Collaborate

合作。。。

News from the Joint Laboratory of Neuroscience & Cognition

神经与认知科学联合实验室信息

Joint Laboratory of
Neuroscience & Cognition
An Initiative of the
Queensland Brain Institute (QBI)
and the Institute of Biophysics (IBP)

Issue 2 2012

Professor Perry Bartlett

Professor Rongqiao He

DIRECTORS' MESSAGES

Welcome to the 2012 edition of Collaborate. Our Joint Laboratory of Neuroscience and Cognition continues to flourish. This is evidenced by the first of what I am sure will be many joint publications between QBI and IBP, describing the altered development of *Xenopus* embryos in a hypogeomagnetic field, and the number of exchanges of researchers including Group Leaders, Postdoctoral Researchers and students that have taken place between the two institutions. I am delighted that we have recently appointed Associate Professor Yajing Sun as our China Liaison Manager. Yajing has been given the responsibility of sourcing future funding opportunities to underpin the work in our laboratory and assist in compiling our submissions, as well as facilitating communication and exchanges, where necessary. I have no doubt that Yajing will be a regular visitor to the Joint Laboratory and is a welcome addition to our team.

Professor Perry Bartlett, QBI

Hello everyone. I am happy with our cooperation with QBI colleagues. We have established hypogeomagnetic facilities and opened the study of cognitive impairments in this Joint Laboratory. It is highly appreciated that Associate Professor Yajing Sun starts her work for this Joint Laboratory. Her work will be involved in funding applications and other affairs in China. We will carry on the exchanges of researchers between IBP and QBI. I believe that our team will obtain fruitful results in the studies of neuroscience and related disease through cooperation.

Professor Rongqiao He, IBP

天涯变近邻

欢迎阅读2012年合作研究简报。我们的神经与认知科学联合实验室延续去年的良好态势，进展顺利。我坚信昆士兰大学脑研究所和中国科学院生物物理研究的合作研究将会共同发表一些论文，如已发表的亚地磁场对非洲爪蟾发育的影响，并且两个研究所之间的科研人员交流，包括研究组长、博士后以及研究生的交流，也将日益增多。近期，我们非常高兴地任命孙雅晶副教授作为中国联络负责人，她主要负责拓宽基金申请渠道方面的工作，支持联合实验室的发展并协助我们起草项目申请书等材料，促进必要的科技联系与交流，并定期访问双边 联合实验室。欢迎她加入我们的团队！

Perry Bartlett 教授

大家好。我非常高兴与昆士兰大学脑研究所的同事们进行科研合作。我们建立了亚磁实验平台，并顺利开展了认知损伤方面的研究。我非常荣幸孙雅晶副教授加入我们的联合实验室。她将在基金申请等中国事务方面发挥重要的作用。我们将继续开展两个研究所间的人员互访和学术交流。我相信我们的团队一定会在神经科学及其相关疾病的研究方面取得丰硕的成果。

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Associate Professor Yajing Sun

The Joint Laboratory welcomes Associate Professor Yajing Sun as the new China Liaison Manager

PROFILE

Associate Professor Yajing Sun, new China Liaison Manager

Associate Professor Yajing (Maggie) Sun has recently been appointed as the China Liaison Manager for the Joint Laboratory and will largely be responsible for sourcing funding opportunities to underpin the research, as well as assisting in managing staff and/or student exchanges and general communication. Ms Yajing Sun is an Associate Professor of Linguistics at the Beijing University of Chemical Technology. She obtained her BA and MA degrees of English Language and Literature in 1995 and 2008, respectively. She worked as a visiting scholar at University College London in 1999 and University of California, Los Angeles in 2010. Welcome Yajing!

简介
孙雅晶 新任中国联络经理

孙雅晶副教授现任联合实验室中国联络负责人，主要负责拓宽基金申请渠道、协助管理交流学者和学生的工作。孙雅晶女士是北京化工大学外语专业副教授，她于1995年和1998年分别获得英语语言文学专业学士学位和硕士学位，1999年作为访问学者到伦敦大学工作，2010年在加利福尼亚大学洛杉矶分校做访问学者。欢迎雅晶！

Hypomagnetic field promotes proliferation of murine neural stem cells

It has been reported that deep geomagnetic field (GMF) shielding, i.e, the hypomagnetic field (HMF, < 2 μT), can interfere with the function of the central nervous system (CNS), e.g., by inducing amnesia in *Drosophila* and chicks, disrupting circadian rhythm in birds and humans, and reducing stress-induced analgesia in mice. However, the cellular and molecular mechanisms of the HMF effects on the CNS remain unclear. Professor Rongqiao He's laboratory (IBP) has established a hypomagnetic cell culture system (< 500 nT) and observed altered development of *Xenopus* embryos in a hypogeomagnetic field, with the cooperation of Associate Professor Helen Cooper (QBI).

Moreover, with the help of Dr Daniel Blackmore in Professor Perry Bartlett's laboratory (QBI), the murine neural stem cell culture system has been successfully set up in IBP. The proliferation of primary neural stem cells, excepting human neuroblastoma cells, was accelerated in the HMF. This response of neural stem cells might be involved in the effects of the HMF on animal behaviour and development. To test this hypothesis, a HMF system in IBP has been upgraded with an advanced magnetic field compensating system and a video monitoring system to investigate the responses of the mice.

亚地磁场促进啮齿类神经干细胞增殖

据报道，对地磁场（GMF）的深度屏蔽，如亚地磁场（HGMF, <2 μT）能够干扰中枢神经系统的功能。已有研究报道，亚地磁场处理能造成果蝇和小鸡的记忆障碍、人和鸟类的昼夜节律混乱、小鼠的诱发性痛觉敏感降低等效应。然而，这些效应的细胞和分子机制依然不清楚。在与昆士兰大学脑研所Helen Cooper副教授的合作中，利用生物物理研究所赫荣乔课题组已经建立的一套亚磁细胞培养系统（<500nT），我们发现亚低磁环镜培养导致非洲爪蟾胚胎发育异常。

此外，在来自昆士兰大学脑研究所 Perry Bartlett教授研究组的Daniel Blackmore博士的帮助下，我们已经在生物物理所成功建立了鼠类神经干细胞培养系统。实验中我们发现原代神经干细胞在亚磁细胞培养系统中表现出增殖速度加快的现象，神经母细胞瘤细胞也有相同的效应。我们猜测，亚磁环境中动物行为和发育异常可能与神经干细胞的变化有关。为了进一步证明这个假设，我们利用先进的自动补偿式线圈屏蔽系统升级生物物理所原有磁屏蔽系统，并且安装了视频检测系统实时监控小鼠行为的变化。

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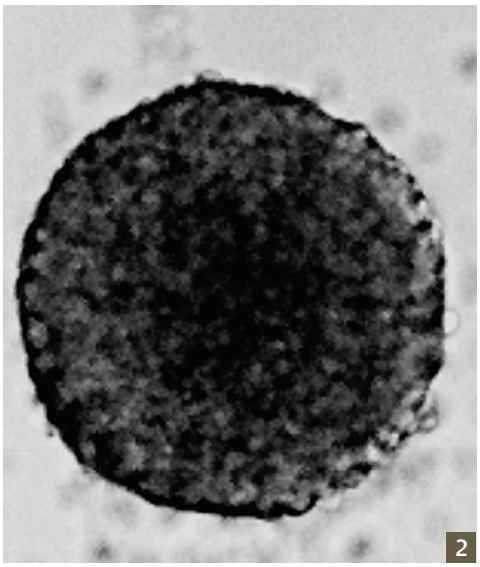


2

Bulk endocytosis at the Calyx of Held

Neuronal endocytosis is a critical mechanism allowing neurons to maintain their ability to communicate with each other. Upon synaptic activity, large portions of the presynaptic membrane are internalised to make new synaptic vesicles and although this has been detected in the brain by capacitance, it has never been visualised. Consequently, how bulk endosomes contribute to make new synaptic vesicles is completely unknown.

Professor Jianyuan Sun (IBP) hosted Dr Tam Nguyen (QBI), a Postdoctoral Researcher from Associate Professor Frederic Meunier's laboratory for 6 weeks. Dr Nguyen had previously visualised bulk endocytosis at the neuromuscular junction and is taking on the challenge of combining his technique with electrophysiological recording of the Calyx of Held under the supervision of Dr Sun in order to visualise bulk endocytosis at the same time as recording it by capacitance.

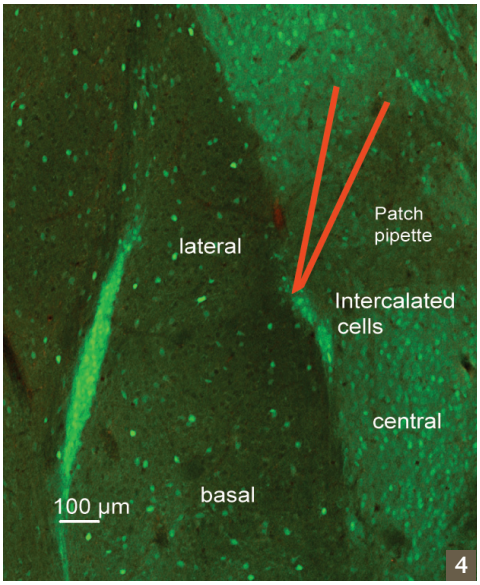
位于Calyx of Held的批量胞吞

神经元的胞吞作用是维持神经元之间正常通讯的主要机制。由于神经突触活动，大块突触前膜被内吞，形成新的突触囊泡。虽然这一活动通过电容记录方法在脑内被检测到，但至今未被观察到。因此，我们对大团内涵体在新的突触小泡形成过程中起到什么作用一无所知。

生物物理研究所孙坚原教授邀请了昆士兰大学脑研究所Frederic Meunier副教授实验室的博士后，Tam Nguyen博士进行了6个星期的交流访问。Nguyen博士曾在神经肌肉接头上直接观察到大团胞吞活动。在孙坚原教授的指导下，他正结合自己已有技术与Calyx of Held的电生理记录手段，以期在电容方法记录到大团胞吞的同时，在光学上观察到这一活动。

3

Dr Cornelia Strobel



4

RESEARCHER PROFILE
Dr Cornelia Strobel

I completed my PhD in Professor Pankaj Sah's laboratory in QBI at the end of 2011. Subsequently, I have continued my work as a Postdoctoral Fellow under his supervision. The opportunity arose to collaborate with Professor Jianyuan Sun's laboratory in IBP. Together, we are interested in the joint project "Presynaptic mechanisms at parabrachial to central lateral amygdala (CeL) synapses." Bringing together Dr Sah's knowledge in amygdala physiology and Dr Sun's expertise in presynaptic recordings of the Calyx of Held we will be able to directly record from large parabrachial (PB) presynaptic basket terminals, which carry nociceptive information and target CeL neurons, a brain region involved in emotional processing.

During my 6-week visit to Dr Sun's laboratory this year I was fortunate to catch up with Xufeng Qiu, a PhD student in Dr Sun's laboratory, who had visited QBI last year to investigate synaptic plasticity at these terminals. In addition, I got to work alongside Qianwen Zhu, another PhD candidate of Dr Sun, who is looking at the morphology of these synapses with electron microscopic resolution.

The amygdala, with its role in emotional processing and the target region of nociceptive fibers of the PB, has been proposed to be the site of integration for painful sensations and affective responses. This collaborative work will provide a better understanding of these synapses. Subsequently, this will improve our knowledge of how painful information can negatively influence emotions, which can, in severe circumstances such as chronic pain, lead to anxiety and depression.

研究人员概况
Cornelia Strobel博士

我于2011年底在昆士兰大学脑研究所Pankaj Sah教授的实验室完成了博士学业，现以博士后的身份继续工作。在此期间，我荣幸的参与了与生物物理研究所孙坚原教授的合作。我们对"臂旁-中央外侧(CeL)杏仁核突触的突触前机制"这一合作项目都有着极大的兴趣。通过结合Sah教授关于杏仁核生理学的知识，以及孙教授在Calyx of Held突触前记录的专长，我们可以对参与情绪加工过程的，传递疼痛反应并靶向中央外侧杏仁核神经元的大型臂旁(PB)篮状突触的突触前末梢进行直接的记录。

在访问孙教授实验室的六个星期里，我有幸遇到曾于去年访问昆士兰大学脑研所的博士研究生邱徐枫，在澳期间，他对此类突触的可塑性进行了研究。同时，我也与孙教授的另一名硕博连读生朱倩雯一起工作，目前她主要负责利用电子显微镜观察此类突触的形态学特征。

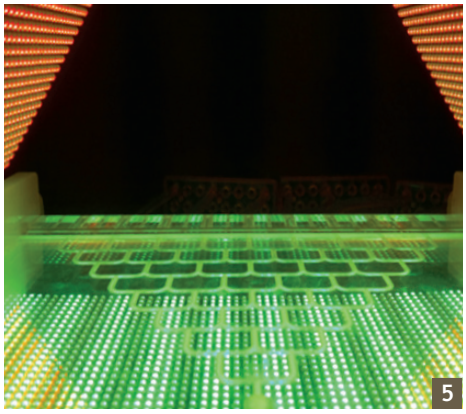
由于在情绪情感处理中扮演的角色以及作为臂旁核(PB)疼痛纤维的投射区域，杏仁核被认为是整合疼痛感觉和情感反应的位置。这项合作将增加我们对这些突触的了解，进而提高我们对痛觉信息如何负面影响情绪的理解，比如慢性痛引发的焦虑症和抑郁症。

Figure 1: The upgraded orthogonal 3D Helmholtz coils system for animal rearing in IBP.
图 1：改进后的可用于动物饲养的三轴亥姆霍兹线圈系统（生物物理所）。

Figure 2: An example of a large neurosphere observed in the HMF, from postnatal day 2 mouse subventricular zone tissue.
图 2：亚地磁场中形成的超大神经z（P2小鼠SVZ组织原代培养）。

Figure 3: Dr Tam Nguyen (QBI).
图3：Tam Nguyen博士（昆士兰大学脑研究所）访问中科院生物物理所孙坚原实验室.

Figure 4: Amygdala in a GAD67-EGFP transgenic mouse.
图4：GAD67-EGFP转基因小鼠的杏仁核.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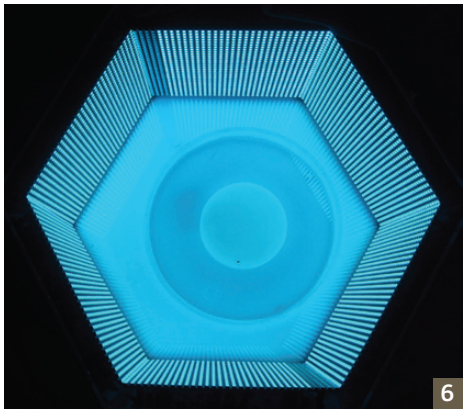
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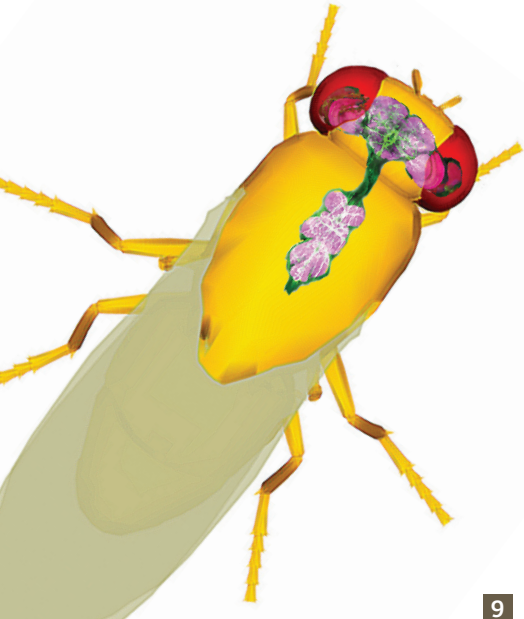
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Figure 9: The fly nervous system is composed of a brain in the head and a ventral nerve cord in the thorax. The nervous system pictured here is the octopaminergic system in green and the synaptic staining in magenta.
图9. 果蝇神经系统由头部的脑和胸节中的腹神经索组成。图片展示的神经系统中，绿色标记的是章鱼胺能系统，红紫色标记的是突触。

QBI-IBP JOINT LABORATORY UPDATE

Associate Professor Bruno van Swinderen and Professor Li Liu

Two related projects are currently underway in the Joint Laboratory, one focused on visual selective attention, and the other on sleep and anaesthesia. In the first project, Ms Yanqiong Zhou has recently completed a genetic screen for visual attention mutants, which was done in the laboratory of Professor Li Liu at IBP. This screen involved a behavioural paradigm where flies responded to competing visual stimuli. Ms Zhou has recently moved to the laboratory of Associate Professor Bruno van Swinderen at QBI to fully characterise these visual attention mutants, by imaging the targeted neurons and by electrophysiology. In addition, Ms Zhou will be developing a number of visual attention paradigms at QBI, and collaborating with Dr Angelique Paulk (Postdoctoral Researcher working on attention electrophysiology) and Ms Leonie Kirszenblat (PhD student working on sleep and attention).

For the second collaborative project on sleep and anaesthesia, Dr Ben Kottler from Dr van Swinderen's laboratory has spent a month at IBP to develop a common strategy for studying arousal circuits in the fly brain. Dr Kottler's research has identified neural systems in the central brain of *Drosophila* that modulate sleep and general anaesthesia phenotypes. Interestingly, the same neurons have been described by Dr Liu as being involved in visual learning (e.g., the fan-shaped body of the central complex), and by Professor Aike Guo as being involved in visual salience (e.g., dopamine). Together, these data suggest a common arousal matrix centred on monoaminergic modulation of central complex circuits. One goal here is to define the various components of this system, including the output neurons, in order to understand how a common arousal circuit might be regulating different behavioural programs ranging from attention and learning to sleep and anaesthesia.

合作实验室研究进展
Bruno van Swinderen 和刘力

目前联合实验室正在进行两项相关项目的研究，一个项目专注于视觉选择性注意，另一个项目则是专注于睡眠和麻醉。在第一个项目中，周艳琼博士已经在生物物理研究所刘力副教授课题组中，完成了视觉注意突变体的筛选。该筛选所涉及的行为范式是果蝇对竞争的视觉刺激的反应。目前周艳琼博士已在昆士兰脑研究所Bruno van Swinderen实验室中继续进行相关研究，希望通过免疫荧光成像技术和相关电生理实验，进一步了解这些筛选得到的注意突变体。另外，周艳琼博士将在昆士兰脑所开发一系列的视觉注意范式，并与Angelique Paulk博士（博士后，从事注意的电生理机制研究）和Leonie Kirszenblat（博士研究生，从事睡眠和注意研究）合作。

关于第二个睡眠和麻醉的合作项目，来自Bruno van Swinderen实验室的Benjamin Kottler博士用了一个月的时间在生物物理所共同制定研究果蝇觉醒的神经回路的策略。Kottler博士的研究发现果蝇的中央脑调节睡眠和全身麻醉的神经回路。有趣的是，之前刘力博士的实验室发现这些神经元参与视觉学习记忆（例如，中央复合体中的扇形体），并且郭爱克院士实验室曾报道它们参与视觉显著性（例如，多巴胺）。总之，这些数据表明，在单胺能调节的中央复合体回路 中存在一个共同的觉醒矩阵。本项目目标之一 是定义这个系统的各个组成部分，包括输出神经元，据此阐明同样的觉醒回路如如何调节从注意力、学习到睡眠、麻醉的不同行为。

Figure 5: Flies walk through a maze while a grating moves beneath. A visual response is calculated as a weighted average of the distribution of flies among the 9 tubes at the end of the maze.
Figure 6: Representation of the fly behaviour rig.
Figure 7: A tethered *Drosophila* fly over dome.
Figure 8: Dr Li Liu in the laboratory (IBP).

图5. 果蝇穿过下方有光栅移动的迷宫。视觉反应通过计算迷宫末端9个管子中果蝇分布的加权平均值来进行衡量。

图6. 果蝇行为学实验装置示意图。

图7. 固定的果蝇在球上飞行。

图8. 实验室中的刘力博士（生物物理所）。

Ms Yanqiong Zhou

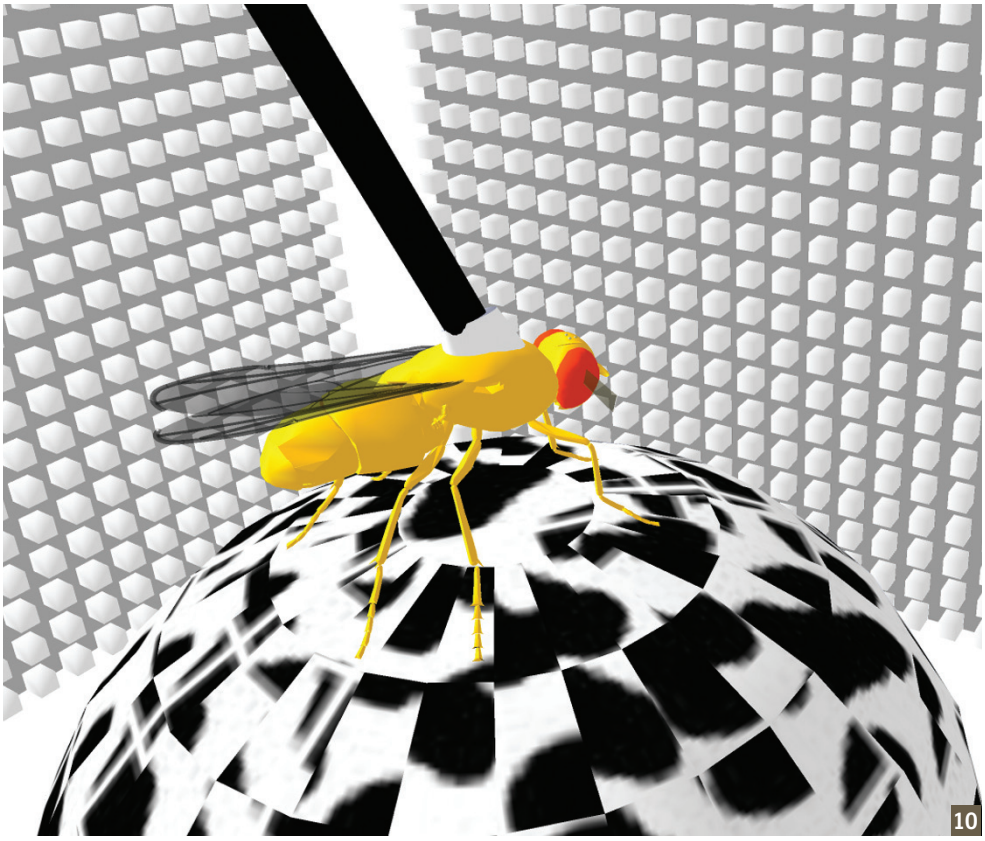
RESEARCHER PROFILE
Ms Yanqiong Zhou

Associate Professor Bruno van Swinderen's laboratory in QBI and Professor Li Liu's laboratory in IBP are collaborating on studying neural mechanisms of visual attention and learning. This joint project benefits from Dr Liu's knowledge in visual learning and Dr van Swinderen's expertise in visual attention. It's a great pleasure for me to participate in this joint project. I first visited Dr van Swinderen's laboratory in QBI in the middle of 2010. During my 2-month visit in Dr van Swinderen's laboratory, I learnt the visual attention paradigm and benefited a lot from interactions with all of the laboratory members. I completed my PhD in Dr Liu's laboratory in IBP at the beginning of 2012. After that, I have continued my work in QBI under Dr van Swinderen's supervision.

During my PhD I was also interested in visual attention and set up a visual selective attention paradigm under the supervision of Dr Liu. I performed a forward-genetic screen of a group of P-element insertion stocks and identified over 20 candidate genes affecting visual selective attention. In addition, I used the powerful genetic tools in *Drosophila* to explore the function of different neural substrates in visual selective attention.

After my PhD, I have continued my visual selective attention project under the supervision of Dr van Swinderen. I rebuilt my visual selective attention paradigm in Dr van Swinderen's laboratory to continue my behavioural research. Learning from Dr van Swinderen and other laboratory members' knowledge in electrophysiology, I have been exploring the neural activity of these candidate mutants, and am developing paradigms to monitor fly brain activity during behavioural testing.

This collaboration will improve our understanding of visual selective attention in *Drosophila* and can potentially benefit our knowledge in the underlying neural mechanism of visual selective attention in general. In our research, we will also explore the relationship between attention and different forms of learning.



10

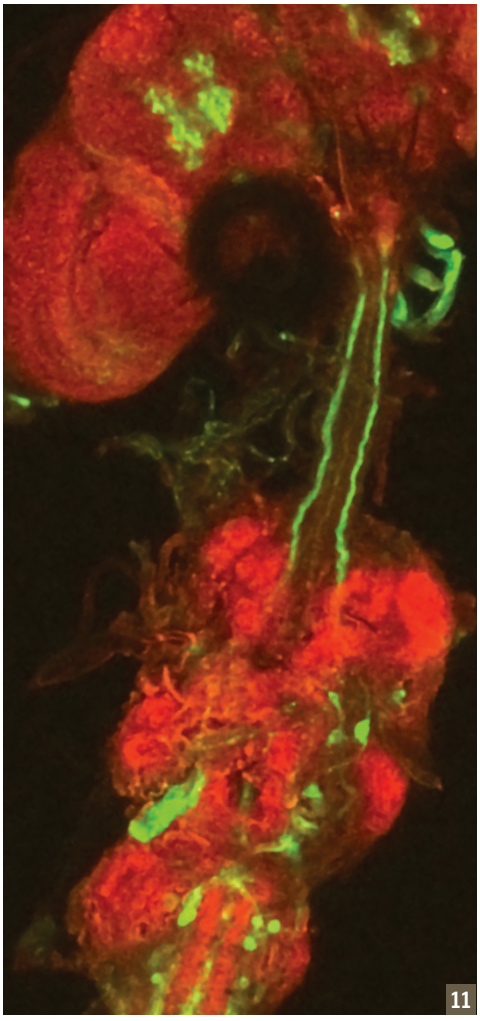
合作课题研究近况
周艳琼博士

昆士兰脑研究所的Bruno van Swinderen实验室和生物物理研究所刘力实验室都对“视觉注意力和学习的神经机制” 这个科研项目感兴趣,这促使了中澳实验室关于该课题的合作研究。这个合作项目得益于刘力研究员在视觉学习记忆方面的知识和Bruno van Swinderen教授在视觉选择注意方面的知识背景。我有幸参加了该合作项目并且在2010年到Bruno van Swinderen实验室交流学习。在昆士兰脑研究所交流学习的两个月中，我学习了视觉注意行为范式并且从实验室其他成员 身上 获益良多。我在生物物理研究所的刘力教授实验室完成了我的博士学习。之后，我作为昆士兰脑研究所的Bruno van Swinderen实验室的研究人员继续我的课题研究。

在博士学习期间我对视觉注意的神经机制非常感兴趣，于是我在刘力博士的指导下建立了单只果蝇的视觉选择注意行为范式。并且完成了P因子插入品系的正向遗传学筛选，在该筛选过程中得到了20多个视觉选择注意相关的备选基因。此外，我还通过果蝇的遗传学操作研究了果蝇不同脑区在视觉选择注意中的功能。

在博士学习之后我来到了昆士兰脑研究所的Bruno van Swinderen 博士实验室继续我的视觉选择注意项目。我在Bruno van Swinderen博士实验室建立了类似的视觉选择注意行为范式继续我的行为学研究。得益于Bruno van Swinderen博士和其他实验室成员的电生理学知识，我在这开始研究备选突变品系的电生理活动。我还打算建立一个行为-电生理范式来实时观测视觉选择注意行为过程中果蝇的电生理活动。

该合作研究会加深我们对果蝇视觉选择注意行为的理解，并将进一步拓展我们对视觉选择注意的神经机制的认识。在对视觉选择注意研究的基础上，未来我们会进一步研究视觉选择注意与视觉学习的关系。



11

Figure 10: 3D representation of a tethered *Drosophila* fly in rig.
图10.固定的果蝇在装置中飞行的三维示意图。

Figure 11: Confocal microscopic image showing the brain and ventral nerve cord in the fly.
图11. 共聚焦显微成像所展示的果蝇脑和腹神经索。

KEY PROJECTS UNDERWAY

合作重点课题

Screening molecules important in regulating neurogenesis – working towards a better understanding of dementia - Professor Perry Bartlett (QBI), Professor Rongqiao He (IBP) and Associate Professor Ying Liu (IBP).

筛选重要的神经发生调控因子-促进对痴呆症的更好理解 - Perry Bartlett（昆士兰大学脑研究所）和赫荣乔（生物物理所）、刘缨（生物物理所）。

Working toward understanding visual attention and learning using *Drosophila* genetic tools - Professor Li Liu (IBP) and Associate Professor Bruno van Swinderen (QBI).

使用果蝇的遗传学工具来理解视觉注意和学习的机制-刘力（生物物理所）和Bruno van Swinderen（昆士兰大学脑研究所）。

Studying the way painful stimuli lead to emotional outcomes – resulting in a better understanding of how we respond to pain and stress - Professor Pankaj Sah (QBI) and Professor Jianyuan Sun (IBP).

对痛觉刺激引发情绪化结果的研究，加深了我们对于人类如何响应疼痛及压力的理解 - Pankaj Sah (昆士兰大学脑研究所) 和 孙坚原 (生物物理研究所)。

Identifying molecules that encourage repair of axon tracts after spinal cord injury - Associate Professor Helen Cooper (QBI) and Professor Yaobo Liu (IBP, Suzhou University).

发现在脊髓损伤后能够帮助神经修复的分子和机制 - Helen Cooper（昆士兰大学脑研究所）和刘耀波（生物物理所客座研究员、苏州大学教授）。

Investigating bulk endocytosis at the molecular level, which will lead to a greater understanding of how neurons "talk" to each other - Associate Professor Frederic Meunier (QBI) and Professor Jianyuan Sun (IBP).

在分子水平上关于大团胞吞作用的研究，将极大地推进对神经元如何相互"交谈"的认知 Frederic Meunier (昆士兰大学脑研究所) 和 孙坚原 (生物物理研究所)。

COMINGS AND GOINGS

互访交流

In August 2011, Associate Professor Helen Cooper visited Professor Yaobo Liu's laboratory and presented her research at the symposium "Wnt signaling in axon guidance" at IBP.

2011年8月 1- 4号，澳大利亚昆士兰大学脑研究所 （QBI）Helen Cooper副教授访问中国科学院生物物理研究所刘耀波实验室, 并参加在中国科学院生物物理研究所举行的 "Wnt signaling in axon guidance" 小型国际学术研讨会，并做学术报告。

In October 2011, Mr Zhenhui Huang from Professor Yaobo Liu's laboratory visited Associate Professor Helen Cooper's laboratory in QBI, and carried out collaborative research of molecular mechanism underlying neural circuit formation including analysis of Ryk-/- mice and *in utero* electroporation.

2011年10月1-31号，刘耀波实验室研究生黄振晖访问昆士兰大学脑研究所Helen Cooper实验室，并进行 "红核神经环路构建的分子机理" 合作课题研究，开展了Ryk-/- 小鼠的分析以及胚胎宫内显微注射等工作。

In June 2012, Professor Yaobo Liu and Associate Professor Helen Cooper attended the Gordon Research Conference (cellular and molecular neurobiology) at HKUST (Hong Kong University of Science and Technology). They met here and discussed the detailed plan for future collaborations.

2012 年6月，刘耀波博士和Helen Cooper博士在参加香港科技大学举行的Gordon Research Conference（cellular and molecular neurobiology）时进行了会面，并且探讨和制定了今后进一步的合作研究计划。

Assoc. Professor Ying Liu (IBP)

Assoc. Professor Frederic Meunier (QBI)

Assoc. Professor Bruno van Swinderen (QBI)

Assoc. Professor Helen Cooper (QBI)