated to prevent redundancy. And the institutes cooperate in a graduate school to educate the aging scientists of tomorrow.”

At the research project level, too, there is a lot of collaboration. For example, Linda Partridge’s group at MPI and Jens Brüning’s group at CECAD work on insulin and the regulation of metabolism. “Intellectual exchange is much higher if you meet in the cafeteria every day instead of once or twice a year at a scientific meeting,” Petri points out. Likewise in Bonn, relations between DZNE and caesar are very close. Indeed,

## FOUR INSTITUTES BY THE NUMBERS

Institute	Funded by	Focus
	German Research Foundation (DFG)	Fundamental and clinical research, genomics, proteomics, cell biology to understand fundamental mechanisms of aging
	Max Planck Society	Fundamental research on biology of aging, animal models, Biological mechanisms and molecular genetics of aging, mitochondrial biology
	Finances itself through earnings from the foundation assets (founded by the Federal Republic of Germany and the federal state North Rhine-Westphalia), scientifically associated to the Max Planck Society (MPG)	Fundamental research in molecular sensory systems, chemical biology of neurodegenerative diseases, neuroimmunology, electron microscopy and analytics
	Helmholtz Society Funding: 90 % Federal Ministry of Education and Research (BMBF); 10 % State of Northrhine Westfalia	Fundamental and clinical research in neurodegenerative diseases; causes, mechanisms, diagnosis and therapy of neurodegenerative disorders, population sciences, health service research

### CREATING SYNERGIES

For now, one of Krieg’s most important efforts is to strengthen connections among the different institutes. To give an example, CECAD principal investigator Jens Brüning has become director of the Max Planck Institute for Neurological Research, which is also based in Cologne. “Connecting institutions and professorships helps to build a community and prevent head-hunting from elsewhere. Given the concentration of quality institutes in the area, we can offer sought-after researchers like Brüning attractive positions, retaining them in Cologne,” Krieg explains. Cross-appointments such as Brüning’s are common:

until DZNE scientists move to their own laboratories in 2015, DZNE is a tenant in caesar’s facilities. “If you lock scientists into the same building”, kids Thomas Klockgether, “cooperation will arise automatically.”

Klockgether himself fulfills a double function. He is a professor and neurologist at University Hospital Bonn and a researcher at DZNE. “Our scientific interests are to find ways to diagnose Alzheimer’s and other neurodegenerative diseases much earlier than we are able to do today,” he explains. “I believe that previous efforts to cure those diseases failed because by the time that we have the diagnosis it’s too late – brain damage is already too severe.” Klockgether and his team perform clinical studies with

the goal of identifying symptoms that could anticipate the onset of dementia. “The close relations between the hospital, DZNE and caesar are very important for that kind of work. As director of clinical sciences, I want to intensify the scientific transfer from fundamental to clinic research.” Klockgether says.

Klockgether is appreciative of the research at caesar. “The work of Benjamin Kaupp, caesar’s scientific director, for example, is outstanding.” Research groups at Caesar and the Medical Faculty of the University of Bonn are exploring new optical methods for stimulating neurons. Brain cells are genetically transformed to become sensitive to light, an approach that is more specific than using electrical stimuli. “This allows us to stimulate neurons very selectively in animal models,” says Kaupp. “If we could apply his approach in a clinical setting it could be really helpful to our work on dementia.”

The Rhineland centers for aging research are also attracting the next generation of science leaders, people like Annett Halle. She joined caesar in 2011 to build a new research group

## TODAY AND TOMORROW

The growth of the cluster is not yet complete. When DZNE moves to its new building, caesar will have space to expand and, like regular Max-Planck-Institutes, the intention is for it

**“Innovative research on model organisms was Cologne’s ace in the hole when the Max Planck Society was looking for the right spot for its Institute for Biology of Ageing.”**



Staff		Working groups	PhD-students	Post-docs	Annual budget (in millions)	
Scien- tists in CECAD	Non- scientific staff	34	150	130	Average annual third-party funds	Annual DFG-Funds
350	100				€ 12.5 Mio	€ 6.72 Mio
116 (350 aimed after moving into new building)		4 (10 aimed)	-	-	€ 15 Mio EUR	
140		5	-	-	Approx. € 12Mio	
170		18 (plus 4 at University Hospital Bonn)	-	-	Approx. 35 Mio	

to host three scientific departments instead of the single one that it has at the moment. And that means jobs for more than hundred additional scientists.

“The decision to focus scientific work in Bonn on neurodegenerative diseases was certainly the correct one,” says Thomas Klockgether. “A smaller University hospital like Bonn cannot be successful in every field.” Cologne’s Thomas Krieg has a similar view. “Our efforts to be a leading cluster in aging

science have brought new structures and facilities,” he says. “We have new research groups and a lot of strong interaction with the whole university and with our partners in the region.”

For Krieg, the strong focus on aging science brings one risk. “Any scientific topic will lose relevance eventually. Although aging is a young and dynamic research field at present, we are trying to balance the scientific work in Cologne. We want other disciplines be represented. A strong university needs both classical departments and special research fields.”

For now, the young science of aging looks likely to be increasingly relevant. And there’s a very good chance that the Cologne-Bonn region will be at the forefront for many years to come. ■

that investigates inflammatory mechanisms in the brain, having pursued her career at Humboldt University Berlin and then in the USA. “After my postdoc at the University of Massachusetts I was convinced to move to Bonn, among many other factors, by the fact that I was asked if my husband – a neuroscientist, too – would also be interested in a position.” Gabor Petzold, Halle’s husband, now heads a new working group at DZNE. “It is usually very difficult to combine careers and family life if both partners work in research,” Halle remarks. “The situation here was different. Cologne-Bonn has developed into a real cluster of aging science, making it possible for both of us to find interesting positions in the same city.”

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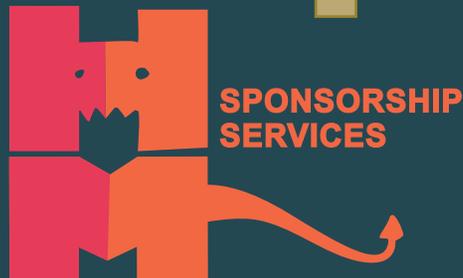
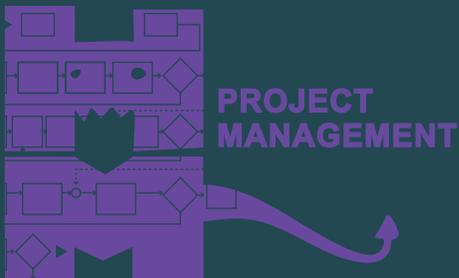
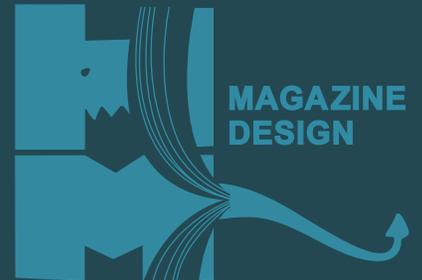
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