MMN2022

The 9th Mismatch Negativity conference in Fukushima

Mismatch negativity : neural basis and biomarker development

September 21(Wed) - 23(Fri), 2022
Venue CORASSE in Fukushima

MMN 2022 Management office
Fukushima Medical University School of Medicine
Department of Neuropsychiatry
Tel:+81.24.547.1331 Fax:+81.24.548.6735 Email:mmn2022@fmu.ac.jp
HP: https://www.c-linkage.co.jp/mmn2022/

なんとかしたい。
だから、挑む。

人類の歴史にはさまざまな挑戦者がいた。どんなに失敗しても、彼らの熱意や想いが何度も立ち上がらせ、その結果、常識を打ち破り新しい世界を見せてくれた。医薬はどうだ。空を自由に飛び、宇宙にまで届く時代に、私たちの体の中には未解決の課題が山積している。私たちにはやるべきことがある。助けなければならない人がいる。だから、挑む。大日本住友製薬は、2022年4月1日に住友ファーマと改め、革新的な医薬品や医療ソリューションの研究開発をより加速させるステージに立つ。研究重点3領域の精神神経、がん、再生・細胞医薬に加えて、感染症、糖尿病、医薬品以外のフロンティア領域で存在感を高めるために、挑み続けます。

大日本住友製薬から、住友ファーマに。

Sumitomo Pharma
Innovation today, healthier tomorrows

詳しくはこちら

Index

Greetings for the 9th Mismatch Negativity conference

Hirooki Yabe, President
Fukushima Medical University School of Medicine
Department of Neuropsychiatry

The 9th Mismatch Negativity conference（MMN 2022）will be held at the CORASSE in Fukushima for three days, September 21–23, 2022. It will be the first time the MMN meeting will be held in Japan. It is a great honor to be hosting this conference, and I would like to sincerely thank all the members and others involved for their support.

Human brain has developed the defensive system in audition to survive in the primeval forest. The automatic change-detection system enables us to find the incoming sound-changes of warning even during the meal. This brain system has been revealed by investigating the mismatch negativity (MMN) which Professor Risto Näätänen discovered in 1978. MMN is generated by the comparison process between sound change and the memory trace of the preceding sounds stored in sensory memory of the brain. This “memory trace theory” has been supported by a large amount of researches. The MMN can be automatically elicited by various types of sound changes, such as change of frequency, intensity, duration, spatial location, phonetic change, and even a stimulus omission (provided that omission is locked in 170 ms duration stimulus). The main generator of MMN is located in the vicinity of the primary auditory cortex as demonstrated by magnetoencephalographic (MEG) studies and electroencephalographic (EEG) studies in humans, electrical recording in cats, and monkeys. Recently, MMN is expected to be one of the promising neurophysiological bio-markers in schizophrenia, because the impaired MMN reflects the cognitive decline and/or psychosocial impairment in the patients with schizophrenia. Most importantly, MMN might provide the prediction of conversion to psychosis when the duration MMN was recorded in clinically at risk-mental state (ARMS) individuals. The MMN 2022 conference is the platform for recent and highly influential findings in basic and applied research related to MMN.

Now I would like to introduce Fukushima Medical University (FMU) and Fukushima Prefecture. FMU has its origins in Fukushima Prefectural Women's Medical College, which was established in 1944. FMU Hospital has a much older history; it has its roots in Shirakawa Temporary Hospital, established in 1871. FMU is now a comprehensive medical university with a school of medicine, nursing, and health science (physical therapy, occupational therapy, radiology, and clinical laboratory study).

Fukushima Prefecture boasts of being the third-largest area in Japan, and is known for its magnificent

display of nature, delicious food, and warm people. Fukushima is roughly divided into three areas: Aizu, Nakadori, and Hamadori.

As is well known, the big earthquake and the nuclear powerplant accident occurred on March 11, 2011. Fukushima was one of the worst-affected prefectures, but over the last few years, has taken bold steps towards prefecture-wide revitalization helped by the resilience and courage of its people.

The 9th MMN conference was originally scheduled for 2021; however, due to COVID-19 and the new coronavirus variants, we postponed the conference to 2022. The fight against COVID-19 is very tough, but I hope the pandemic will end in 2022 as huge efforts are being made to get the entire Japanese population vaccinated.
I am looking forward to meeting many researchers of MMN in Fukushima and wish the success of the MMN conference.

About the 9th Mismatch Negativity conference

Conference Chairman: Hirooki Yabe, (President Fukushima Medical University School of Medicine Department of Neuropsychiatry)

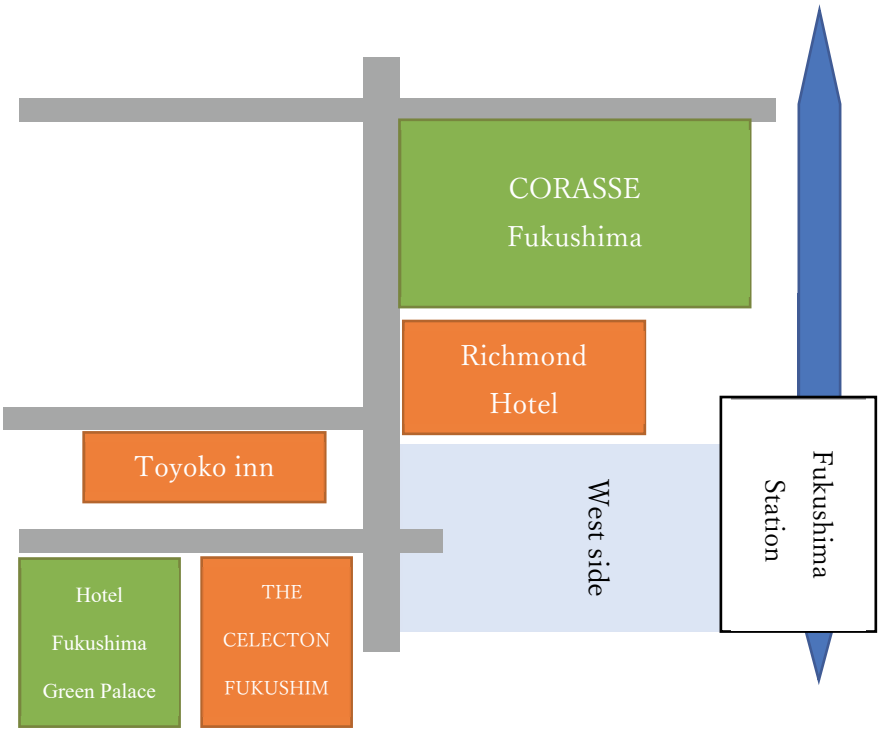
Time of the conference: September 21–23, 2022

Thema: Mismatch negativity: neural basis and biomarker development

Holding format: onsite and web

Conference venue: CORASSE Fukushima

1-20 Mikawaminami-machi, Fukushima city, Fukushima prefecture, Japan



management office:

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tel: +81-24-547-1331, fax: +81-24-548-6735

Timeline [Fukushima]	Timeline [SYD] fukushima +1h	Time Line [Helsinki] fukushima -6h	Time Line [Leipzig] [Budapest] [Barcelona] fukushima -7h	TimeLine [NY] fukushima -13h	2022/9/21 WED	2022/9/22 THU	2022/9/23 FRI
8:00	9:00	2:00	1:00	19:00	(Honorific titles omitted below)	Excursion Program (in Nihonmatsu City)	
8:30	9:30	2:30	1:30	19:30			
9:00	10:00	3:00	2:00	20:00	Registration		Symposium8 (Chair: Shugo Suwazono, Kazunari Ikeda) Shugo Suwazono, Kazunari Ikeda, Motonobu Hidaka, Yuhei Mori Application in Clinical Psychophysiology
9:30	10:30	3:30	2:30	20:30			
10:00	11:00	4:00	3:00	21:00	Opening Speech Hirooki Yabe		Symposium9 (Chair: Dean F Salisbury, Juanita Todd) Juanita Todd, Derek J. Fisher Christian Valt ,Fran López-Caballero MMN and Early Psychosis
10:30	11:30	4:30	3:30	21:30	Honor lecture (Chair: Hiroyuki Nawa) Patricia T. Michie MMN: from exhilarating beginnings, significant middle years to a glorious future.		Poster browsing
11:00	12:00	5:00	4:00	22:00			Break
11:30	12:30	5:30	4:30	22:30	Symposium1 (Chair: Piia Astikainen & Manuel Malmierca) Manuel S. Malmierca, Piia Astikainen, Tobias Teichert, Lauren Harms Misako Komatsu The neurobiological basis of predictive coding: Studies across animal species.		Symposium10 (Chair: Mari Tervaniemi, Elvira Brattico) Mari Tervaniemi, Elvira Brattico Vesa Putkinen, Niels Trusbak Haumann Naturalistic MMN paradigms - dream or reality?
12:00	13:00	6:00	5:00	23:00		Poster browsing	
12:30	13:30	6:30	5:30	23:30	Luncheon seminar 1 sponcered by Meiji Seika Pharma Co Ltd (Chair: Hirooki Yabe) Kiyoto Kasai Mismatch negativity: a translatable brain marker to understand psychosis		Luncheon seminar 2 sponcered by Takeda Pharmaceutical Co Ltd (Chair: Tomiki Sumiyoshi) Toshiaki Onitsuka Neurophysiological findings in patients with mood disorder
13:00	14:00	7:00	6:00	0:00			
13:30	14:30	7:30	6:30	0:30		Symposium4 (Chair: Fengyu Cong, Peixin Nie) Steven Luck, Scott Makeig Xiaoyu Wang, Fengyu Cong The Methodology Symposium	
14:00	15:00	8:00	7:00	1:00	Symposium2 (Chair: Hirokzau Takahashi, Hiroyuki Nawa) Tomoyo I. Shiramatsu, Amit Yaron Hiroyuki Nawa,Hirokazu Takahashi MMN in animal models		Symposium11 (Chair: Patricia Michie, Juanita Todd) Jaishree Jalewa, Patricia T. Michie Tomoyo Isoguchi Shiramatsu Jordan P. Hamm, Jakob Heinzle The Neuronal Basis of Predictive Coding: What we have learnt about Predictive Coding Deficits in Schizophrenia from Animal Studies
14:30	15:30	8:30	7:30	1:30		Symposium5 (Chair: Thomas Jacobsen) Giuseppe Di Dona, Arild Hestvik, Sari. P. Ylinen, Hatice Zora Language	
15:00	16:00	9:00	8:00	2:00	Break		Symposium12 (Chair: Vesa Putkinen, Teija Kujala) Laurel J Trainor, István Winkler Teija Kujala Mismatch response reflecting typical and atypical auditory cognition in infants
15:30	16:30	9:30	8:30	2:30	Symposium3 (Chair: Erich Schröger & Hiroshi Nittono) Kai Ishida & Hiroshi Nittono, Ana B. Lao-Rodríguez & Manuel S. Malmierca, Fabrice Parmentier, Erich Schröger & Andreas Widmann Auditory prediction violations with different types of regularities	Break	
16:00	17:00	10:00	9:00	3:00	Poster browsing	Symposium6 (Chair: Yuko Higuchi, Tetsuya Shiga) Kenji Kirihara, Yuko Higuchi Ryo Mizui, Tetsuya Shiga Mismatch negativity as a measure of synaptic plasticity and a biological biomarker in psychiatric disorders	Key note2 (Chair: Manuel S. Malmierca) Carles Escera Neural encoding of speech sounds at birth and during early development
16:30	17:30	10:30	9:30	3:30			
17:00	18:00	11:00	10:00	4:00	Afternoon coffee and poster session	Symposium7 (Chair: Motohiro Kimura, István Czigler) Ann-Kathrin Beck , Kairi Kreegipuu, Petia Kojouharova & István Czigler, Chun-Yu Tse Visual mismatch negativity	Closing Speech
17:30	18:30	11:30	10:30	4:30		Poster browsing	Poster removing
18:00	19:00	12:00	11:00	5:00	Key note1 (Chair: Erich Schroger) Claude Alain Optimizing auditory attention and performance: The role of long-term memory	Afternoon coffee and poster session	
18:30	19:30	12:30	11:30	5:30			
19:00	20:00	13:00	12:00	6:00			
19:30	20:30	13:30	12:30	6:30			
20:00	21:00	14:00	13:00	7:00		Reception (in Hotel Fukushima Green Palace)	
20:30	21:30	14:30	13:30	7:30			
21:00	22:00	15:00	14:00	8:00			

Dear participants

Register and pay of Registration fee

The conference accepts online registration only. Please register and pay the registration fee on the conference website(https://www.c-linkage.co.jp/mmn2022/ or QR code). When logging in for the first time, please create a new user account.

Registration Fees

	ADVANCED **Until June 1, 2022**	**REGULAR** **Until September 23, 2022**
STANDARD	JPY 35,000	JPY 40,000
STUDENT	JPY 20,000	JPY 25,000

- The registration fees include fees for welcome reception and allow you to join both onsite and online.

Name card and receipt/participation certificate

Name cards, participation certificates and receipts will be handed out at the venue. For web participation only, please contact the Secretariat (mmn2022@fmu.ac.jp).

Infection Control Measures at the Venue

1、Each day, you are required to submit a "Health Check Sheet" to the receptionist.
2、Please wear a mask in the venue.
3、Please refrain from talking when eating or drinking during the luncheon seminar, afternoon coffee and poster session.

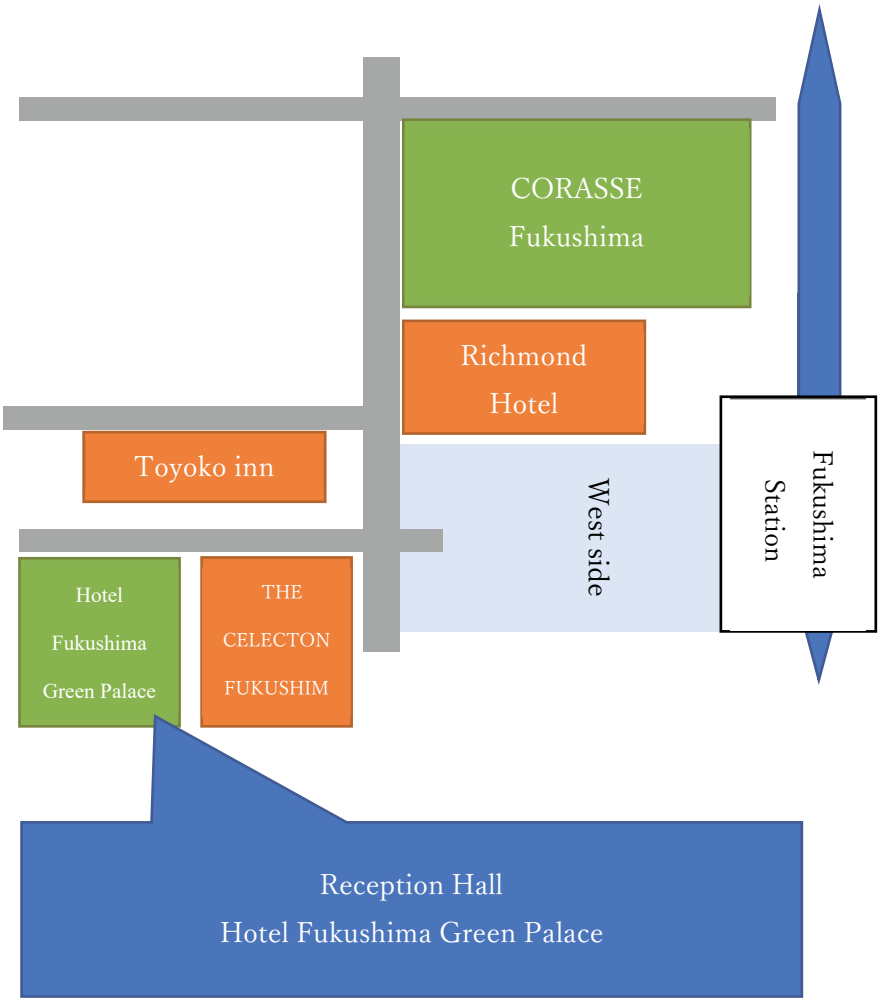
How to participate via web

For the Honor lecture, Keynote Lecture and Symposium, the venue will be webcast. We will be webcasting from the venue using Webex (https://www.webex.com/). All participants will be notified in advance of the participation URL. Please participate using the participation URL.

＊Please note that poster presentations will be only available on-site. If you cannot come to the venue, please send the data of your poster to the secretariat. The secretariat will print it out and post it.

Reception

We are planning reception in conference. The reception will be held at the Hotel Fukushima Green Palace in Sep 22nd 19:30 – 21:30. It is free of charge. Please note that the reception will be a seated dinner to prevent infection. There is no dress code, so please come in casual attire.



Excursion Program

The excursion program will begin at 8:00 a.m. on September 22. The destination is Nihonmatsu City located south of Fukushima City. Nihonmatsu has a castle ruin called Prefectural Kasumigajo Castle Park. In addition, there are many sake breweries. There is no charge for this event, including lunch, so please join us! The number of participants in this program is limited. We will accept applicants in advance.

Prefectural Kasumigajo Castle Park

Our called "Kasumigajo Castle", the official name is "Nihonmatsu Castle" and it was built by Michiyasu Hatakeyama who was appointed the Oshu Tandai (local commissioner in Oshu) in the middle of the Muromachi period (around 1414). Mitsushige Niwa was given control of the area and castle and granted in 1643 and it continued to be the castle of the Tanba family until the Meiji Restoration. As a result of the Boshin war (1868 to 1869), the Tanba family was wiped out and was forced out of the castle (July 29, 1868) and there were many harrowing stories starting with the gallant battles of the Nihonmatsu boys' brigade.

Established in 1752 (the 2nd year of the Horeki period), Daishichi Sake Brewery has always insisted on a strictly orthodox brewing tradition: the kimoto method. Daishichi's rich, mellow sakes are all outstanding examples of kimoto sake. Daishichi's history began when the Ohta family moved from the old Ise province to Nihonmatsu. The present head is the 10th generation. Daishichi's sakes come to life at a meal and form perfect pairings with fine food.

Daishichi Shuzo

Time line	8:00		8:45		9:45		10:00
itinerary	**Departure from Fukushima Station**	→ By bus	**Arrival at Kasumigajo Park**	→ Strolling in the park	**Departure from Kasumigajo Park**	→ By bus	**Arrival at Daishichi Sake Brewery**

	12:00		13:00
→ Sake Tasting and factory tour	**Departure from Daishichi Sake Brewery**	→ By bus	**Arrival at Fukushima Station**

Dear Chairperson and Presenters

Keynote lecture & symposium

For the Chairpersons

For on-site presentation

1. each session must be made on time.
2. Chairpersons are requested to be seated at the next chairperson's seat in the front row of the room 15 minutes prior to the start of each presentation.

For remote presenters

You will be connected to the venue by web conference system during your presentation time.

Please enter the Webex URL sent to you in advance from your PC by 30 minutes before the start of the session.

For the Presenters

About Presentation Data

1, All oral presentations will be PC presentations (single image projection).

2, A PC with Windows 10 OS will be provided at the venue.

3, Please bring your presentation data on a USB memory stick that can be read by Windows. When saving the data, please name the file "Session name - Presenter name (e.g. S1-name)".

4, Presentations must be created in PowerPoint 2010, 2013, 2016, or 2019 for Windows.

If your presentation data was created using the Macintosh version of PowerPoint, please be sure to bring the data that has been tested on a Windows PC. Please be sure to bring your own laptop computer.

5, Presentation data will be copied to the PC on site and will be deleted by the secretariat after the conference.

For remote presenters

Please enter the Webex URL sent to you in advance from your own PC at least 15 minutes before the session starts. A question-and-answer session will be held between the moderator and presenter via the web conferencing system.

Poster session

For the Presenters

1, Posting and Removal of Posters

Please display and remove your poster from the designated panel in the poster room during the following period.

Poster Putting	2022/09/21 11:30-15:00
Poster Removing	2022/09/23 17:30-18:00

2, How to display your poster

Poster panels 180 cm high by 90 cm wide will be provided at the venue. The dimensions for mounting posters are 140 cm (H) x 70 cm (W).

3, Presentation format

Poster session will be used free discussion format. Presenters are requested to stand in front of their own posters during the Afternoon coffee and poster session slot below to make presentations, answer questions, etc. If you have more than one presentation, please ask your co-authors to share the responsibility.

Afternoon coffee and poster session

2022/09/21 16:30-18:00

2022/09/22 18:00-19:00

Presenters are welcome to be at the poster room for either time. You are welcome to be present on both days. Light meals and beverages will be served on the floor during the discussions on both days. We look forward to a lively discussion and exchange of information among the participants in a friendly atmosphere.

4, If you are unable to attend on-site

If you cannot come to the venue, please send the data of your poster to the secretariat. The secretariat will print it out and post it.

It would be helpful if you could include your contact information for questions and answers on the poster.

Scientific Board

The 9th Mismatch Negativity conference (MMN2022) will be organized by the scientific boards on the below list members.

International Committee

Patricia Michie AUS
Juanita Todd AUS
Marta Garrido AUS
Fengyu Cong CHN
Yun Nan CHN
Erich Schroger DEU
Alexandra Bendixen DEU
Thomas Jacobsen DEU
Carles Escera ESP
Manuel S. Malmierca ESP
Kimmo Alho FIN
Mari Tervaniemi FIN
Teija Kujala FIN
Minna Huotilainen FIN
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Paavo Leppänen FIN
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Toshiaki Onitsuka JPN
Motohiro Kimura JPN
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Motonobu Hidaka
Yuko Higuchi
Kazunari Ikeda
Masumi Inagaki
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Taichi Kurayama
Takashi Matsuoka
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Hiroshi Nittono
Yusuke Osakabe
Katsuya Ota
Toyosaku Ota
Tetsuya Shiga
Tomoyo Shiramatsu
Shugo Suwazono
Shuntaro Itagaki
Kazuhiko Yamamuro
Hirooki Yabe

Local organizer

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Takaaki Chiyoda
Yuya Hagane
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Takashi Matsuoka
Itaru Miura
Yuhei Mori
Michinari Nozaki
Haruka Ochiai
Yusuke Osakabe
Aya Sato
Tetsuya Shiga
Ken Suzutani
Yuichi Takahashi
Ryo Tanji
Wataru Toda
Yuka Ueda
Tomohiro Wada
Hirooki Yabe

Programs

Day1 21st, September 2022

10:00-10:30

Opening Speech

Hirooki Yabe

10:30-11:30 Honor lecture
Chairperson: Hiroyuki Nawa. Department of Physiological Sciences, School of Pharmaceutical Sciences, Wakayama Medical University

MMN: from exhilarating beginnings, significant middle years to a glorious future.

Lecturer：Patricia T. Michie

School of Psychological Sciences, College of Engineering, Science and Environment, University of Newcastle. Callaghan, NSW.

11:30-12:30 Symposium 1 **The neurobiological basis of predictive coding: Studies across animal species.**
Chairperson： Piia Astikainen[1], Manuel S. Malmierca[2]. [1]Department of Psychology, University of Jyvaskyla, Jyväskylä, Finland [2]Institute of Neuroscience, Med School. Univ. Salamanca. Spain.

Talk1: Basic studies on SSA and MMN and the neuromodulatory role of achetylcholine in deviance detection in rats

David-Pérez-González[1], Ana Belén Lao-Rodríguez[1], Cristian Aedo-Sánchez[1], Manuel S. Malmierca[1].

[1]Institute of Neuroscience, Med School. Univ. Salamanca. Spain.

Talk2: Speech perception and speech sound learning in rodents

Piia Astikainen[1], Arto Lipponen[1], Tiantian Yang[1], Markku Penttonen[1,] Jari Kurkela[1], Kaisa Lohvansuu[1].

[1]Department of Psychology, University of Jyvaskyla, Jyväskylä, Finland

Talk3: Mismatch Negativity in the Monkey is Supported by Two Distinct Auditory Short-term Memory Systems

Tobias Teichert[1]

[1]Department of Psychiatry, Department of Bioengineering, Center for Neuroscience, University of Pittsburgh

Talk 4: How well do mismatch responses in rats emulate the predictive coding nature of MMN in humans?

Lauren Harms[1], Jaishree Jalewa[1], Deborah Hodgson[1], Juanita Todd[1], Patricia Michie[1]

[1]University of Newcastle, Callaghan, NSW, Australia

Talk 5: Constructing the Hierarchy of Predictive Auditory Sequences in the Marmoset Brain

Misako Komatsu,[1] Yuwei Jiang,[2] Yuyan Chen,[2] Ruoying Xie,[2] Kaiwei Zhang,[2] Ying Xia,[2] Peng Gui,[2] Zhifeng Liang,[2] Liping Wang.[2]

[1]RIKEN Center for Brain Science, Saitama, Japan,

[2]CEBSIT, CAS, Shanghai, China.

[3]Laboratory for Molecular Analysis of Higher Brain Function, Center for Brain Science, RIKEN, Saitama, Japan.

12:30-14:00 Luncheon seminar 1

Sponsored by Meiji Seika Pharma Co., Ltd

Chairperson：Hirooki Yabe

Department of Neuropsychiatry, Fukushima Medical University School of Medicine

Mismatch negativity: a translatable brain marker to understand psychosis

Lecturer：Kiyoto Kasai

Department of Neuropsychiatry, Graduate School of Medicine, 13143The University of Tokyo, Tokyo, Japan.

The International Research Center for Neurointelligence (WPI-IRCN) at The University of Tokyo Institutes for Advanced Study (UTIAS), 13143The University of Tokyo, Tokyo, Japan.

University of Tokyo Institute for Diversity & Adaptation of Human Mind (UTIDAHM), Tokyo, Japan.

UTokyo Center for Integrative Science of Human Behavior (CiSHuB), Graduate School of Art and Sciences, 13143The University of Tokyo, Tokyo, Japan.
Center for Diversity in Medical Education and Research, Graduate School of Medicine, 13143The University of Tokyo, Tokyo, Japan.

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14:00-15:00 Symposium 2

New trends of MMN studies in animal models

Chairperson： Hirokzau Takahashi[1], Hiroyuki Nawa[2].

[1]Graduate School of Information Science and Technology, The University of Tokyo, Tokyo, Japan

[2] Department of Physiological Sciences, School of Pharmaceutical Sciences, Wakayama Medical University

Talk1: Cortical mapping of auditory, visual, and cross-modal mismatch negativities in rat

Tomoyo Isoguchi Shiramatsu,[1] Kanato Mori, [1] Hirokazu Takahashi,[1]

[1]Graduate School of Information Science and Technology, The University of Tokyo, Tokyo, Japan

Talk2: Stimulus-specific adaptation to behaviorally relevant sounds in awake rats

Amit Yaron [1 2 3] , Maciej M. Jankowski [3], Ruan Badrieh [2], Israel Nelken [2 3]

[1] International Research Center for Neurointelligence (WPI-IRCN), The University of Tokyo Institutes for Advanced Study

[2] Department of Neurobiology, Institute of Life Sciences, Hebrew University of Jerusalem, Jerusalem, Israel,

[3] The Edmond and Lily Safra Center for Brain Sciences, Hebrew University of Jerusalem, Jerusalem, Israel

Talk3: Pitch and duration mismatch negativity of a cytokine-induced rat model for schizophrenia

Hiroyuki Nawa

Department of Physiological Sciences, School of Pharmaceutical Sciences, Wakayama Medical University

Talk4: Beat synchronization in rat

Hirokazu Takahashi [1], Yoshiki Ito [1,] Tomoyo [I]. Shiramatsu [1], Naoki Ishida [1],
Karin Oshima[1], Kaho Magami [1]

[1]Graduate School of Information Science and Technology, The University of Tokyo, Tokyo, Japan

15：00-15：30

Break

15:30-16:30 Symposium3

Auditory prediction violations with different types of regularities

Chairperson： Erich Schröger[1], Hiroshi Nittono[2]

[1]Wilhelm-Wundt Institute for Psychology, Leipzig University, Leipzig, Germany

[2]Graduate School of Human Sciences, Osaka University, Japan

Talk1: Parallel Detection of Music-Syntactic and Acoustic Irregularities in Chord Progression

Kai Ishida[1], Hiroshi Nittono[1]

[1]Graduate School of Human Sciences, Osaka University, Japan

Talk2: The Sound of Silence: Neuronal Responses to Omitted Tones in the Auditory Brain

Ana B. Lao Rodríguez[1], Karol Przewrocki[2], David Pérez-González[1], Artoghrul Alishbayli[2], Bernhard Englitz[2] and Manuel S. Malmierca[2]

[1] Cognitive and Auditory Neuroscience Laboratory. Institute of Neuroscience of Castilla y León (INCYL). Salamanca. Spain.

[2] Computational Neuroscience Lab. Department of Neurophysiology. Donders Centre for Neuroscience. Nijmegen, The Netherlands.

Talk3: Behavioral distraction by violation of sensory predictions: deviant sounds vs unexpected silences

Fabrice B. R. Parmentier[1,3], Alicia Leiva[2], Pilar Andrés[1], Murray T. Maybery[3]

[1]Department of Psychology & Research Institute of Health Sciences, University of the Balearic Islands

[2]Department of Psychology, Universitat de Vic-Universitat Central de Catalunya, Spain

[3]School of Psychological Science, University of Western Australia

Talk4: Effects of violation of auditory predictions based on sound regularity versus action intention

Erich Schröger[1], Andreas Widmann,[1,2]

[1]Wilhelm-Wundt Institute for Psychology, Leipzig University, Leipzig, Germany

[2]Leibniz Institute for Neurobiology, Magdeburg, Germany

16:30-18:00

Afternoon coffee and poster session

18:00-19:00 Key note1
Chairperson: Erich Schroger Wilhelm-Wundt Institute for Psychology, Leipzig University, Leipzig, Germany

Optimizing auditory attention and performance: The role of long-term memory

Lecturer：Claude Alain

Rotman Research Institute, Baycrest Centre

Department of Psychology, University of Toronto

Day2 22nd, September 2022

8:00-13:00

Excursion Program

13:30-14:30 Symposium4 **The Methodology Symposium**
Chairperson： Fengyu Cong[1], Peixin Nie[2], [1]School of Biomedical Engineering, Dalian University of Technology, China, [2]Centre of Excellence on Music, Mind, Body and Brain, Cognitive Brain Research Unit, University of Helsinki, Finland,

Talk1: Quantifying data quality for the MMN and other common ERP components

Steven Luck

Department of Psychology, Center for Neuroscience, UC Davis, USA

Talk2: Unattended auditory stream orienting as a brain network event

Scott Makeig

Swartz Center for Computational Neuroscience, Institute for Neural Computation, UC San Diego, USA

Talk3: Similarity analysis of passive auditory ERPs for individual-level diagnosis of disorders of consciousness.

Xiaoyu Wang,

Department of Physiology and Pharmacology, Western University, Canada

Talk4: Temporal hierarchy characteristic of passive auditory ERPs and its clinical application.

Fengyu Cong

School of Biomedical Engineering, Dalian University of Technology, China,

14:30-15:30 Symposium5

Language

Chairperson： Thomas Jacobsen

Experimental Psychology Unit, Helmut Schmidt University/University of the Federal Armed Forces Hamburg, Hamburg, Germany

Talk1: Can the MMN differentiate word representations embedding familiar and unfamiliar allophones? A study on native speakers of regional linguistic varieties.

Giuseppe Di Dona[1], Federica Mantione[1], Birgit Alber[2], Simone Sulpizio[3,4,] Francesco Vespignani[5]

[1] Dipartimento di Psicologia e Scienze Cognitive, Università degli Studi di Trento, Italy

[2] Facoltà di Scienze della Formazione, Libera Università di Bolzano, Italy

[3] Dipartimento di Psicologia, Università degli Studi di Milano-Bicocca, Italy

[4] Milan Center for Neuroscience (NeuroMi), Università degli Studi di Milano-Bicocca, Italy

[5] Dipartimento di Psicologia dello Sviluppo e della Socializzazione, Università degli Studi di Padova, Italy

Talk2: On the effect of "varying the standards" in linguistic MMN experiments

Arild Hestvik[1], Chao Han[1], Ryan Rhodes[2], William Idsardi[3]

[1] Department of Linguistics and Cognitive Science, University of Delaware, USA

[2] Center for Cognitive Science, Rutgers University, USA

[3] Department of Linguistics, University of Maryland, USA

Talk3: The processing and learning of linguistic rules in the brain as indicated by the MMN

Sari. P. Ylinen[1,2]

[1] Faculty of Social Sciences, Tampere University, Finland

[2] Cognitive Brain Research Unit, Faculty of Medicine, University of Helsinki, Finland

Talk4: Macro- Micro- and Nano-level Signatures of Prosodic Information Processing

Hatice Zora[1]

[1] Neurobiology of Language Department, Max Planck Institute for Psycholinguistics, Netherlands

16:00-17:00 Symposium6

Mismatch negativity as a measure of synaptic plasticity and a biological biomarker in psychiatric disorders

Chairperson：Yuko Higuchi,[1,2], Tetsuya Shiga[3]

[1] Department of Neuropsychiatry, Graduate School of Medicine and Pharmaceutical Sciences, University of Toyama, Toyama, Japan

[2] Research Center for Idling Brain Science, University of Toyama, Toyama, Japan

[3] Fukushima Medical University, School of Medicine, Department of Neuropsychiatry, Fukushima, Japan

Taik1: Mismatch negativity as a biological marker in early stages of psychosis

Kenji Kirihara,[1,2] Mariko Tada,[2,3] Daisuke Koshiyama,[2] Mao Fujioka,[2] Kaori Usui,[2] Ryoichi Nishimura,[2] Tsuyoshi Araki,[2,4] Kiyoto Kasai[2]

[1]Disability Services Office, The University of Tokyo, Tokyo, Japan

[2]Department of Neuropsychiatry, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan

[3]Office for Mental Health Support, Center for Research on Counseling and Support Services, The University of Tokyo, Tokyo, Japan

[4]Department of Psychiatry, Teikyo University Hospital, Mizonokuchi, Kawasaki, Japan

Taik2: Mismatch Negativity in Attention-Deficit/Hyperactivity Disorder

Ryo Mizui,[1] MD, Toyosaku Ota,[2] MD, PhD

[1]Department of Psychiatry, Nara Medical University, Kashihara

[2]Department of Human Development, Nara Medical University, Kashihara

Talk3: Event-related potentials as a feasible biomarker in the high-risk state for psychosis; an update

Yuko Higuchi,[1,2], Tomiki Sumiyoshi[3], Takahiro Tateno[1,2], Suguru Nakajima[1,2], Naohito Kaneko[1,2,] Yuko Mizukami[1], Yukiko Akasaki[1], Daiki Sasabayashi[1,2,] Tsutomu Takahashi[1,2], Michio Suzuki[1,2]

[1] Department of Neuropsychiatry, Graduate School of Medicine and Pharmaceutical Sciences, University of Toyama, Toyama, Japan

[2] Research Center for Idling Brain Science, University of Toyama, Toyama, Japan

[3] Department of Preventive Intervention for Psychiatric Disorders, National Institute of Mental Health, National Center of Neurology and Psychiatry, Tokyo, Japan

Taik4: Mismatch negativity as an indicator of synaptic plasticity in psychiatric medication and neuromodulation

Tetsuya Shiga

Fukushima Medical University, School of Medicine, Department of Neuropsychiatry, Fukushima, Japan

17:00-18:00 Symposium7

Visual mismatch negativity

Chairperson：Motohiro Kimura[1], István Czigler[2]

[1]Advanced Industrial Science and Technology, Tsukuba, Japan

[2]Research Centre for Natural Sciences, Institute of Cognitive Neuroscience and Psychology, Budapest, Hungary

Talk1: Can categorical information modulate the visual mismatch-negativity?

Ann-Kathrin Beck

Center for Cognitive Science, University of Kaiserslautern, Germany

Talk2: Reliability and validity of the vMMN for letters

Kairi Kreegipuu

Institute of Psychology, University of Tartu, Tartu, Estonia

Talk3: Localizing the visual mismatch negativity (vMMN)

Petia Kojouharova and István Czigler

Research Centre for Natural Sciences, Institute of Cognitive Neuroscience and Psychology, Budapest, Hungary

Talk4: From the Optical Mismatch Responses in Auditory and Visual Change Detections to a Generic Fronto-Sensory Cortical Brain Network in Mismatch Negativity

Chun-Yu Tse

Department of Social and Behavioural Sciences, City University of Hong Kong, Hong Kong

18:00-19:00

Afternoon coffee and poster session

19:30-21:00

Reception

Day3 23rd, September 2022

9:00-10:00 Symposium 8

Application in Clinical Psychophysiology

Chairperson： Shugo Suwazono[1], Kazunari Ikeda[2]

[1]Center for Clinical Neuroscience, National Hospital Organization Okinawa National Hospital, Ginowan, Japan

[2]Tokyo Gakugei University, Koganei, Japan

Talk1: ERP abnormalities in patients with myotonic dystrophy, including P3a and mismatch negativity

Shugo Suwazono,[1] Hiroshi Arao,[2] Shino Maedo,[3] Yukihiko Ueda[3]

[1]Center for Clinical Neuroscience, National Hospital Organization Okinawa National Hospital, Ginowan, Japan

[2]Taisho University, Tokyo, Japan

[3]Okinawa International University, Ginowan, Japan

Talk2: Mismatch negativity deficits associated with sensory hypersensitivity in autism spectrum disorder

Kazunari Ikeda[1]

[1]Tokyo Gakugei University, Koganei, Japan

Talk3: Mismatch negativity in Japanese children with developmental dyslexia

Motonobu Hidaka[1]

[1]Saga University, Saga, Japan

Talk4: A functionally impaired temporal window of integration leading to mismatch negativity abnormalities in schizophrenia

Yuhei Mori,[1] Hiroshi Hoshino,[1] Yusuke Osakabe,[1] Tomohiro Wada,[1] Kazuko Kanno,[1] Tetsuya Shiga,[1] Shuntaro Itagaki,[1] Itaru Miura,[1] Hirooki Yabe[1]

[1]Fukushima Medical University, School of Medicine, Department of Neuropsychiatry, Fukushima, Japan

10:00-11:00 Symposium 9

MMN and Early Psychosis

Chairperson： Dean F Salisbury[1], Juanita Todd[2],

[1]Clinical Neurophysiology Research Laboratory, Western Psychiatric Hospital, Department of Psychiatry, University of Pittsburgh School of Medicine, Pittsburgh, PA, USA

[2]School of Psychological Sciences, University of Newcastle.

Talk1: Computational modelling exposes early signs of auditory network changes associated with smaller mismatch negativity in schizophrenia.

Juanita Todd[1], Zachary Howard[2], Ryszard Auksztulewicz[3,] Dean Salisbury[4]

[1]School of Psychological Sciences, University of Newcastle.

[2]School of Psychological Science, University of Western Australia.

[3]European Neuroscience Institute - A Joint Initiative of the University Medical Center Göttingen and the Max Planck Society; Göttingen, Germany.

[4]Department of Psychiatry, University of Pittsburgh School of Medicine.

Talk2: Utility of complex MMN elicited by auditory patterns in early phase psychosis

Derek J. Fisher[1,2,3,4], T-Jay Anderson[2], Jenna N. Bissonnette[3], Emma M.L. Ells[1], Hayley Riel[3], Erica D. Rudolph[4,] Dean F. Salisbury[5], Philip G. Tibbo[3]

[1] Department of Psychology, Mount Saint Vincent University, Halifax, NS, Canada

[2] Department of Psychology & Neuroscience, Dalhousie University, Halifax, NS, Canada

[3] Department of Psychiatry, Dalhousie University, Halifax, NS, Canada

[4] Department of Psychology, Saint Mary's University, Halifax, NS, Canada

[5] Department of Psychiatry, University of Pittsburgh Medical Centre, Pittsburgh, PA, USA

Talk3: Reduced Magnetic Mismatch Negativity in Psychosis

Christian Valt[1], Tiziana Quarto[1,2], Angelantonio Tavella[3], Fabiola Romanelli[3], Leonardo Fazio[1,4], Giorgio Arcara[5], Mario Altamura[6], Antonello Bellomo[6], Giuseppe Barrasso[7], Giuseppe Blasi[1,3], Flora Brudaglio[7], Angela Carofiglio[8], Enrico D'Ambrosio[3,9], Flavia Antida Padalino[6], Antonio Rampino[1,3], Alessandro Saponaro[10], Domenico Semisa[8], Domenico Suma[10], Giulio Pergola[1], & Alessandro Bertolino[1,3],

[1] Department of Basic Medical Sciences, Neuroscience and Sense Organs, University of Bari Aldo Moro, Bari, Italy.

[2] Department of Law, University of Foggia, Foggia, Italy.

[3] Bari University Hospital.

[4] IRCCS "Casa Sollievo Della Sofferenza" – San Giovanni Rotondo, Foggia, Italy.

[5] IRCCS San Camillo Hospital, Lido, Venice, Italy

[6] Department of Clinical and Experimental Medicine, University of Foggia, Foggia, Italy.

[7] Department of Mental Health, ASL Barletta-Andria-Trani, Andria, Italy.

[8] Department of Mental Health, ASL Bari, Bari, Italy.

[9] Department of Psychosis Studies, Institute of Psychiatry, Psychology & Neuroscience – King's College London, London, United Kingdom.

[10] Department of Mental Health, ASL Brindisi, Brindisi, Italy.

Talk4: Longitudinal assessment of magnetoencephalographic (MEG) pitch and duration MMN in first-episode psychosis: progressive deficits in right-hemisphere lateral belt

Fran López-Caballero, Yiming Wang, Dylan Seebold, Rebekah Farris, Vanessa Fishel, Natasha Torrence, Mark Curtis, Brian A Coffman, Dean F Salisbury

Clinical Neurophysiology Research Laboratory, Western Psychiatric Hospital, University of Pittsburgh School of Medicine, Pittsburgh, PA, USA

11:00-11:30

Break

11:30-12:30 Symposium 10

Naturalistic MMN paradigms - dream or reality?

Chairperson：Mari Tervaniemi[1,2], Elvira Brattico[3,4].

[1]Cognitive Brain Research Unit, Department of Psychology and Logopedics, Faculty of Medicine, University of Helsinki, Helsinki, Finland

[2]Centre of Excellence in Music, Mind, Body and Brain (MMBB), Faculty of Educational Sciences, University of Helsinki, Finland

[3]Center for Music in the Brain, Department of Clinical Medicine, Aarhus University, Denmark

[4]Department of Education, Psychology, Communication, University of Bari Aldo Moro, Italy

Talk1：Various auditory stimulation paradigms in MMN studies

Mari Tervaniemi

Cognitive Brain Research Unit, Department of Psychology and Logopedics, Faculty of Medicine, University of Helsinki, Helsinki, Finland

Centre of Excellence in Music, Mind, Body and Brain (MMBB), Faculty of Educational Sciences, University of Helsinki, Finland

Talk2: Investigating learning and maturation in the brain with naturalistic MMN paradigms

Elvira Brattico

Center for Music in the Brain, Department of Clinical Medicine, Aarhus University, Denmark

Department of Education, Psychology, Communication, University of Bari Aldo Moro, Italy

Talk3: The effects of music and language training on MMN generators in complex stimulation paradigms

Vesa Putkinen,

Turku PET Center, University of Turku, Turku, Finland

Talk4: Clinical applications of naturalistic MMN paradigms

Niels Trusbak Haumann

Center for Music in the Brain, Department of Clinical Medicine, Aarhus University, Denmark

12:30-14:00 Luncheon seminar 2

Sponsored by Takeda Pharmaceutical Company Limited.

Chairperson: Tomiki Sumiyoshi

Department of Preventive Intervention for Psychiatric Disorders, National Institute of Mental Health, National Center of Neurology and Psychiatry, Kodaira, Tokyo, Japan.

Neurophysiological findings in patients with mood disorder

Lecturer: Toshiaki Onitsuka

Department of Neuroimaging Psychiatry, Graduate School of Medical Sciences, Kyushu University, Fukuoka, Japan.

14:00-15:00 Symposium 11

The Neuronal Basis of Predictive Coding: What we have learnt about Predictive Coding Deficits in Schizophrenia from Animal Studies

Chairperson: Patricia Michie[1], Juanita Todd[1].

[1] School of Psychological Sciences, University of Newcastle, Australia

Talk 1: The effect of schizophrenia risk factors on mismatch responses in a rat model: the importance of contextual factors induced by paradigm manipulations and sex for modelling schizophrenia-like MMN impairments in rodents.

Jaishree Jalewa[1], Juanita Todd[1], Patricia T. Michie[1], Deborah M. Hodgson[1], Lauren Harms[2]

[1] School of Psychological Sciences, College of Engineering, Science and Environment, University of Newcastle, Callaghan, NSW 2308. Australia

[2] School of Biomedical Science and Pharmacy, College of Health, Medicine and Wellbeing, University of Newcastle, Callaghan, NSW 2308. Australia

Talk 2: Why the NMDA model of schizophrenia is not the whole story based on NMDA-R antagonism in animal models and what are the data that suggest this?

Patricia T. Michie,[1] Lauren Harms,[2] Gloria G. Parras[3], Manuel S. Malmierca[3]

[1]School of Psychological Sciences, College of Engineering, Science and Environment, University of Newcastle. Callaghan, NSW.

[2]School of Biomedical Sciences and Pharmacy, College of Health, Medicine and Wellbeing, University of Newcastle. Callaghan, NSW

[3]Cognitive and Auditory Neuroscience Laboratory, Institute of Neuroscience of Castilla y León (INCYL), Salamanca, Spain.

Talk 3: A new functional role of MMN-like response beyond simple deviance detection: using animal models to elucidate the underlying neural mechanisms of schizophrenia

Tomoyo Isoguchi Shiramatsu,[1] Hirokazu Takahashi,[1]

[1]Graduate School of Information Science and Technology, The University of Tokyo, Tokyo, Japan

Talk 4: Cortical Microcircuit Mechanisms of Mismatch Negativity and Its Underlying Subcomponents

Jordan P. Hamm[1]

[1]Neuroscience Institute, Georgia State University, Atlanta, Georgia, United States of America

Talk 5: Model-based prediction of muscarinic receptor function from auditory mismatch negativity responses

Jakob Heinzle,[1] Dario Schöbi,[1] Klaas Enno Stephan[1,2,3]

[1]Translational Neuromodeling Unit, Institute for Biomedical Engineering, University of Zurich & Swiss Institute of Technology (ETH Zurich), Zurich, Switzerland,

[2]Wellcome Centre for Human Neuroimaging, University College London, London, UK,

[3]Max Planck Institute for Metabolism Research, Cologne, Germany

15:00-16:00 Symposium 12

Mismatch response reflecting typical and atypical auditory cognition in infants

Chairperson： Vesa Putkinen[1,2] Teija Kujala[1]

[1]Cognitive Brain Research Unit, Centre of Excellence in Music, Mind, Body and Brain, Department of Psychology and Logopedics, Faculty of Medicine, University of Helsinki, Helsinki, Finland,

[2]Turku PET Centre, University of Turku, Turku, Finland,

Talk 1: Rhythm in the premature brain: Neural encoding of auditory beat and grouping (meter) structure

Laurel J Trainor,[1,2] Sahar Moghimi,[3,4] Erica Flaten,[1] Mohammadreza Edalati,[3,4] Guy Kongolo,[3,4] Ghida Ghostine,[3,4] Fabrice Wallois[3,4]

[1]Department of Psychology, Neuroscience & Behaviour, McMaster University, Hamilton, Canada,

[2]McMaster Institute for Music and the Mind, McMaster University, Hamilton, Canada,

[3]Inserm UMR1105, Groupe de Recherches sur l'Analyse Multimodale de la Fonction Cérébrale, Amiens, France,

[4]Inserm UMR1105, EFSN Pédiatriques,, Amiens, France

Talk 2: Statistical learning and higher-order structure in neonates

István Winkler,[1] Juanita Todd,[2] Gábor P. Háden[1,3]

[1]Institute of Cognitive Neuroscience and Psychology, Research Centre for Natural Sciences, Budapest, [2]School of Psychological Sciences, University of Newcastle, Callaghan,

[3]Department of Telecommunications and Media Informatics, Budapest University of Technology and Economics, Budapest

Talk 3: Early neural signs of dyslexia and potential means to prevent reading problems

Teija Kujala,[1] Paula Virtala[1]

[1]Cognitive Brain Research Unit, Centre of Excellence in Music, Mind, Body and Brain, Department of Psychology and Logopedics, Faculty of Medicine, University of Helsinki

16:00-17:00 Key note2

Chairperson：Manuel S. Malmierca

Institute of Neuroscience, Med School. Univ. Salamanca. Spain.

Neural encoding of speech sounds at birth and during early development

Lecturer: Carles Escera

[1]Cognitive Neuroscience Research Group, Department of Clinical Psychology and Psychobiology, University of Barcelona,

[2]Institute of Neurosciences, University of Barcelona,

[3]Institut de Recerca Sant Joan de Déu (IRSJD), Esplugues de Llobregat, Barcelona

17:00-17:30 Closing Speech

Poster session

Group1 MMN in Basic Fields (Animal, Neural and Brain)

Moderator: Eiichi Jodo[1], Misako Komatsu[2], Tomoyo Shiramatsu[3],

[1]Department of Systems Neuroscience, School of Medicine, Fukushima Medical University, Fukushima, Japan

[2]RIKEN Center for Brain Science, Saitama, Japan,

[3] Graduate School of Information Science and Technology, The University of Tokyo

P-1 Sensitivity to Complex Statistical Regularities in Neuronal Culture

Amit Yaron,[1] Zhuo Zhang,[2] Tomoyo Isoguchi Shiramatsu,[2] Zenas C. Chao [1],
Hirokazu Takahashi[2]

[1] International Research Center for Neurointelligence (WPI-IRCN), The University of Tokyo Institutes for Advanced Study

[2] Graduate School of Information Science and Technology, The University of Tokyo

P-2 Loss of asymmetry of the descending vs ascending deviant MMN response in the alternating paradigm.

Jaishree Jalewa[1], Juanita Todd[1], Patricia T. Michie[1], Deborah M. Hodgson[1], Lauren Harms[2]

[1] School of Psychology, University of Newcastle, Australia.

[2] School of Biomedical Sciences and Pharmacy, University of Newcastle, Australia.

P-3 Human brain network involved in auditory deviance detection. An intracranial EEG study.

Alejandro Omar Blenkmann[1], Anne-Kristin Solbakk[1], Sabine Leske[1], Anais Llorens[2], Ingrid Funderud[1], Santiago Collavini[3], Pål G. Larson[4], Jugoslav Ivanovic[4], Torstein Meling[4], Tristan Bekinschtein[5], Silvia Kochen[3], Robert T Knight[2], Tor Endestad[1]

[1] Department of Psychology, University of Oslo, Oslo,

[2] Helen Wills Neuroscience Institute and Department of Psychology, University of California at Berkeley, Berkeley,

[3] Studies in Neurosciences and Complex Systems, National Scientific and Technical Research Council - El Cruce Hospital, Florencio Varela,

[4] Department of Neurosurgery, Oslo University Hospital, Rikshospitalet, Oslo,

[5] Psychology Department, University of Cambridge, Cambridge.

P-4 Deviance Detection Properties in Dissociated Cultures of Neurons

Zhuo Zhang,[1] Amit Yaron,[2] Tomoyo Isoguchi Shiramatsu,[1] Hirokazu Takahashi [1]

[1] Graduate School of Information Science and Technology, The University of Tokyo,

[2] International Research Center for Neurointelligence (WPI-IRCN), The University of Tokyo Institutes for Advanced Study

P-5 Altered hierarchical predictive processing after lesions to the orbitofrontal cortex

Olgerta Asko[1], Alejandro O. Blenkmann[1], Sabine L. Leske[2], Anaïs Llorens[3], Maja Dyhre Foldal[1], Ingrid Funderud, Torstein R. Meling, Robert T. Knight[3,] Tor Endestad[1], and Anne-Kristin Solbakk[1,4]

[1]RITMO, Department of Psychology, University of Oslo, Oslo, Norway

[2]RITMO, Department of Musicology, University of Oslo, Oslo, Norway

[3]Helen Wills Neuroscience Institute and Department of Psychology, University of California, Berkeley, CA, USA

[4]Department of Neurosurgery, Oslo University Hospital, Rikshospitalet, Oslo, Norway

P-6 Development during the 1st year of hearing:Typically hearing vs. cochlear implanted children

Niki Katerina Vavatzanidis[1] , Alexandra Horst[1] , Nina Siefke[1] , Alexander Mainka[1,2] , Dirk Mürbe[1,2] , Anja Hahne[1]

[1]Medical Faculty, Technische Universität Dresden, Germany,

[2]Department of Audiology and Phoniatrics, Charité Berlin, Germany

P-7 Network of the mismatch negativity in a gap multideviant paradigm

Thomas Augereau [1, 2, 3], François Champoux[1, 3], & Victoria Duda[1, 2]

[1] School of Speech Language Pathology and Audiology, University of Montreal,

[2] Institut universitaire sur la readaptation en déficience physique de Montréal,

[3] Centre de recherche de l'Institut universitaire de gériatrie de Montréal

P-8 Mismatch responses to sound source elevationdeviants in mice

Alessandro Braga,[1,2] Marc Schonwiesner[1,3]

[1]Institute of Biology, Faculty of Life Sciences, University of Leipzig, Leipzig,Germany,

[2]International Max Plank Research School, Max Plank Institute for Human Cognitive and Brain Sciences, Leipzig, Germany,

[3]International Laboratory for Research on Brain, Music, and Sound (BRAMS), Universite de Montreal, Montreal, QC, Canada

Group2 Auditory MMN

Moderator: Masumi Inagaki[1], Kazunari Ikeda[2], Shuntaro Itagaki[3], Yuhei Mori[3].

[1]Tottori prefectural Tottori Rehabilitation Center

[2]Tokyo Gakugei University, Koganei, Japan

[3]Department of Neuropsychiatry, school of Medicine, Fukushima Medical University

P-9 Neural Indices of Top-Down Meter Perception: A Comparison of Infants and Adults

Erica Flaten[1], Laurel J. Trainor[1]

[1] Department of Psychology, Neuroscience & Behaviour, McMaster University, Hamilton, CA

P-10 Symbolic vs. Gradient Phonemes

Chao Han[1], Ryan Rhodes[2], William Idsardi[3], Arild Hestvik[1]

[1] Department of Linguistics and Cognitive Science, University of Delaware, Newark, DE, USA

[2] Rutgers Center for Cognitive Science, Rutgers University, New Brunswick, NJ, USA

[3] Department of Linguistics, University of Maryland, College Park, MD, USA

P-11 Ambiguous culture or unambiguous nature? Neural correlates of melodic expectations

Mathias Klarlund[1,2,3], Elvira Brattico[3,4], Marcus Pearce[3,8], Xing Lidongshen[1,5], David Ricardo Quiroga Martinez[3,9], Niels Trusbak Haumann[3], Peter Vuust[3], Yi Du[1,5,6,7].

[1] CAS Key Laboratory of Behavioral Science, Institute of Psychology, Chinese Academy of Sciences, Beijing, China,

[2] Sino-Danish College, University of Chinese Academy of Sciences, Beijing, China

[3] Center for Music in the Brain, Department of Clinical Medicine, Aarhus University & Royal Academy of Music Aarhus/Aalborg, Aarhus, Denmark

[4] Department of Education, Psychology, Communication, University of Bari Aldo Moro, Italy

[5] Department of Psychology, University of Chinese Academy of Sciences, Beijing, China

[6] CAS Center for Excellence in Brain Science and Intelligence Technology, Shanghai, China

[7] Chinese Institute for Brain Research, Beijing, China

[8] Music Cognition Lab, Queen Mary University of London, London, England

[9] Knight laboratory, University of California, Berkeley, USA.

P-12 Hearing thresholds related to auditory MMN

Nele Põldver[1], Kati Luukas[1], Kairi Kreegipuu[1]

[1] Institute of Psychology, University of Tartu, Tartu, Estonia

P-13 Complementary Time Thresholds in MMN Elicitation with Global Duration Increase

Xuemei Li[1], Hayate Ohwada[1], Kazunari Ikeda[1]

[1] Laboratory of Cognitive Psychophysiology, Tokyo Gakugei University, Koganei, Tokyo

P-14 Mismatch responses to violations of musical features in children compared to adults

Alexandre Celma-Miralles[1], Marina Kliuchko[2], Silvia E.P. Bruzzone[3], Niels T. Haumann[1], Pætur Zachariasson, Peter Vuust[1], Elvira Brattico[1,4]

[1]Department of Clinical Medicine, Aarhus University and Royal Academy of Music Aarhus/Aalborg, Aarhus, Denmark;

[2]Department of Health Technology, Technical University of Denmark, Lyngby, Denmark

[3]Dept. Neurology and Neurobiology Research Unit, Copenhagen University Hospital, Copenhagen, Denmark;

[4]Department of Education, Psychology, Communication, University of Bari Aldo Moro, Italy

P-15 Harmonic and inharmonic sounds: which ones elicit greater prediction errors?

Krzysztof Basínski[1], Alexandre Celma-Miralles[2], David R. Quiroga-Martínez[2,3], Peter Vuust[2]

[1]Division of Quality of Life Research, Medical University of Gdańsk, Gdańsk, Poland;

[2]Department of Clinical Medicine, Aarhus University and Royal Academy of Music Aarhus/Aalborg, Aarhus, Denmark;

[3]Helen Wills Neuroscience Institute, University of California Berkeley, United States of America

P-16 Standard tone stability as a manipulation of precision in the oddball paradigm: modulation of prediction error responses to fixed-probability deviants

Iria SanMiguel[1,2,3], Jordi Costa-Faidella[1,2,3], Zulay R Lugo[4], Elisabet Vilella[4,5], Carles Escera[1,2,3]

[1] Brainlab-Cognitive Neuroscience Research Group, Department of Clinical Psychology and Psychobiology, University of Barcelona, Barcelona, Spain

[2] Institute of Neurosciences, University of Barcelona, Barcelona, Spain

[3] Institut de Recerca Sant Joan de Déu, Esplugues de Llobregat, Spain.

[4] Hospital Universitari Institut Pere Mata, IISPV, URV, Reus, Spain

[5] Centro de investigación biomédica en red en salud mental (CIBERSAM), Spain

P-17 What can music preference teach us about the auditory mismatch negativity?

Vincent K.M. Cheung[1], Shinichi Furuya[1]

[1]Sony Computer Science Laboratories, Inc., Tokyo

P-18 Spatial Variability Does Not Reduce MMN Amplitude

Juanita Todd,[1] Mattsen Yeark[1], Bryan Paton[1]

[1]School of Psychology, University of Newcastle

P-19 The relationship of stream segregation and the temporal integration.

Ken Suzutani,[1] Hiroshi Hoshino,[1] Ayaka Arakawa,[1] Yuhei Mori,1 Takaaki Chiyoda,[1] Ryuta kawamoto,[1] Aya Sato,[1] Yuichi Takahashi,[1] Tomohiro Wada,[1] Yuka Ueda,[1] Takatomo Matsumoto,1 Kazuko Kanno,[1] Yusuke Osakabe,[1] Michinari Nozaki,1Masayuki Hikita,1 Tetsuya Shiga,[1] Shuntaro Itagaki,[1] Itaru Miura,1 Takashi Matsuoka,1and Hirooki Yabe,[1]

[1]Department of Neuropsychiatry, school of Medicine, Fukushima Medical University

P-20 Does frequency mismatch negativity reflect when frequency changes delayed from stimulus onset?

Hiroshi Hoshino[1] Ayaka Arakawa[1], Ken Suzutani[1], Takaaki Chiyoda[1], Yusuke Osakabe[1], Tetsuya Shiga[1], Kazuko Kanno[1], Michinari Nozaki[1], Masayuki Hikita[1], Takatomo Matsumoto[1], Yuka Ueda[1], Tomohiro Wada[1], Yuhei Mori[1], Yuichi Tkahashi[1], Aya Sato[1], Ryuta Kawamoto[1], Shuntaro Itagaki[1], Itaru Miura[1], Takashi Matsuoka[1], Hirooki Yabe[1]

[1] Department of Neuropsychiatry, School of Medicine, Fukushima Medical University Fukushima, Japan

P-21 Examination of healthy subjects affected by mismatch negativity in the second half of change of the sound stimuli

Ayaka Arakawa[1], Hiroshi Hoshino[1], Ken Suzutani[1], Motonobu Hidaka[2], Kazuko Kanno[1], Yuhei Mori[1], Aya Sato[1], Takaaki Chiyoda[1], Ryuuta Kawamoto[1], Yuka Ueda[1], Takatomo Matsumoto[1], Yuuichi Takahashi[1], Tomohiro Wada[1], Yuusuke Osakabe[1], Masayuki Hikita[1], Tetsuya Shiga[1], Shuntaro Itagaki[1], Itaru Miura[1], Hirooki Yabe[1],

[1] Department of Neuropsychiatry, School of Medicine, Fukushima Medical University Fukushima, Japan

[2]Faculty of Education, Saga University

P-22 The mismatch negativity to abstract relationship can be modulated by attention

Yi-Fang Hsu [1,2], Chia-An Tu[1,2], Yuchun Chen[1,3], Huei-Mei Liu[1,4]

[1] Institute for Research Excellence in Learning Sciences, National Taiwan Normal University, 106308 Taipei, Taiwan

[2] Department of Educational Psychology and Counselling, National Taiwan Normal University, 106308 Taipei, Taiwan

[3] Center of Teacher Education, Fu Jen Catholic University, 242062 New Taipei City, Taiwan

[4] Department of Special Education, National Taiwan Normal University, 106308 Taipei, Taiwan

Group3 Language perception& processing
Moderator: Motonobu Hidaka Saga University, Saga, Japan

P-23 Effect of environmental exposure to foreign speech perception: a cross-linguistic study

Kaijun Jiang,[1] Xueqiao Li[1] & Piia Astikainen[1]

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P-24 Native language impacts the perception of linguistic as well as non-linguistic stimuli

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P-25 Maturation of Speech-evoked Mismatch Responses to Persian Initial Consonant Deviants

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Group4 Somatosensory MMN & Visual MMN

Moderator: Taichi Kurayama[1], Petia Kojouharova[2]

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P-26 Somatosensory mismatch response is elicited by location but not by intensity changes

Elina S. Kangas[1], Elisa Vuoriainen[2], Xueqiao Li[1], Pessi Lyyra[1], & Piia Astikainen[1]

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P-27 Differences of the somatosensory mismatch negativity between hand and foot stimulation.

Taichi Kurayama, Minami Haga and Eri Kato.

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P-28 Comparisons of ERP Responses to Auditory and Visual Stimulus Omissions

Tomomi Ishida[1] & Hiroshi Nittono[1]

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P-29 Proof of different processing resources for unattended and attended stimuli

Kairi Kreegipuu, Nele Põldver

University of Tartu, Tartu, Estonia, Institute of Psychology

P-30 What does VMMN tell about predictive model updating?

Motohiro Kimura[1]

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P-31 Automatic processing of two simultaneous oddball sequences: a visual mismatch negativity study

Nóra Csikós[1,2], Béla Petro[1,3], Petia Kojouharova[1], István Czigle[r1]

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Group5 Clinical MMN

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P-32 Associations of childhood maltreatment with mismatch negativity and P300 in adults with autism spectrum disorder

Kosuke Okazaki,[1] Kazuhiko Yamamuro,[1] Ryo Mizui,[1] Kibo Ishioka,[2] Kohei Kamikawa,[1] Fumimaro Doi,[3] Yuri Maeda,[1] Toyosaku Ota,[4] Manabu Makinodan[1],

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P-33 Evaluation of cognitive function using the event related potential in adolescent anorexia nervosa.

Ryo Mizui,[1] Kazuhiko Yamamuro,[1] Kosuke Okazaki,[1] Kibo Ishioka,[2] Kohei Kamikawa,[1] Fumimaro Doi,[1] Yuri Maeda ,[1]Toyosaku Ota,[3] Manabu Makinodan[1]

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P-34 Maturation of Neural Speech Processing, Prelinguistic Skills and The Effects of Early Music Exposure in Infants At Risk for Dyslexia

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P-35 Alzheimer's disease – neuro-desynchronisation as a potential resourceful paternal set for AI

Anna kaszyńska,[1 2]

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P-36 Interim analysis of duration - mismatch negativity in adult with autism spectrum disorder versus attention deficit hyperactivity disorder

Aya Sato,[1] Shuntaro Itagaki,[1] Takashi Onishi,[2] Yusuke Osakabe,[1] Hiroshi Hoshino,[1] Kazuko Kanno,[1] Hirooki Yabe,[1]

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P-37 A longitudinal comparative study of MMN in Mild cognitive impairment and Parkinson's disease

Yuya Hagane[1] Tetsuya Shiga Wataru[1] Toda[1] Itaru Miura[1] Mitsunari Abe[2] Kazuaki Kanai[3] Hiroshi Ito[4] Hirooki Yabe[1]

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P-38 Effects of night and shift work disrupting circadian rhythms on duration mismatch negativity

Kazuko Kanno[1], Hiroshi Hoshino[1],Yuhei Mori[1], Ayaka Arakawa[1], Ryuta Kawamoto[1], Takaaki Chiyoda[1], Yuichi Takahashi[1], Aya Sato[1], Ken Suzutani[1], Tomohiro Wada[1], Yuka Ueda[1], Takatomo Matsumoto[1], Michinari Nozaki[1], Yusuke Osakabe1, Tetsuya Shiga[1], Masayuki Hikita[1], Shuntaro Itagaki[1], Itaru Miura[1], Takashi Matsuoka[1], and Hirooki Yabe[1]

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P-39 Impaired mismatch negativity reflects the inability to perceive beat interval in patients with schizophrenia

Yuichi Takahashi[1,2], Shinya Fujii[3], Yusuke Osakabe[1], Hiroshi Hoshino[1], Rei Konno[3], Takeyasu Kakamu[4], Tetsuhito Fukushima[4], Takatomo Matsumoto[1], Kumi Yoshida[1], Shuntaro Aoki[1], Kazuko Kanno[1], Naoyuki Ooi[2], Yuka Ueda[1], Ken Suzutani[1], Aya Sato[1], Yuhei Mori[1], Tomohiro Wada[1], Tetsuya Shig[a1], Shuntaro Itagaki[1], Itaru Miura[1], and Hirooki Yabe[1]

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P-40 Effects of benzodiazepine dosage on mismatch negativity.

Yuka Ueda[1], Tetsuya Shiga[1], Kazuko Kanno[1], Hiroshi Hoshino[1], Haruka Ochiai[2], Sho Horikoshi[3], Yuhei Mori[1], Wataru Toda[1], Norika Hirayama[1], Yuya Hagane[1], Ryo Tanji[1], Yusuke Osakabe[1], Shuntaro Itagaki[1], Itaru Miura[1], Hirooki Yabe[1].

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P-41 Interim report on the change of MMN before and fter weight recovery in AN.

Tomohiro Wada,[1] Hiroshi Hoshino,[1] Yuhei Mori,[1] Ayaka Arakawa,[1] Ryuta Kawamoto,[1] Takaaki Chiyoda,[1] Yuichi Takahashi,[1] Aya Sato,[1] Ken Suzutani,[1] Kazuko Kanno,[1] Yuka Ueda,[1] Takatomo Matsumoto,[1] Michinari Nozaki,[1] Yusuke Osakabe,[1] Tetsuya Shiga,[1] Masayuki Hikita,[1] Shuntaro Itagaki,[1] Itaru Miura,[1] Takashi Matsuoka,[1]and Hirooki Yabe,[1]

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P-42 The effect of oxytocin nasal spray on cognitive dysfunction in schizophrenia measured by mismatch negativity

Haruka Ochiai,[1] Norika Hirayama[2], Tetsuya Shiga[2], Hiroshi Hoshino[2], Yuya Hagane[2], Ryo Tanji[2], Yuhei Mori[2], Yuka Ueda[2], Wataru Toda[2], Sho Horikoshi[3], Kazuko Kannno[2], Itaru Miura[2], Hirooki Yabe[2]

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Abstracts

Honor Lector

Honor lecture
Chairperson: Hiroyuki Nawa. Department of Physiological Sciences, School of Pharmaceutical Sciences, Wakayama Medical University

MMN: from exhilarating beginnings, significant middle years to a glorious future.

Lecturer : Patricia T. Michie

School of Psychological Sciences, College of Engineering, Science and Environment, University of Newcastle. Callaghan, NSW.

ABSTRACT

In this historical perspective on MMN, the towering figure of Professor Risto Näätänen dominates the landscape intellectually and physically. As a young academic, I spent a 3 months sabbatical with Risto in Helsinki in the fall of 1977 during which time we wrote the review published in Biological Psychology in 1979 where we identified two negativities – mismatch negativity (MMN) and processing negativity. Processing negativity disappeared as a topic of research focus in the following decades but MMN went on under Risto's guidance to be a major source of information about brain function and continues to do so today. Risto's early research was devoted to discovering characteristics of the deviant stimulus on MMN amplitude and latency: degree of deviance difference, probability, type of deviance, etc. He and his collaborators showed that the amplitude of this automatically elicited potential was related to the discrimination capacities of the individual, that it was robustly elicited by a variety of deviant dimensions at least in the auditory modality and that it was real!

It wasn't long before the concept of MMN reflecting the operation of a sensory memory for recent events and a primitive intelligence emerged. Risto led the charge on these ideas – the TINS 2001 paper showing that the mechanisms underlying MMN were responsible for parsing the chaos of the auditory stimulus into separate streams is a tour de force. These concepts and debates

about the role of adaptation in the generation of MMN merged into the realization that MMN was a reflective of predictive coding in the brain and more generally of the brain as a predictive machine. Risto challenged many of us in this room and attending remotely, his collaborators and colleagues, to ask new research questions and test novel hypotheses using MMN.

Risto embraced the finding that MMN was reduced in various clinical conditions and has written extensively on this issue. Because its generation is not reliant on active attention to the eliciting stimulus, MMN is an ideal measure to use in conditions where the patient is unable to respond (e.g. coma), where assessments cannot rely on intact cognitive capacities (e.g. in schizophrenia) or studies of early development in infants and children. To this day, reduced MMN is the most replicated biomarker of schizophrenia! The role of the glutamate NMDA receptor system in mediating synaptic plasticity and in the generation of MMN lent weight to an alternative model of schizophrenia as a disorder of the Glutamatergic system, in contrast to the dominant Dopaminergic model of psychosis.

MMN continues to surprise us – witness the finding of primacy bias (or first impressions learning) observed by my colleague Juanita Todd – and what it reveals about fundamental learning mechanisms of the brain. Or the information coming from the many animal studies of MMN. With the advent of new technologies (eg triaxial OPMs for MEG measurement) and advanced hypotheses arising from predictive coding theories, the continued contribution of MMN to brain science in the future is ensured.

Keynote lecture

Key note1
Chairperson: Erich Schroger Wilhelm-Wundt Institute for Psychology, Leipzig University, Leipzig, Germany

Optimizing auditory attention and performance: The role of long-term memory

Lecturer：Claude Alain

Rotman Research Institute, Baycrest Centre

Department of Psychology, University of Toronto

ABSTRACT

Auditory scene analysis (ASA) is an area of study in cognitive neuroscience that seeks to understand how we perceive and identify sound objects in the environment from the soundscape (i.e., a mixture of sound waveforms) that reaches our ears. To date, ASA research has primarily focused on low-level feature-driven processes using a wide range of pure tone configurations. In comparison, the influence of prior knowledge or experience on ASA has received relatively little attention. In a series of studies, we measure neuroelectric brain activity to examine the interplay between attention and memory during ASA. We use a novel auditory paradigm to assess how long-term contextual memory facilitates the detection of an auditory target in healthy young adults and whether performance on this task is related to Apolipoprotein E4 (APOE4) genotype, a risk factor for sporadic Alzheimer's disease. Findings from these studies reveal benefits from long-term auditory memory on signal detection, which is associated with specific neural signatures. Evidence also suggests that these auditory associations can be formed automatically and subsequently used to guide attention. Consistent with vision research, memory-guided auditory attention may be supported by enhanced top-down attention employed by the superior partial lobe. These studies advance attention and ASA theories by comprehensively examining the mnemonic source of attentional bias and the mechanisms that optimize auditory attention and performance.

Key note2
Chairperson：Manuel S. Malmierca Institute of Neuroscience, Med School. Univ. Salamanca. Spain.

Neural encoding of speech sounds at birth and during early development

Carles Escera

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ABSTRACT

Infants master their native language with remarkable ease, following a common developmental trajectory across different languages and cultures. There is ample consensus on critical behavioral attainments at given time points during development, such as cooing (1-4 months), babbling (6-10 months) and uttering the first words (12 months). Mismatch negativity played also a very relevant role in revealing that language-specific phoneme representations are well formed by the age of six months. Yet, the underlying neural underpinnings of these language attainments are poorly understood. The acquisition of spoken language requires a sophisticated neural machinery to disentangle the fine-grained spectro-temporal acoustic features differentiating speech sounds. This neural machinery is partially functional in utero, from the 27th gestational week, and keeps its natural maturation processes under genetic, biological, nutritional and environmental influences. From the very same moment of birth, the baby is exposed to a much richer acoustic environment (the mother's bomb behaves as low-pass filter), fostering rapid plastic-dependent changes in the neural encoding of complex sound features, that I will argue, support early language acquisition.

Here, I will discuss the results of a series of studies carried out in my laboratory addressed to investigate the neural consequences of a compromised environment during fetal development, neural plasticity during fetal hearing and the natural maturation of the sophisticated neural machinery supporting the encoding of the fine-grained spetro-temporal features of speech sounds. Specifically, we ask questions related to the effects of abnormal intrauterine nutrition and birth weight, twin gestations, the prenatal exposure to moderate alcohol consumption, the exposure to environmental music –and to a mono/bilingual acoustic environments- during pregnancy, and the development of the neural encoding of speech sounds in neonates and infants during the early months of life.

These studies were carried out with the Frequency-Following Response (FFR), a non-invasive scalp-recorded auditory evoked potential that reflects compound phase-locked neural activity elicited to the spectrotemporal components of the acoustic signal, along the entire auditory hierarchy. Compared to other evoked potentials such as mismatch responses, the FFR is unique as it transparently mimics the eliciting stimulus, so that it can be “heard” when played through a speaker. By decomposing the FFR into the temporal and spectral domains, one can read subcortico-cortical neural traces from the scalp as sounds are transcribed in neuronal aggregates, and how these sound traces are shaped by experience and context. Results obtained so-far allowed us to establish the standards for recording the neonatal FFR in a hospital routine, to show that fundamental frequency (F0) encoding is adult-like at birth whereas temporal-fine structure encoding develops by the age of 6 months, and that babies born small or large for gestational age have compromised neural encoding of F0 at birth. Furthermore, we observed identical FFRs in twins compared to non-related newborn pairs, and that music exposure and a monolingual environment during pregnancy enhances the neonatal FFR. Altogether, these result support the FFR as a powerful to investigate the neural underpinnings of early language acquisition.

Funding. PGC2018-094765-B-I00 MCIN/AEI/10.13039/50110001103; Fundación Alicia Koplowitz; 2022AR-IRSJDCdTorres; ICREA Acadèmia.

Symposium

Symposium 1

The neurobiological basis of predictive coding: Studies across animal species.

Chairperson： Piia Astikainen[1], Manuel S. Malmierca[2].

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[2]Institute of Neuroscience, Med School. Univ. Salamanca. Spain.

Description of theme and target audience

Currently there is rather universal consensus in neuroscience, that a major function of the brain is to constantly predict the environment on multiple levels. For example, one anticipates how a word of a friend will sound, and when and how a sentence will end, even before it has ended. This proposal is based on the assumption that the brain's neuronal circuitry is organized as a highly predictive machine (Friston and colleagues). Behavior becomes more efficient when we can predict a stimulus. This is the basis of the enormous flexibility underlying interactions with our physical and social environment. Impairments in this process likely underlie the cognitive deficits observed in autism and schizophrenia. One model of study this theory of predictive coding is stimulus-specific adaptation (SSA, a change-detection measure). SSA has become a major field of research in recent years. It is believed to parallel Mismatch Negativity (MMN), a human EEG deflection. MMN has been positioned as a promising biomarker for the diagnosis of pathologies such as schizophrenia and autism spectrum disorders. Thus, SSA, MMN and other models presented here may become a handle for understanding neuronal dysfunction in such disorders.

Filtering out non-relevant stimuli is an important but understudied aspect of cognition. The auditory system is particularly important for predictive processing because it can detect signals coming from any direction within noisy backgrounds in a pre-attentive mode (e.g. during sleep). The auditory system can, thus, cope with the variability and redundancy in the auditory scene. This symposium will address the adaptive nature of the neural coding behind background characterization, novelty detection, and decision making in the auditory system of mammals under different degrees of uncertainty.

While a great deal of research on MMN and predictive coding has been carried out in humans, studies on animal models are elusive despite the fact that animal experiments are advantageous for clear ethical and methodological reasons. For example, recent studies have demonstrated that the rodent brain can detect auditory changes along the auditory hierarchy not only in simple, but also in complex sounds including speech sounds, as indexed by the mismatch response (MMR). MMR is elicited in rodents also to violations in speech sound patterns mimicking grammatical rules. Auditory perceptual learning has been demonstrated in rats due to short-term passive exposure to speech sounds. We will present a series of complementary talks based on animal studies from more simple rodent models to more complex primate model that highlight the similarities and differences across studies and species.

Talk1: Basic studies on SSA and MMN and the neuromodulatory role of achetylcholine in deviance detection in rats

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ABSTRACT

Neuromodulatory inputs can not only gate plasticity (Martins and Froemke, 2015), but also change the balance of top-down versus bottom-up influence. For instance, it is well known that neuromodulation strongly impacts sensory processing, learning and memory.

According to the predictive coding theory (Friston, 2005), the brain constantly generates top-down predictions that are compared with sensory bottom-up signals. The ability of the brain to recognize which prediction errors carry reliable information is critical in the process of prediction error minimization. For example, if a sensor is malfunctioning because of an impairment (e.g., hearing loss or tinnitus) or because it is operating out of its appropriate physical range, the sensory input it provides may not be adequately reporting on real changes in the environment, which would generate misinformative prediction errors. According to the predictive coding theory, this distinction between signal and noise is based on an important element, the so-called precision, which weights the driving power of prediction errors according to how reliable they are estimated to be (Friston, 2005).

Predictive coding models propose that neuromodulatory systems implement precision weighting through regulation of postsynaptic gain (Bastos et al., 2012), particularly theorizing about the involvement of acetylcholine (Moran et al., 2013) and dopamine (Friston et al., 2012). Therefore, in this talk I will show our recent work that investigates which neuromodulators are involved in the encoding of the predictions and prediction errors and how neuromodulators regulate the precision of prediction errors. We have used single neuron recordings and microiontophoresis manipulation of the cholinergic system in the rat brain to study how these neuromodulators shape the predictive responses in cortical and subcortical brain regions.

Financial support was provided by the Spanish Agencia Estatal de Investigación [(AEI), PID2019-104570RB-I00] to MSM; DPG was supported by the by the European Union's Horizon 2020 research and innovation programme under grant agreement No 952378 - BrainTwin. BE,

Talk2: Speech perception and speech sound learning in rodents

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ABSTRACT

Mismatch negativity (MMN), which is an electrophysiological response found both in humans and animals, reflects deviance detection in a series of sounds, and it has been associated to brain's predictive coding functions. In humans, MMN indexes also speech perception and speech sound learning, but it is still unclear to what extend the brain responses to speech sounds reflect genuine deviance detection and rule-based learning in rodents. In my symposium talk, I will present results from our laboratory based on recordings of local-field potentials (MMN) from the

auditory cortex in urethane-anesthetized mice and rats. The experiments were approved by the Finnish National Animal Experiment Board, and they were carried out in accordance with the European Communities Council Directive on the care and use of animals in experimental procedures. First, our results suggest that rodent brain can detect changes in human speech sounds - in vowel duration and in syllables. In the light of control conditions, the responses to duration but not to syllable changes could be explained by increased level of neural adaptation to frequent (standard) stimulus in comparison to rare (deviant) stimulus. Second, we have found that urethane-anesthetized rats are able to detect changes in abstract patterns of syllables. Our findings suggest that, similarly to the human brain, the rat brain can generalize rules to new items. Third, we have demonstrated a formation of long-term memory traces to speech sounds in adult rats due to passive sound exposure. After exposure to human speech sounds for 3 consecutive days, 12 h/d (two groups of rats exposed to either spectrotemporal or tonal changes in speech sounds), MMN was elicited to spectrotemporal changes, but only by the animals exposed to these stimuli. The results suggest that passive exposure to speech sounds can form long-term memory representations in adult animals.

Talk3: Mismatch Negativity in the Monkey is Supported by Two Distinct Auditory Short-term Memory Systems

Tobias Teichert[1]

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ABSTRACT

Mismatch negativity (MMN) is a macroscopic EEG deflection in response to rare or unexpected sounds. MMN has been suggested to reflect both passive adaptation as well as deviance detection, a component of predictive coding. While the two mechanisms differ with respect to theoretical underpinning and computational complexity, both reflect information about past sounds and are thus dependent on an implicit or explicit short-term memory trace. While the two mechanisms have been distinguished anatomically, it has not been tested if they draw information from the same or different memory systems. To answer this question, macaque monkeys listened to a modified roving standard paradigm with a many-standards control condition that quantified the functional properties of both components of the MMN. Micro- and macroscopic mismatch responses in the rhesus were dominated by putative adaptation at short latencies but included a meaningful contribution of putative deviance detection at longer latencies. A computational model of short-term presynaptic depression at thalamo-cortical synapses was fit to the data in the control condition and confirmed that the putative deviance detection component cannot be accounted for by cross-frequency adaptation. Furthermore, several control analyses confirmed that the putative adaptation component cannot be accounted for by predictive suppression. After establishing the existence of two genuinely distinct components, we show that mismatch responses mediated by adaptation have a short temporal scope and narrow frequency tuning while mismatch responses mediated by deviance detection have a longer temporal scope but broader frequency tuning. The different functional profiles point to the involvement of two distinct auditory short-term memory systems. Specifically, we propose that adaptation is a correlate of echoic memory, a short-lived sensory memory trace, while deviance detection,

a marker of predictive coding, depends on auditory recognition memory, a more stable but less detail-rich memory trace.

Talk 4: How well do mismatch responses in rats emulate the predictive coding nature of MMN in humans?

Lauren Harms[1], Jaishree Jalewa[1], Deborah Hodgson[1], Juanita Todd[1], Patricia Michie[1]

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ABSTRACT

Mismatch negativity (MMN) is an event-related potential measured in humans that occurs in response to unexpected auditory stimuli and can represent a prediction error signal. Several aspects of human MMN have been identified that contribute to our understanding of it as a prediction error signal. These include adaptation-independence, sensitivity to changing deviant properties, and sensitivity to a first impressions or primacy bias. The neurocircuitry of MMN as a prediction error signal, and ways in which it is impacted in disorders such as schizophrenia, can be further understood using animal models. However, the extent to which species such as rats can emulate human MMN will define the limits of animal model work. Therefore, one of our lines of research has investigated how well mismatch responses (MMRs) in control rats mimic aspects of human MMN. We, and others, have previously found strong evidence that MMRs in rats have some degree of adaptation-independence. In this presentation, I will present further work of ours examining whether rat MMRs were sensitive to modulations in the deviant's degree of difference from the standard, the probability of the deviant, and the temporal stability of the oddball sequence. In addition, we investigated whether rat MMRs were susceptible to a first impressions bias as human MMN is. In experiments reviewed, accepted, and monitored by the University of Newcastle's Animal Care and Ethics Committee, we found that in control Wistar rats, MMRs increased in size when the difference in frequency between the deviant and standard increased in size, and when the deviant became less probable. However, we found that rats were not sensitive to the first impressions bias. These data demonstrate that rat models can be used to investigate some, but not all, predictive coding aspects of human MMN.

Talk 5: Constructing the Hierarchy of Predictive Auditory Sequences in the Marmoset Brain

Misako Komatsu,[1] Yuwei Jiang,[2] Yuyan Chen,[2] Ruoying Xie,[2] Kaiwei Zhang,[2] Ying Xia,[2] Peng Gui,[2] Zhifeng Liang,[2] Liping Wang.[2]

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ABSTRACT

Our brains constantly generate predictions of sensory input that are compared with actual inputs, propagate the prediction-errors through a hierarchy of brain regions, and subsequently update the internal predictions of the world. However, the essential feature of predictive coding, the notion of hierarchical depth and its neural mechanisms, remains largely unexplored. Here, we investigated the hierarchical depth of predictive auditory processing by combining functional magnetic resonance imaging (fMRI) and high-density whole-brain electrocorticography (ECoG) in marmoset monkeys during an auditory local-global paradigm in which the temporal regularities of the stimuli were designed at two hierarchical levels. The prediction-errors and prediction updates were

examined as neural responses to auditory mismatches and omissions. Using fMRI, we identified a hierarchical gradient along the auditory pathway: midbrain and sensory regions represented local, shorter-time-scale predictive processing followed by associative auditory regions, whereas anterior temporal and prefrontal areas represented global, longer-time-scale sequence processing. The complementary ECoG recordings confirmed the activations at cortical surface areas and further differentiated the signals of prediction-error and update, which were transmitted via putative bottom-up gamma and top-down beta oscillations, respectively. Furthermore, omission responses caused by absence of input, reflecting solely the two levels of prediction signals that are unique to the hierarchical predictive coding framework, demonstrated the hierarchical top-down process of predictions in the auditory, temporal, and prefrontal areas. Thus, our findings support the hierarchical predictive coding framework, and outline how neural networks and spatiotemporal dynamics are used to represent and arrange a hierarchical structure of auditory sequences in the marmoset brain.

The protocol of the fMRI study was approved by the Ethical Committee of the Institute of Neuroscience, Chinese Academy of Sciences (No. ION-20180522), and all procedures of the ECoG study were conducted in accordance with a protocol approved by the RIKEN Ethical Committee (No. W2020-2-008(2)).

Symposium 2

New trends of MMN studies in animal models

Chairperson： Hirokzau Takahashi[1], Hiroyuki Nawa[2].

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[2] Department of Physiological Sciences, School of Pharmaceutical Sciences, Wakayama Medical University

Description of theme and target audience

Mismatch negativity (MMN)-like responses has been characterized in animal models. However, there has been considerable debate on whether these responses in animals are homologous to MMN in humans, and whether they exhibit any higher-order function. The electrophysiological, pharmacological, and functional characterizations of MMN-like responses demonstrate that MMN-like responses in animals can be distinguished from mere effects of adaptation, and in turn, can be characterized as neural traits of higher-order prediction. These accumulating evidences now pave a new direction for research on MMN-like responses in animals. In order to inspire MMN and predictive coding studies in humans, we would like to discuss the importance of animal studies to reveal potential functional roles of MMN beyond the simple deviance detection: e.g., audio-visual interaction, learning-induced plasticity and psychiatric disease models.

Talk1: Cortical mapping of auditory, visual, and cross-modal mismatch negativities in rat

Tomoyo Isoguchi Shiramatsu,[1] Kanato Mori, [1] Hirokazu Takahashi,[1]

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ABSTRACT

Rodents have been widely studied as a major animal model to study Mismatch negativity (MMN), especially in the auditory domain. Considering the importance of multisensory integration and accumulating evidence that MMN is similar in several modalities, including the visual domain, we studied whether and how cross-modal information processing affected MMN in rodents.

We designed a new surface microelectrode array and simultaneously recorded visual and auditory evoked potentials from the visual and auditory cortices of rats under anesthesia. Then, we mapped MMNs for five types of deviant stimuli: single-modal deviants in (i) the visual oddball and (ii) auditory oddball paradigms, eliciting single-modal MMN; (iii) congruent audio-visual deviants, (iv) incongruent visual deviants, and (v) incongruent auditory deviants in the audio-visual oddball paradigm, eliciting cross-modal MMN. First, we demonstrated that visual MMN exhibited deviance detection properties and that the first-generation focus of visual MMN was localized in the visual cortex, as previously reported in human studies. Second, a comparison of MMN amplitudes revealed a nonlinear relationship between single-modal and cross-modal MMNs. Moreover, congruent audio-visual MMN exhibited characteristics of both visual and

auditory MMNs—its latency was similar to that of auditory MMN, whereas local blockage of N-methyl-D-aspartic acid receptors in the visual cortex diminished it as well as visual MMN. These results indicate that cross-modal information processing affects MMN without involving strong top-down effects, such as those of prior knowledge and attention. The present study is the first electrophysiological evidence of cross-modal MMN in animal models, and future studies including laminar properties of cross-modal MMN will reveal the neural mechanisms of multimodal deviance detection.

Talk2: Stimulus-specific adaptation to behaviorally relevant sounds in awake rats

Amit Yaron [1 2 3] , Maciej M. Jankowski [3], Ruan Badrieh [2], Israel Nelken [2 3]

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ABSTRACT

Stimulus-specific adaptation (SSA) is the reduction in responses to a common stimulus that does not generalize, or only partially generalizes, to other stimuli. SSA has been studied mainly with sounds that bear no behavioral meaning. We hypothesized that the acquisition of behavioral meaning by a sound should modify the amount of SSA evoked by that sound. To test this hypothesis, we used fear conditioning in rats, using two word-like stimuli, derived from the English words "danger" and "safety", as well as pure tones. One stimulus (CS+) was associated with a foot shock whereas the other stimulus (CS-) was presented without a concomitant foot shock. We recorded neural responses to the auditory stimuli telemetrically, using chronically implanted multi-electrode arrays in freely moving animals before and after conditioning. Consistent with our hypothesis, SSA changed in a way that depended on the behavioral role of the sound: the contrast between standard and deviant responses remained the same or decreased for CS+ stimuli but increased for CS- stimuli, showing that SSA is shaped by experience. In most cases the sensory responses underlying these changes in SSA increased following conditioning. Unexpectedly, the responses to CS+ word-like stimuli showed a specific, large decrease, which we interpret as evidence for substantial inhibitory plasticity.

Talk3: Pitch and duration mismatch negativity of a cytokine-induced rat model for schizophrenia

Hiroyuki Nawa

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ABSTRACT

We have shown that rats perinatally exposed to inflammatory cytokines later exhibit several neurobehavioral abnormalities relevant to schizophrenia. With the given behavioral differences between humans and rodents, however, it remains to be tested whether this animal model exhibits the schizophrenia-like auditory neuropathology as seen in human patients. To explore translatable deficits in auditory processing in rats, we monitored auditory evoked responses of this EGF model with electrocorticography (ECoG) using the oddball

paradigms carrying pitch and duration deviants for mismatch negativity (MMN). The animal model was established by challenging rat pups with epidermal growth factor (EGF), an inflammatory cytokine. After their growth, ECoG electrodes were implanted on the primary auditory cortex, frontal cortex, and cerebellum. They were exposed to the oddball paradigms of 3 kHz (standard) / 6 kHz (deviants) or 50 ms (3kHz; standard) / 150 ms (deviants) in free-moving condition. The pitch paradigm evoked MMN-like responses in the frontal electrode, whereas the duration paradigm elicited MMN-like responses in the auditory electrode. The strength of individual MMN-like responses depended the preceding standard density, suggesting the authenticity of the deviant detection in rats. Both MMN-like responses were significantly reduced in the EGF schizophrenia model. However, the opposing descending paradigm in pitch and duration markedly attenuated or abolished the above MMN-like responses in rats. These observations suggest that MMN is a good translatable marker for schizophrenia and its animal model, although there are several phenotypic differences between human and rats.

Talk4: Beat synchronization in rat

Hirokazu Takahashi [1], Yoshiki Ito [1,] Tomoyo [I]. Shiramatsu [1], Naoki Ishida [1], Karin Oshima 1, Kaho Magami[1]

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ABSTRACT

Neural dynamics and predictive mechanisms might play critical roles in our auditory perception, probably including music perception. Beat perception and synchronization around 120 beats per minute (BPM) are common in humans, and are frequently used in music composition. Why beat synchronization is uncommon in some species and the mechanism determining the optimal tempo are unclear. Here, we examined physical movements and neural activities in rats to determine their beat sensitivity. Close inspection of head movements and neural recordings revealed that rats displayed prominent beat synchronization and activities in the auditory cortex at approximately 120 BPM. Mathematical modelling suggests that short-term adaptation underlies this beat tuning. Our results support the hypothesis that the optimal tempo for beat synchronization is determined by the time constant of neural dynamics conserved across species rather than the species-specific time constant of physical movements. Thus, latent neural propensity for auditory motor entrainment may provide a basis for human entrainment that is much more widespread than currently thought. Further studies comparing humans and animals will offer insights into the origins of music and dancing.

Symposium3:

Auditory prediction violations with different types of regularities

Chair: Erich Schröger,[1] Hiroshi Nittono[2]

[1]Wilhelm-Wundt Institute for Psychology, Leipzig University, Leipzig, Germany

[2]Graduate School of Human Sciences, Osaka University, Japan

Description of theme and target audience

Regularities in the environment can be detected and integrated into a mental model. This model aids the processing incoming stimuli via generating predictions about forthcoming sensory input. This informs the organism about what to expect next. If a stimulus violates the expectation generated by the mental model, a prediction-error signal (PE) is elicited; for example, the Mismatch Negativity (MMN) in auditory oddball paradigms. Theories on PE postulate that an actual PE (e.g. MMN) can be the origin of involuntary attention informing the organism that an unexpected stimulus appeared which may deserve additional analysis. It is also assumed that this PE is used to update the mental model so that it can better predict forthcoming information. For the "involuntary attention" function an unspecific PE would be sufficient, while for the "model update" function a content- and context-specific PE would be beneficial. This symposium presents research comparing the effects of different kinds of regularities and regularity violations on the PE (e.g. MMN) in humans and animals. All in all, the studies presented in this symposium reveal content- and context-specificity of the PE, but not necessarily functional independence.

Talk1: Parallel Detection of Music-Syntactic and Acoustic Irregularities in Chord Progression

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ABSTRACT

Mismatch negativity (MMN) is not just an index of auditory irregularity detection; it can also assist investigation of multi-level regularity processing in a complex auditory context, such as music. During music listening, the human brain needs to simultaneously process various regularities, including music-syntactic (e.g., harmony) and acoustic (e.g., intensity) dimensions. Event-related potential (ERP) studies have revealed that harmonic irregularities elicit early right anterior negativity (ERAN), and acoustic irregularities elicit MMN. However, the relationship between the detection processes of music-syntactic and acoustic irregularities reflected in these negativities remains unclear. This study investigates the ERP, behavioral, and subjective responses to a harmonic and an intensity deviance occurring in isolation and in combination at the end of a short musical phrase comprising five chords. The standard and three types of deviant chords (i.e., harmonic, intensity, and double deviants) occurred equiprobably at the final position. In the ERP experiment (N = 24), participants were presented with the sequences while watching a silent video clip, and subjective ratings were obtained by asking how well the final chord fitted the preceding musical context on a 7-point scale. In the behavioral experiment, which was

conducted online (N = 52), participants were asked to perform a Go/No-go task, pressing a button when they detected a deviant chord at the final position. The overall results showed that (1) the ERAN/MMN amplitudes increased additively for double deviants, (2) only the harmonic deviant was recognized as a musical deviance, and (3) reaction times were shorter for double deviants than for single deviants. The test of the race model inequality suggests a coactivation of signals from separate perception modules, each corresponding to a different type of irregularity. The additivity and the coactivation process indicate that music-syntactic and acoustic irregularities are detected in parallel and reflected in the ERAN and MMN, respectively.

Talk2: The Sound of Silence: Neuronal Responses to Omitted Tones in the Auditory Brain

Ana B. Lao Rodríguez[1], Karol Przewrocki[2], David Pérez-González[1], Artoghrul Alishbayli[2], Bernhard Englitz[2] and Manuel S. Malmierca[2]

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[2] Computational Neuroscience Lab. Department of Neurophysiology. Donders Centre for Neuroscience. Nijmegen, The Netherlands.

ABSTRACT

Human brain reacts to perceptual mismatch between expected and actual sensory inputs. These responses have been widely recorded in all sensory systems and have been interpreted in terms of predictive processing. Predictive processing is a leading and unifying theory of how the brain performs probabilistic inference. According to this framework, the brain extracts the regularities from the environment and uses them to actively predict what should happen next. When the prediction and input do not match, a prediction error signal is generated. It has been argued that the omission response provides conclusive, empirical evidence of the predictive process, as it occurs in the absence of sensory input (Wacongne et al., 2011, 2012). Nevertheless, to date, empirical evidence of omission responses at the neuronal level remains elusive. We investigated the existence of omission responses by measuring neuronal activity during the omission deviant in an oddball paradigm context. Recordings were carried out in the inferior colliculus and auditory cortex in anesthetized and awake preparations. Our results reveal a subset of neurons in the auditory pathway that robustly increases their activity during the omission of an expected tone. These responses are evident, although weak, at inferior colliculus level and become stronger and distinct at the cortical level. These results are consistent with previous studies that assume that prediction error is organized hierarchically along the central auditory pathway (Parras et al., 2017). We also found a higher response magnitude in awake preparations suggesting that anesthesia may affect the level of predictions. Omission responses also show a higher probability of occurrence with shorter SOAs which aligns with the highest probability of omission responses at short latencies in humans (Raij et al. 1997; Hughes et al. 2001; SanMiguel et al., 2013a, 2013b). Our findings suggest that neurons in the auditory system detect a deviation from expectations without the need for an external stimulus (Bendixen, et al 2012) and gives a decisive empirical support to the theory of predictive processing.

Financial support was provided by the Spanish Agencia Estatal de Investigación [(AEI), PID2019-104570RB-I00] to MSM; DPG was supported by the by the

European Union's Horizon 2020 research and innovation programme under grant agreement No 952378 - BrainTwin. BE, KP and AA were supported by an NWO-VIDI Grant (016.VIDI.189.052) and KP was supported by an NWO-ALW-Open grant (ALWOP-346).

Talk3: Behavioral distraction by violation of sensory predictions: deviant sounds vs unexpected silences

Fabrice B. R. Parmentier[1,3], Alicia Leiva[2], Pilar Andrés[1], Murray T. Maybery[3]

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ABSTRACT

It has been established that participants performing a continuous categorization task respond significantly slower following the presentation of unexpected, task-irrelevant, auditory stimuli, compared to a repetitive (standard) sound. Evidence indicates that such distraction emerges because of the violation of sensory predictions. This has typically been studied by measuring the impact of replacing the repeated sound by a different sound on rare and unpredictable trials. Here, we examine the impact of a different type of violation: the mere omission of the standard sound. Capitalizing upon the recent finding that deviant sounds exert distinct effects on response times as a function of whether participants produced or withheld a response on the previous trial, we present the results of an experiment seeking to disentangle two potential effects of sound omission: deviance distraction and the removal of an unspecific warning signal. The results indicate that deviant sound and the unexpected omission of the standard sound impact response times through, at least partially, distinct mechanisms. Deviant sounds affect performance by triggering the orienting of attention towards a new sensory input. Sound omissions, in contrast, appear to affect performance in part because responses no longer benefit from an unspecific warning signal to prepare for action.

Talk4: Effects of violation of auditory predictions based on sound regularity versus action intention

Erich Schröger[1], Andreas Widmann,[1,2]

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[2]Leibniz Institute for Neurobiology, Magdeburg, Germany

ABSTRACT

The human brain generates various responses to (deviant) sounds violating an auditory sensorial regularity. Such brain responses are usually investigated in situations when the sounds were produced by the experimenter, with deviants being unpredictable for the listener. Acknowledging that humans also actively produce sounds, the present talk will present studies that tested for brain responses to deviant sounds when participants produced standard and deviant sounds by themselves (e.g. by pressing one of two buttons frequently, the other rarely). For example, there was one condition, in which the type of button press was uncorrelated with the type of sound (standard, deviant) so that deviants were not predictable; and there was another condition, in which they were correlated; that is, participants produced standards and deviants intentionally so that most deviants could be predicted correctly, but few of the

frequent button presses generated a (mispredicted) deviant. Deviance-specific N1-increase is usually elicited for each deviant type, suggesting that it reflects release from adaptation to standards. The Mismatch Negativity (MMN) was obtained for unpredictable and for mispredicted deviants, but MMN was abolished for predictable deviants. This supports the hypothesis that MMN indicates prediction error processing, irrespectively of whether the prediction is sensory-regularity or action-intention-based. The P3a (an indicator of involuntary attention) is usually elicited by each deviant type but being largest for mispredicted deviants, which deviate from the sensory-regularity-based prediction and from the action-intention-based prediction. This suggests that the processes underlying P3a not only evaluate the sensorial deviancy but also the intention of the behaving participant.

Symposium4

The Methodology Symposium

Chairperson： Fengyu Cong[1], Peixin Nie[2],

[1]School of Biomedical Engineering, Dalian University of Technology, China,

[2]Centre of Excellence on Music, Mind, Body and Brain, Cognitive Brain Research Unit, University of Helsinki, Finland,

Description of theme and target audience

Mismatch Negativity (MMN) is one of the small event-related potentials (ERPs) due to the mostly used passive oddball paradigms. Therefore, how to evaluate the quality of the EEG data in the MMN experiments and how to extract features of MMN are critical to the study of MMN.

In this symposium, three speakers will introduce the latest research on those topics. Firstly, a new metric of data quality called the Standardized Measurement Error (SME), which quantifies the precision of a given ERP amplitude or latency score will be introduced; secondly, a new metric called global field time-frequency representation similarity measurement (GFTFR-SM), which quantifies the cross-subject similarity of the test patient with a library of healthy patterns, will be introduced; finally, the temporal hierarchy characteristic of passive auditory ERPs in the MMN experiments will be introduced and its application for discriminating the minimally conscious state (MCS) patients and vegetative state (VS) patients will be reported.

Talk1: Quantifying data quality for the MMN and other common ERP components

Steven Luck

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Abstract

The mismatch negativity (MMN) is a tiny signal relative to the ongoing EEG, and signal averaging is typically used to isolate the MMN from the background “noise”. When we measure MMN amplitude or latency from an average, how well have we actually minimized the noise? In this presentation, I will describe a new metric of data quality called the Standardized Measurement Error (SME), which quantifies the precision of a given ERP amplitude or latency score. I will then provide SME results from 40 neurotypical young adults from the ERP CORE dataset. When we obtained SME values from the MMN, we found that the precision was greater (i.e., the SME was lower) for mean amplitude measures than for peak amplitude measures, and the SME was also better greater when MMN timing was quantified as the 50% area latency than when it was quantified as the peak latency. The SME also varied across individuals, driven mainly by individual differences in trial-by-trial amplitude variability. I will end the presentation by describing how researchers could use the SME to optimize data quality in future MMN studies.

Talk2 Unattended auditory stream orienting as a brain network event

Scott Makeig

Swartz Center for Computational Neuroscience,

Institute for Neural Computation, UC San Diego, USA

ABSTRACT

A study of unattended auditory mismatch evoked responses collected from chronic schizophrenics and controls by Gregory Light and colleagues showed that the auditory orienting response represents a theta-dominant brain network event. Further, examination of difference response peak heights and latencies for schizophrenic subjects carried considerable information about individual differences in their clinical and neuropsychiatric condition. Prospects for use of high-resolution EEG imaging in psychiatry appear promising.

Talk3: Similarity analysis of passive auditory ERPs for individual-level diagnosis of disorders of consciousness.

Xiaoyu Wang,

Department of Physiology and Pharmacology, Western University, Canada

Abstract

Previous evidence suggests that passive auditory ERP components are critical in the diagnosis of disorders of consciousness (DOC). However, as such evidence is limited to group-level analyses, the extent to which they enable residual consciousness detection at the individual level is still unclear. Here, I will introduce a new metric called global field time-frequency representation similarity measurement (GFTFR-SM), which quantifies the cross-subject similarity of the test patient with a library of healthy patterns. Then, the proposed method was evaluated in a binary classification task, including 40 minimally conscious state and 54 vegetative state patients. At the individual level, the GFTFR-based similarity indexes served as individual samples were incorporated with a support vector machine (SVM) classifier to perform MCS/UWS binary classification, and this model achieved the accuracy, sensitivity, and specificity of 0.777, 0.725, and 0.815. Overall, the proposed machine learning algorithm combining interpretable features (GFTFR-SM) and SVM classifiers seems a promising approach for automatically diagnosing patients with DOC, which can in principle be transferred into any ERP-based DOC detection investigations.

Talk4: Temporal hierarchy characteristic of passive auditory ERPs and its clinical application.

Fengyu Cong

School of Biomedical Engineering, Dalian University of Technology, China,

Abstract

Previous evidence suggests that N1 (the first negativity) and mismatch negativity (MMN) can be elicited in a temporal hierarchy manner, namely, the existence of the exogenous component (N1) can be a prerequisite for the automatic deviance detection (MMN). Here, we asked whether the temporal hierarchy characteristic can be transferred into a two-step approach to detect the residual auditory functions in patients with disorders of consciousness (DOC). Firstly, we investigated the effects of stimulus onset asynchronies (SOA) on N1 properties, and found that

N1 was obligatorily elicited (N1 existed in all 28 healthy subjects) when SOA was 1000 ms, whereas only 14.29% (4/28) subjects showed N1 in 600 ms SOA condition. On this basis, we conducted the paradigm with 1000 ms SOA on DOC patients and found that it achieved a 0.910 sensitivity and 0.526 specificity for the primary minimally conscious state (MCS) and vegetative state (VS) assessment when taking the presence of N1 as the diagnostic criterion. Subsequently, we set MMN amplitudes as the diagnostic criterion to conduct the secondary assessment on DOC patients with the N1 component, and found the outperformance of the proposed two-step approach than directly measuring the MMN amplitudes on all patients.

Symposium5

Language

Chairperson： Thomas Jacobsen

Experimental Psychology Unit, Helmut Schmidt University/University of the Federal Armed Forces Hamburg, Hamburg, Germany

Description of theme and target audience

Human language comprises a vast system of complex, highly coordinated, fast, and efficient processes. A wealth of these processes can be considered automatic, taking place outside the focus of attention, and not requiring active selection. Over the last decades, the Mismatch Negativity component of the event-related brain potential has been demonstrated to be a well-suited tool to tap into different levels - acoustic, phonetic, phonological, lexical, and more - of auditory language reception. This symposium presents and discusses new developments. "

Talk1: Can the MMN differentiate word representations embedding familiar and unfamiliar allophones? A study on native speakers of regional linguistic varieties.

Giuseppe Di Dona[1], Federica Mantione[1], Birgit Alber[2], Simone Sulpizio[3,4,] Francesco Vespignani[5]

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ABSTRACT

Mismatch Negativity (MMN) has proven to be a powerful tool to investigate language processing. In particular, it has been efficiently employed to probe the automatic memory retrieval processes for native linguistic representations, showing larger amplitude when native phonemes or known words are presented as deviant stimuli. This effect highlights the robustness of automatic memory retrieval processes that may subserve phoneme and word recognition but it is not yet clear if it the same effect can be modulated by naturally occurring phonetic variation. In fact, while listeners robustly recognize words despite physical variability in the speech signals, they are also sensitive to subtle phonetic variations, especially when such variations are systematic and familiar. The present study aimed at understanding whether familiar allophonic variations are encoded in word representations by testing the associated amplitude modulations of the MMN. Two groups of Italian native speakers, one born in Trentino (a north-eastern province) and one in the Central-Southern regions of Italy, took part in the experiment. We tested the MMN elicited by the same word encompassing two different allophones, with one being more familiar to the Trentino group and the other one more familiar to the Central-Southern group. Both groups showed a robust MMN to both word variants, but only the Trentino

group showed a right-lateralised amplitude enhancement in late time windows for the familiar word variant. Moreover, the amplitude of the MMN for the unfamiliar word variant in Trentino speakers was larger for participants which were less exposed to Trentino dialect. Results suggest that words embedding familiar and unfamiliar allophones are differently represented in the brain of native speakers of regional linguistic varieties and the degree of differentiation is partly modulated by individual experience. Concurrently, the inconsistency/lack of results in the MMN literature about allophonic processing and the atypical spatiotemporal distribution of the effects we report calls for important theoretical updates about the core mechanisms of the MMN and its influence on later-occurring electrophysiological activity.

Talk2: On the effect of "varying the standards" in linguistic MMN experiments

Arild Hestvik[1], Chao Han[1], Ryan Rhodes[2], William Idsardi[3]

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[2] Center for Cognitive Science, Rutgers University, USA

[3] Department of Linguistics, University of Maryland, USA

ABSTRACT

Phillips et al (2000) argued that varying the standards within the acoustic/phonetic limits of a speech sound category causes the latent phoneme representation to be retrieved from long-term memory and to be used as the memory trace for the MMN mechanism. This lead to a long line of MMN research into the nature of the phoneme, particularly featural underspecification (initiated by Lahiri and colleagues). Here, we used varying standards to ask whether the phoneme contains prototypical or gradient phonetic information (Iverson & Kuhl, 1995; McMurray et al., 2008; Pierrehumbert, 2016; Smolensky et al., 2014) or whether it is purely symbolic, as in classical theories (Chomsky & Halle, 1968; Kazanina et al., 2018). A corollary of the varying standards assumption is that a single-token, non-varying standard should lead to a phonetic memory trace. The symbolic phoneme theory then predicts that a within-category phonetic MMN should be observed with a single-token/non-varying standard (e.g., [t] with 48ms VOT vs. [t] with 120ms VOT), but the MMN should disappear if the standards are varied, because the retrieved phoneme is a proper subset of the features of its allophone (i.e., /t/ is non-distinct from [t]). Contrary to the symbolic theory prediction, we observed MMN under both conditions, which we interpret as indicating that phonemes contain gradient acoustic/phonetic information. However, this conclusion only holds if the varying standards assumption is correct. An alternative hypothesis is that listeners construct a statistical summary of the standard stimuli, and this summary (a mean and a standard deviation over phonetic features) generates the MMN effects. For example, Garrido et al (2013, 2016) observed MMN sensitivity to statistical outliers with non-linguistic, pure tone stimuli and different Gaussian distributions of standards. We are currently conducting conceptual replications of Garrido's experiment but with speech sound stimuli. If we observe similar outlier effects, this would suggest that varying standards MMN (including our other findings) arise from statistical summaries of the stimuli, not from retrieval of phonemes from memory.

Chomsky, N., & Halle, M. (1968). *The sound pattern of English*. Harper & Row.

Garrido, M. I., Sahani, M., & Dolan, R. J. (2013). Outlier Responses Reflect Sensitivity to Statistical Structure in the Human Brain. *PLoS Computational Biology, 9*(3), e1002999. https://doi.org/10.1371/journal.pcbi.1002999

Garrido, M. I., Teng, C. L. J., Taylor, J. A., Rowe, E. G., & Mattingley, J. B. (2016). Surprise responses in the human brain demonstrate statistical learning under high concurrent cognitive demand. *Science of Learning, 1*(1). https://doi.org/10.1038/npjscilearn.2016.6

Iverson, P., & Kuhl, P. K. (1995). Mapping the perceptual magnet effect for speech using signal detection theory and multidimensional scaling. *Journal of the Acoustical Society of America, 97*(1), 553–562. https://doi.org/10.1121/1.412280

Kazanina, N., Bowers, J. S., & Idsardi, W. (2018). Phonemes: Lexical access and beyond. *Psychonomic Bulletin & Review, 25*(2), 560–585. https://doi.org/10.3758/S13423-017-1362-0

McMurray, B., Aslin, R. N., Tanenhaus, M. K., Spivey, M. J., & Subik, D. (2008). Gradient sensitivity to within-category variation in words and syllables. Journal of Experimental Psychology. *Human Perception and Performance, 34*(6), 1609–1631. https://doi.org/10.1037/a0011747

Phillips, C., Pellathy, T., Marantz, A., Yellin, E., Wexler, K., Poeppel, D., McGinnis, M., & Roberts, T. (2000). Auditory cortex accesses phonological categories: an MEG mismatch study. *Journal of Cognitive Neuroscience, 12*(6), 1038–1055. https://doi.org/10.1162/08989290051137567

Pierrehumbert, J. B. (2016). Phonological Representation: Beyond Abstract Versus Episodic. *Annual Review of Linguistics, 2*(1), 33–52. https://doi.org/10.1146/annurev-linguistics-030514-125050

Smolensky, P., Goldrick, M., & Mathis, D. (2014). Optimization and quantization in gradient symbol systems: a framework for integrating the continuous and the discrete in cognition. *Cognitive Science, 38*(6), 1102–1138. https://doi.org/10.1111/cogs.12047

Talk3: The processing and learning of linguistic rules in the brain as indicated by the MMN

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[2] Cognitive Brain Research Unit, Faculty of Medicine, University of Helsinki, Finland

ABSTRACT

Languages are structured by certain rules in phonology, morphology and syntax. Here I show two examples of how these rules are processed and learned in the brain. In the first study (Ylinen et al. 2016), we used auditory event-related potentials (ERP) and the mismatch negativity (MMN) to explore the processing of a phonological rule that is already established in long-term memory. Specifically, we looked at the Finnish vowel harmony rule, according to which Finnish words can include either front vowels /æ, ø, y/ or back vowels /ɑ, o, u/ (all vowels can be combined with /i, e/). Using a back vowel in the beginning of a pseudoword thus constrained the phonological composition of pseudoword endings. The phonological rule of vowel harmony was expected to create predictions about phonologically legal pseudoword endings. Results showed that MMN responses were larger for phonologically illegal than legal pseudowords, suggesting that speech input is evaluated against

context-dependent phonological predictions that are based on phonological rules established in long-term memory.

In the second study (Suppanen et al., 2022), we focused on the learning of rules from speech input. We exposed newborn infants to syllable combinations AB and CD and tested the learning of rules “A is followed by B” and “C s followed by D” with auditory ERP and the mismatch responses (MMR). Ability to predict the second syllable required the learning of the rules. A larger difference between predicted and unpredicted syllable combinations was expected to indicate better quality of learning during exposure. We found a significant difference between responses to predicted and unpredicted syllable combinations, suggesting that neonates can memorize syllable combinations so that a learned first syllable generates predictions for the second syllable. This difference in MMRs was correlated with expressive language scores (the mean length of utterance) at 24 months in the same infant, indicating that these abilities may form a basis for later language development. These findings on early rule learning may be applicable to word learning (if AB and CD formed words), morphology learning (if A+B and C+D were morpheme combinations) or syntactic learning (if A+B and C+D were syntactic units). Together, these findings show that the application and learning of phonological, morphological or syntactic rules is linked with predictive processing reflected by the MMN/MMR in adult and infant brain.

Ylinen, S., Huuskonen, M., Mikkola, K., Saure, E., Sinkkonen, T., & Paavilainen, P. (2016). Predictive coding of phonological rules in auditory cortex: A mismatch negativity study. *Brain & Language, 162*, 72-80. https://doi.org/10.1016/j.bandl.2016.08.007

Suppanen, E., Winkler, I., Kujala, T., & Ylinen, S. (2022). More efficient formation of longer-term representations for word forms at birth can be linked to better language skills at 2 years. *Developmental Cognitive Neuroscience, 55,* 101113. https://doi.org/10.1016/j.dcn.2022.101113

Talk4: Macro- Micro- and Nano-level Signatures of Prosodic Information Processing

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ABSTRACT

A functioning communication builds on both sensory and cognitive processes, and every source of information, be it at the macro, micro or nano levels, codetermines the interpretation of an utterance. To understand the nature of communication, we therefore need to unravel the symbiosis of information emerging from different sources, and prosody offers an optimal tool for this pursuit. Prosodic information – such as duration, intensity, and fundamental frequency (*f*0) – serve for versatile communicative functions, ranging from tone bursts conveying affective states to pitch accents giving rise to meaning. Prosody as such offers a unified domain for studying the crosstalk between bottom-up sensory and top-down cognitive communicative operations in the brain. The mismatch negativity (MMN) component of event-related potentials has became the most effective experimental means for investigating the nature and time course of brain responses to prosodic information at the *nano* acoustic, *micro* morphophonological and *macro*

semantic levels. In this talk, I will first give an overview of communicative functions of prosody at various levels, with a special focus on semantics, and then discuss the segregation and integration of these functions as indexed by MMN responses. Finally I will elaborate on how prosody influences the *mega* pragmatic level, and parse out to what degree it is reflected in MMN activity. Such knowledge may not only shed further light on the nature of prosodic communication but also give us new insights into justifying the use of MMN for investigating higher level communicative operations in the brain.

Zora, H., Schwarz, I.-C., & Heldner, M. (2015). Neural correlates of lexical stress: mismatch negativity reflects fundamental frequency and intensity. *Neuroreport, 26,* 791-796.

Zora, H., Heldner, M., & Schwarz, I.-C. (2016). Perceptual correlates of Turkish word stress and their contribution to automatic lexical access: evidence from early ERP components. *Frontiers in Neuroscience,* 10:7.

Zora, H., Riad, T., Schwarz, I.-C., & Heldner, M. (2016). Lexical specification of prosodic information in Swedish: evidence from event-related potentials. *Frontiers in Neuroscience,* 10:533.

Zora, H., Riad, T., & Ylinen, S. (2019). Prosodically controlled derivations in the mental lexicon. *Journal of Neurolinguistics*, 52, 100856.

Zora, H., Rudner, M., & Magnusson, A. (2020). Concurrent affective and linguistic prosody with the same emotional valence elicits a late positive ERP response. The *European Journal of Neuroscience, 51*, 2236-2249.

Zora, H., & Csépe, V. (2021). Perception of Prosodic Modulations of Linguistic and Paralinguistic Origin: Evidence From Early Auditory Event-Related Potentials. *Frontiers in Neuroscience,* 15:797487.

Symposium6

Mismatch negativity as a measure of synaptic plasticity and a biological biomarker in psychiatric disorders

Chairperson：Yuko Higuchi,[1,2], Tetsuya Shiga[3]

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[3] Fukushima Medical University, School of Medicine, Department of Neuropsychiatry, Fukushima, Japan

Description of theme and target audience

Mismatch negativity (MMN) amplitude is reduced in patients with schizophrenia and indicates glutamate N-methyl-d-aspartate receptor (NMDAR) dysfunction. It is also reduced in patients with ultra-high-risk psychosis and may be a useful predictor of the onset and remission of psychosis. Despite schizophrenia-related specificity, MMN is emerging as a neurophysiological biomarker of mood and neurodevelopmental disorders.

Regarding pharmacological findings, the MMN response is reduced by NMDAR antagonists and also regulated by other psychotropic drugs, such as nicotinic and gamma-aminobutyric acid receptor agonists. Therefore, pharmacological considerations of MMN are complex.

This symposium covers some known MMN findings of psychiatric diseases, such as schizophrenia, ultra-high-risk psychosis, mood disorders, and neurodevelopment disorders, and their pharmacological responses.

Taik1: Mismatch negativity as a biological marker in early stages of psychosis

Kenji Kirihara,[1,2] Mariko Tada,[2,3] Daisuke Koshiyama,[2] Mao Fujioka,[2] Kaori Usui,[2] Ryoichi Nishimura,[2] Tsuyoshi Araki,[2,4] Kiyoto Kasai[2]

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Psychotic disorders including schizophrenia are psychiatric disorders characterized by hallucinations and delusions. One of the most robust biological findings in psychotic disorders is reduced amplitude of mismatch negativity (MMN). Because early diagnosis and treatments are important for good prognosis of psychotic disorders, recent studies focused on MMN in early stages of psychosis.

We measured duration MMN and frequency MMN in patients with resent-onset psychotic disorder (ROPD) and individuals with ultra-high risk for psychosis (UHR). Amplitude of duration MMN was reduced in ROPD and UHR compared to healthy control (HC) while amplitude of frequency MMN showed reduction in neither ROPD nor UHR. Neither duration MMN nor frequency MMN showed progressive reduction in

ROPD and UHR. Duration MMN was associated with global function in ROPD and UHR while frequency MMN was associated with cognitive function in ROPD. Duration MMN predicted remission in UHR while frequency predicted cognitive function in UHR. Reduced amplitude of duration MMN was associated with increased plasma level of glutamate in ROPD. Written informed consent was obtained from each subject before participation in all of these studies. The Research Ethics Committee of the Faculty of Medicine, The University of Tokyo, approved all of these studies These findings suggest that alterations of neural circuits underlying MMN is present before the onset of psychosis and affect cognitive function, global function, and prognosis in patients with early stages of psychosis. In addition, Association between MMN and glutamate suggests that MMN reflect aberrant glutamatergic neurotransmission in psychosis. Therefore, MMN may be a useful biomarker for predicting prognosis and developing treatments in early stages of psychosis.

Taik2: Mismatch Negativity in Attention-Deficit/Hyperactivity Disorder

Ryo Mizui,[1] MD, Toyosaku Ota,[2] MD, PhD

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[2]Department of Human Development, Nara Medical University, Kashihara

Attention-deficit/hyperactivity disorder (ADHD) is characterized by age-inappropriate and impairing levels of inattention, hyperactivity, or impulsivity, and abnormalities in one or more cognitive processes. Event-related potentials (ERP) are commonly used as physiological measures of cognitive function as they are easily measured and non-invasive. Mismatch negativity (MMN) is an ERP component that is presumed to index the preattentive monitoring of changes in the auditory environment. Previous studies have reported that the MMN amplitude is lower in children with ADHD compared with control participants. Additionally, our previous study suggested that MMN reflected the severity of ADHD symptoms in children and adolescents. These findings support the notion that ERP represent a clinically useful and noninvasive method for estimating symptom severity in children and adolescents with ADHD. Furthermore, effects of pharmacotherapy were examined in pediatric ADHD. We measured MMN in children with ADHD in the drug-naïve condition and those who had received osmotic-controlled release oral delivery system methylphenidate for 8 weeks. Consequently, the MMN amplitude at Pz and C4 in post-medication were significantly greater than those in pre-medication. Moreover, another study has demonstrated that atomoxetine raises MMN amplitude to normal levels in children with ADHD. These findings suggest that MMN can be used to measure the pharmacological effects of anti-ADHD drugs in children and adolescents with ADHD. We would like to have deeper discussions with attendances in this symposium. Our studies, which are going to be showed in this symposium, were approved by the Institutional Review Board at the Nara Medical University. The authors report no conflicts of interest in this work.

Taik3: Event-related potentials as a feasible biomarker in the high-risk state for psychosis; an update

Yuko Higuchi,[1,2], Tomiki Sumiyoshi3, Takahiro Tateno[1,2], Suguru Nakajima[1,2], Naohito Kaneko[1,2,] Yuko Mizukami[1], Yukiko Akasaki[1], Daiki Sasabayashi[1,2,]

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Several studies have indicated that event-related potentials (ERPs), for example, mismatch negativity (MMN) and P300, in addition to neurocognitive functions, are already impaired in the prodromal stage of schizophrenia. To determine if these ERPs would provide a biomarker to predict the development of the illness, we measured duration MMN (dMMN) in subjects with at-risk mental state (ARMS) and conducted longitudinal observations. During the follow-up period (2 years), about 20% ARMS subject transitioned to schizophrenia (converters), while others did not (non-converters). dMMN amplitudes of converters were significantly smaller than those of non-converters at the frontal and central electrodes at baseline (e.g., before the onset of illness). There was a significant positive correlation between dMMN amplitudes at the frontal electrodes and verbal fluency, a domain of neurocognition. We also observed a progressive decline in dMMN amplitudes during the transition period. P300 was also measured in antipsychotic drug-free ARMS subjects. Compared to non-converters, converters showed prolonged P300 latency and poorer cognitive abilities related to daily-living functioning.

The relationship between MMN or P300 parameters and autistic traits was examined in patients with ARMS. Specifically, we found that subjects with high scores on the Autism Spectrum Quotient Japanese version (AQ-J) showed shorter latencies of frequency MMN (fMMN) compared with those in patients with low AQ-J scores. These results suggest the ability of fMMN to objectively evaluate autism tendencies in subjects with ARMS.

Overall, the above electrophysiological indices may provide a feasible biomarker for some of the key clinical issues (e.g. onset of schizophrenia, functionality) in people with ARMS.

The studies herein discussed were approved by the Committee on Medical Ethics of the University of Toyama.

There is no COI to disclose.

[References]

Higuchi et al., PLoS one, 2013; Higuchi et al., Front Behav Neurosci. 2014; Tateno et al., Cereb Cortex. 2021; Higuchi et al., J Pers Med. 2021

Talk4: Mismatch negativity as an indicator of synaptic plasticity in psychiatric medication and neuromodulation

Tetsuya Shiga

Fukushima Medical University, School of Medicine, Department of Neuropsychiatry, Fukushima, Japan

Mismatch negativity (MMN), a particularly interesting marker of auditory synaptic plasticity, is found to be reduced in schizophrenia. The association between N-methyl-D-aspartate (NMDA) receptor function and MMN may be relevant to the clinical condition in schizophrenia since NMDA receptor antagonists are used as pharmacological models of schizophrenia. In healthy controls, these antagonists produce symptoms

that closely mimic schizophrenia. High-affinity NMDA receptor antagonists, such as ketamine and phencyclidine, strongly attenuate MMN, whereas low-affinity NMDA receptor antagonists, such as memantine, enhance MMN in healthy controls and patients with schizophrenia. NMDA receptor agonists, such as glycine and d-serine, enhance MMN.

Regarding other neurotransmission modulators, gamma-aminobutyric acid (GABA) agonists decrease the amplitude of MMN. Acetylcholine receptor agonists, particularly α7 nicotinic acetylcholine receptor agonists, such as cytidine 5'-diphosphocholine-choline (PCP), enhance MMN.

Recently, SEP-363856, which does not act on D2 receptors but acts as an agonist of trace amine-associated receptor 1 (TAAR1) and 5-hydroxytryptamine type 1A (5-HT1A) receptors, demonstrated a statistically significant and clinically meaningful improvement in the Positive and Negative Syndrome Scale total score in comparison with placebo after 4 weeks of treatment in patients with schizophrenia. Administration of RO5263397, a TAAR1 partial agonist, in mice enhanced MMN-like responses.

In conclusion, MMN may serve as an indicator of neural plasticity during the clinical treatment of schizophrenia.

Symposium7

Visual mismatch negativity

Chairperson：Motohiro Kimura[1], István Czigler[2]

[1]Advanced Industrial Science and Technology, Tsukuba, Japan

[2]Research Centre for Natural Sciences, Institute of Cognitive Neuroscience and Psychology, Budapest, Hungary

Description of theme and target audience

In this symposium, we will share recent important findings on visual mismatch negativity (VMMN). The findings will mainly include (1) the underlying processes of the VMMN generation in terms of the encoding of categorical information, (2) the test-retest reliability of VMMN and the validity of VMMN in terms of the relationships to several indices such as memory, attention, and personality, and (3) the neural substrates of the deviant processing represented by VMMN revealed with the combined measurement of event-related potentials (ERPs), functional magnetic resonance imaging (fMRI), and event-related optical signal (EROS).

Talk1: Can categorical information modulate the visual mismatch-negativity?

Ann-Kathrin Beck

Center for Cognitive Science, University of Kaiserslautern, Germany

Abstract

Several studies suggest that the system underlying the auditory mismatch-negativity (MMN) categorizes a continuous auditory input at an abstract level; it is assumed that the auditory MMN reflects automatic and pre-attentive processing of information. In contrast, automatic acquisition of novel visual categorical information is evident relatively late (around 350–600 ms after stimulus presentation). Hence, I present the result of three experiments investigating whether the visual system, reflected by the visual mismatch-negativity (vMMN), exhibits such early categorization. In Experiment 1 and Experiment 2, an oddball paradigm and a Bayesian analysis of vMMN was employed with the aim to test whether or not categorical information modulate the vMMN. Based on these results, in Experiment 3 an oddball paradigm was combined with a n-back task. In Experiment 1 and Experiment 2 categorical information did not modulate the vMMN, whereas in Experiment 3 categorical information did modulate the vMMN. Note, that in all experiments the encoding of categorical information was task-irrelevant. Thus, the results suggest that the system underlying the vMMN can exhibits early categorization. However, the results also emphasize the flexibility of the neuronal processes to encode categorical information depending on the overall processing goal of information.

Talk2: Reliability and validity of the vMMN for letters

Kairi Kreegipuu

Institute of Psychology, University of Tartu, Tartu, Estonia

Abstract

In the NMMN literature there are several reports of the relatively high test-retest reliability of auditory preattentive deviance detection (MMN) but almost no reports for the reliability of the vMMN. When measured twice (at least 1 week delay in between), vMMN estimations from the same 65 participants showed modest but significant reliability of the vMMN for letters (“B” and “T”). For validity of the vMMN several relationships between the vMMN and (a) memory, (b) attention, (c) reaction time, (d) general intelligence, (e) personality, (f) emotional experience, (g) personality, and (h) auditory MMN were estimated. Altogether, this is the first compact report of the systematic relationships between these measures.

Talk3: Localizing the visual mismatch negativity (vMMN)

Petia Kojouharova and István Czigler

Research Centre for Natural Sciences, Institute of Cognitive Neuroscience and Psychology, Budapest, Hungary

Abstract

There is general agreement that some of the generators of the visual mismatch negativity (vMMN) are found in modality-specific brain structures. However, the involvement of anterior structures is less clear. The inconsistent results may have been due to paradigms that could not distinguish between low-level stimulus adaptation and the genuine vMMN. In our study we used an experimental paradigm in which the unattended standard and deviant stimuli were the vanishing and appearing parts of a constantly present object. In this case mainly genuine vMMN is elicited to the vanishing deviants. The paradigm was modified for use in EEG and fMRI studies. In our ERP study vMMN to the vanishing deviant stimuli emerged in the 100-200 ms time window. VMMN was also observed to the appearing deviant stimuli in the 100-200 ms and in the ~230-280 ms time windows but with a different scalp distribution. The fMRI results indicated larger activity for the deviant stimuli compared to the standard stimuli at posterior, modality-specific brain areas, but no difference in the anterior activation. By contrast, the results from the source localization analysis of the EEG data indicated differences in anterior activation. We explore the reasons for this contradiction.

Talk4: From the Optical Mismatch Responses in Auditory and Visual Change Detections to a Generic Fronto-Sensory Cortical Brain Network in Mismatch Negativity

Chun-Yu Tse

Department of Social and Behavioural Sciences, City University of Hong Kong, Hong Kong

Abstract

Prediction violation hypothesis is suggested in Mismatch Negativity (MMN) generation. In the auditory modality, a cortical brain network with frontal-to-temporal and temporal-to-frontal connections were shown by using the event-related optical signal (EROS). Studies combining the transcranial magnetic stimulation (TMS) with the EROS or EEG/ERP further demonstrated causal fronto-temporal connections of the network. In the visual modality, optical mismatch responses in the fronto-occipital cortical network and simultaneously recorded ERP vMMNs have been revealed. Assuming that the prediction violation hypothesis is universal in MMN generation, a similar neural mechanism should be found in all sensory

modalities. This presentation will discuss the evidence supporting a generic fronto-sensory cortical brain network of mismatch negativity in the auditory and visual modalities.

Symposium 8

Application in Clinical Psychophysiology

Chairperson： Shugo Suwazono[1], Kazunari Ikeda[2]

[1]Center for Clinical Neuroscience, National Hospital Organization Okinawa National Hospital, Ginowan, Japan

[2]Tokyo Gakugei University, Koganei, Japan

Description of theme and target audience

Psychophysiology is a research field where physiological variables are evaluated in association with psychological variables. This symposium presents current advance of psychophysiological practices using mismatch negativity (MMN) for a wide range of neurological and psychiatric disorders. Suwazono et al. account for attentional deficits in patients with myotonic dystrophy type 1 (DM1) in conjunction with possible abnormalities of MMN, P3a and P3b. Ikeda reviews a relation of sensory hypersensitivity symptoms with neural connectivity deficits in autism spectrum disorder (ASD), and a possible correlation of MMN with sensory hypersensitivity in patients with ASD. Hidaka provides a review of MMN abnormalities found for patients with developmental dyslexia (DD). He then presents MMN outcomes recorded from Japanese children with DD. Mori et al. examine, by using MMN as a measure, a hypothesis that sensory memory associated with the temporal window of integration (TWI) is impaired in patients with schizophrenia. They then show a delay of omission MMN in patients with schizophrenia as an evidence supporting the hypothesis.

Talk1: ERP abnormalities in patients with myotonic dystrophy, including P3a and mismatch negativity

Shugo Suwazono,[1] Hiroshi Arao,[2] Shino Maedo,[3] Yukihiko Ueda[3]

[1]Center for Clinical Neuroscience, National Hospital Organization Okinawa National Hospital, Ginowan, Japan

[2]Taisho University, Tokyo, Japan

[3]Okinawa International University, Ginowan, Japan

ABSTRACT

Myotonic dystrophy type 1 (DM1) is most frequently experienced muscular dystrophy among adults with autosomal dominant inheritance, and can be lethal due to respiratory failure as well as multi-organ dysfunctions. This disease is also known to cause dementia.

Neuropsychologically abnormal findings were reported repeatedly, including impairments of attention or visual information processing.

Neuroimaging studies have reported high-intensity T2/FLAIR lesions at subcortical areas, frequently occurring within temporal lobes (especially at temporal tips and/or around insula) and parietal lobes.

As for the event-related potential, several auditory P3b and P3a studies have reported abnormality (delayed peak latency and/or smaller peak amplitude), but no reports are searchable using mismatch negativity (MMN) in May 2022.

At this symposium, we are going to present some features of MMN in the preliminary data recorded from 6 patients with DM1 compared to those from 5 normal controls, as well as the literature review of P3a and P3b.

Talk2: Mismatch negativity deficits associated with sensory hypersensitivity in autism spectrum disorder

Kazunari Ikeda[1]

[1]Tokyo Gakugei University, Koganei, Japan

ABSTRACT

The tendency of autism spectrum disorder (ASD) runs parallel with sensory processing deviance, such as sensory hypersensitivity. A behavioral feature of sensory hypersensitivity is a reduced threshold of discomfort to stimuli, whereas those patients do not differ from healthy persons in stimulus detection thresholds. Sensory hypersensitivity is theorized to be resulting from compensatory neuronal overactivity in response to signaling deficits in the brain, in particular neural connectivity deficits of sensory processing pathways.

Studies using mismatch negativity (MMN) suggest the neural connectivity deficits underlying sensory hypersensitivity associated with ASD. Ludlow et al. (2014) found the tendency of MMN amplitude reduction according to sensory hypersensitivity for individuals with ASD. Ryu and Ikeda (2017) examined global and local processing of MMN by using Bekinschtein et al. (2009)'s paradigm and showed that MMN amplitudes for local but not for global deviations inclined to decrease in correlation with ASD traits and sensory hypersensitivity.

It is known that MMN amplitudes in patients with ASD increase with age development. In this presentation, it is explained that age-depended compensation against sensory hypersensitivity would partly contribute to the age-depended increase of MMN amplitudes in patients with ASD.

Talk3: Mismatch negativity in Japanese children with developmental dyslexia

Motonobu Hidaka[1]

[1]Saga University, Saga, Japan

ABSTRACT

Specific Learning Disorders (SLD) are neurodevelopmental disorders that show difficulties in specific academic skills such as reading, writing, and computing. Among SLD, developmental dyslexia (DD) reveals the difficulty to read fluently due to phonological processing problems.

Previous studies have demonstrated the atypical MMN in individuals with DD. A recent review has shown that children and adults with DD have the reduced MMN amplitude to speech sounds, and only adults with DD have the reduced MMN amplitude to non-speech sounds (Gu & Bi, 2020). Furthermore, at-risk children, from infants to preschool-age children, show the reduced MMN amplitude to speech sounds (Volkmer & Schulte-Körne, 2018). It is known that there are correlations between the MMN to speech sounds and behaviors, such as rapid automatized naming, reading, and spelling skills. Therefore, the MMN may be used to assess DD early (Norton et al.,

2021).

The Japanese language has a clear correspondence between kana characters and their mora sounds. Therefore, few Japanese children have difficulty in reading. Because Japanese children with DD have demonstrated reading and writing difficulties in kanji, it is considered that DD in Japanese is related to phonological and visuospatial processing impairments (Tanaka Welty et al., 2014; Kaga, 2020).

We will review the MMN in DD at this symposium and present a pilot study on the MMN to speech sounds in Japanese children with DD.

Talk4: A functionally impaired temporal window of integration leading to mismatch negativity abnormalities in schizophrenia

Yuhei Mori,[1] Hiroshi Hoshino,[1] Yusuke Osakabe,[1] Tomohiro Wada,[1] Kazuko Kanno,[1] Tetsuya Shiga,[1] Shuntaro Itagaki,[1] Itaru Miura,[1] Hirooki Yabe[1]

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ABSTRACT

Mismatch negativity (MMN) has recently become one of favorable neurophysiological biomarkers in schizophrenia. A definite reduction in early schizophrenia was evident in duration-MMN (dMMN） but not frequency deviants. The impaired dMMN might be caused by the dysfunction of temporal window of integration (TWI). We hypothesized that sensory memory associated with the TWI would be impaired in patients with schizophrenia. We aimed to assess the functional changes in auditory sensory memory associated with the TWI in patients with schizophrenia by investigating the effect of omission of complex speech stimuli on the MMN. In total, 17 patients with schizophrenia and 15 control individuals participated in the study. The MMN in response to omission deviants of complex speech sounds was recorded, while the participants were instructed to ignore the series of speech sounds. The MMN latency in patients with schizophrenia was significantly prolonged by deviant stimuli to omissions corresponding to the early and late parts of the temporal TWI. Our results suggested that sensory tracing function in patients with schizophrenia was impaired in the early and the latter half of the TWI. We showed that certain MMN abnormalities in patients with schizophrenia may be caused by an impaired TWI.

Symposium 9

MMN and Early Psychosis

Chairperson： Dean F Salisbury[1], Juanita Todd[2],

[1] Department of Psychiatry, University of Pittsburgh School of Medicine.

[2]1School of Psychological Sciences, University of Newcastle.

Description of theme and target audience

The purpose of this session is to present newer paradigms and methods for exploring MMN deficits early in the course of psychosis. Each speaker will present data in early psychosis that goes beyond the traditional oddball subtraction of scalp-recorded EEG. Other modalities, such as MEG will be highlighted by Drs. Valt and López-Caballero, and include advanced source modeling and spectral analyses of MMN activity in auditory cortex. Dr. López-Caballero will also present preliminary data on the longitudinal course of MMN changes during the first year following initial psychotic episode, with scans at 3, 6, and 12 months follow-up. Computational modeling of the extended auditory system effective connectivity between temporal and frontal cortices in early psychosis and long-term psychosis will be presented by Dr. Todd. Results of newer paradigms based on complex pattern recognition will be presented by Dr Fisher. The overarching theme of the session will be to explore more fine-grained analyses and complex paradigms to uncover subtle pathophysiology in early psychosis and to increase the ability to utilize MMN as a biomarker of psychosis earlier in the disease course, while also exploring possible longitudinal changes in MMN processing with disease progression.

Talk1: Computational modelling exposes early signs of auditory network changes associated with smaller mismatch negativity in schizophrenia.

Juanita Todd[1], Zachary Howard[2],

Ryszard Auksztulewicz[3], Dean Salisbury[4]

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Abstract

Differences in sound relevance filtering in schizophrenia are proposed to represent a key index of biological changes in brain function in the illness. A computational modelling approach was used to test the hypothesis that differences might already be evident in first episode, becoming more pronounced in the established illness. Event-related potentials to a typical oddball sequence (rare pitch deviations within a sequence of regular sounds) were recorded from ninety persons with schizophrenia (40 first episode, 50

established illness) and age-matched healthy controls. The data were analysed using dynamic causal modelling to identify the changes in effective connectivity that best explained group differences. Schizophrenia group differences were linked to intrinsic (within brain region) connectivity changes. In activity-dependent measures these were restricted to the left-auditory cortex in first episode but were more widespread later in the illness. Modelling suggested significantly lower inhibition of inhibitory interneuron activity and altered gain on superficial pyramidal cells, with the data indicative of differences in both putative N-methyl -D- aspartate glutamate receptor activity-dependent plasticity and classic neuromodulation. The study further supports responsiveness to structured sound sequences in schizophrenia as informative to uncovering the nature and progression of changes in brain function during the illness.

Talk2: Utility of complex MMN elicited by auditory patterns in early phase psychosis

Derek J. Fisher[1,2,3,4], T-Jay Anderson[2], Jenna N. Bissonnette[3], Emma M.L. Ells[1], Hayley Riel[3], Erica D. Rudolph[4,] Dean F. Salisbury[5], Philip G. Tibbo[3]

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Abstract

While robust MMN deficits, particularly to duration deviants, have been reported in chronic schizophrenia, MMN reduction in first-episode and early phase psychosis is significantly less consistent. Traditional "oddball" MMN measures of sensory information processing relying on deviance of a single stimulus feature may be considered too simple for use in early phase psychosis in which pathology has not progressed fully, and a paradigm that requires more complex cortical processing may be more appropriate for elucidating consistent auditory change detection deficits.

We report a series of studies in early phase psychosis participants using both typical and complex MMN paradigms. Less complex paradigms only appeared to elicit MMN amplitude deficits with greater illness progression and/or severity, while more complex pattern paradigms were associated with more consistent deficits and larger between-group effect sizes.

These findings suggest that MMNs elicited by complex pattern paradigms are impaired in psychosis patients early in the progression of illness and may be better suited to elucidate the subtle brain-based changes in this early phase. Future work should continue to investigate complex paradigms in hopes of identifying more consistent early processing deficits in this population, as well as in first episode and clinical high risk samples.

Talk3: Reduced Magnetic Mismatch Negativity in Psychosis

Christian Valt[1], Tiziana Quarto[1,2], Angelantonio Tavella[3], Fabiola Romanelli[3], Leonardo Fazio[1,4], Giorgio Arcara[5], Mario Altamura[6], Antonello Bellomo[6], Giuseppe Barrasso[7], Giuseppe Blasi[1,3], Flora Brudaglio[7], Angela Carofiglio[8], Enrico

D'Ambrosio[3,9], Flavia Antida Padalino[6], Antonio Rampino[1,3], Alessandro Saponaro[10], Domenico Semisa[8], Domenico Suma[10], Giulio Pergola[1], & Alessandro Bertolino[1,3],

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ABSTRACT

Abnormal auditory processing of deviant stimuli, as reflected by mismatch negativity (MMN), is often reported in schizophrenia. At present, it is still under debate whether this dysfunctional response is specific to the full-blown schizophrenia diagnosis or rather a marker of psychosis in general. The present study tested MMN in patients with schizophrenia (SCZ), with bipolar disorder (BD), with a first episode of psychosis (FEP), and in subjects at clinical high risk for psychosis (CHR).

The ethics committee of the University Hospital of Bari approved the MEG protocol of the present study, and all the participants gave their informed consent for the recording of both clinical and MEG data.

Source-based MEG activity evoked during a passive auditory oddball task was recorded from 135 patients grouped according to diagnostic subgroup (SCZ, BD, FEP, and CHR) and 135 healthy controls also divided into four subgroups, age- and gender-matched with diagnostic subgroups. The magnetic MMN (mMMN) was analyzed as event-related field (ERF), Theta power, and Theta inter-trial phase coherence (ITPC).

The clinical group as a whole showed reduced mMMN ERF amplitude, Theta power and ITPC, without any statistically significant interaction between diagnosis and mMMN reductions. The mMMN subgroup contrasts showed lower ERF amplitude in all the diagnostic subgroups. While SCZ also showed significant power and ITPC reductions and indications of diminished ITPC were observed in CHR, no significant power and ITPC decreases characterized BD and FEP.

Significant mMMN alterations in people experiencing psychosis, also for diagnoses other than SCZ, suggest that this neurophysiological response may be a marker of psychosis. Additionally, reduced Theta ITPC may be associated with risk for psychosis.

Talk4: Longitudinal assessment of magnetoencephalographic (MEG) pitch and duration MMN in first-episode psychosis: progressive deficits in right-hemisphere lateral belt

Fran López-Caballero, Yiming Wang, Dylan Seebold, Rebekah Farris, Vanessa Fishel, Natasha Torrence, Mark Curtis, Brian A Coffman, Dean F Salisbury

Clinical Neurophysiology Research Laboratory, Western Psychiatric Hospital, University of Pittsburgh School of

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Abstract

Mismatch Negativity (MMN) is considered a biomarker of cortical dysfunction in schizophrenia (SZ) because it is severely reduced to pitch (pMMN) and to duration (dMMN) deviant stimuli. However, it is less clear if MMN is reduced in first episode psychosis, and if MMN shows progressive impairment with early disease course. We investigated the neural generators of pMMN and dMMN with MEG in first episode psychosis patients (FE) and healthy controls (HC) at baseline and at a 3-to-12 months follow-up (23 FE and 25 HC). We projected MEG inverse solutions to participant's individual MRI-based cortical surfaces, parcellated using the Human Connectome Project Glasser quasi-functional parcellation, and localized MMN activity in left and right primary auditory cortices (A1), Lateral Belts (LBelt) and ParaBelts (PBelt). Two-way rmANOVAs with Time (Baseline vs Follow-up), Hemisphere and Group factors at each parcel revealed an overall trend-level reduction of dMMN in FE relative to HC at A1 ($p = 0.6$), LBelt ($p = 0.6$) and PBelt ($p = 0.6$), while no differences were observed for pMMN. In dMMN, trend-level significant Time x Hemisphere x Group interactions were found at A1 ($p = 0.5$) and LBelt ($p = 0.6$). Further exploring these interactions revealed a right-hemisphere LBelt selective dMMN deficit in FE relative to HC, present only at the follow-up ($p = 0.006$). Our results, albeit trend-level, suggest a right-hemisphere selective pathophysiology in the auditory cortex during early psychosis that is progressive with psychosis duration and affects the processing of stimulus duration. We continue to test participants longitudinally for this project to increase the sample sizes and power. In our next steps we will include MMN paradigms with double-rule deviants which will reveal more consistently and prematurely the functional auditory processing deficits in early psychosis.

Symposium 10

Naturalistic MMN paradigms - dream or reality?

Chairperson： Mari Tervaniemi[1,2], Elvira Brattico[3,4].

[1]Cognitive Brain Research Unit, Department of Psychology and Logopedics, Faculty of Medicine, University of Helsinki, Helsinki, Finland

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[4]Department of Education, Psychology, Communication, University of Bari Aldo Moro, Italy

Description of theme and target audience

MMN studies have primarily been conducted using the oddball paradigm, with repeated sound features interspersed by infrequent ones. However, if we consider the auditory environments of our everyday life, we notice the difference and the limits of generalising MMN findings to real-world auditory predictions. We are often surrounded by speech, environmental sounds, and some background music in parallel. In order to cope with such chaotic auditory signals, we need to encode and predict various auditory signals at once. With the goal of reaching ecological validity for MMN research, several paradigms have been developed, particularly in the musical domain. This symposium highlights and integrates those efforts, hopefully enabling us to move one step further in future studies. The talks of the symposium would illuminate the existing paradigms: the melodic multifeature MMN paradigm, the musical multifeature MMN paradigm, the polyphonic MMN paradigm, the free-listening MEEG paradigm, in parallel with the key findings and the initial applications on special populations (cochlear implant users, elderly individuals, children).

Talk1: Various auditory stimulation paradigms in MMN studies

Mari Tervaniemi

Cognitive Brain Research Unit, Department of Psychology and Logopedics, Faculty of Medicine, University of Helsinki, Helsinki, Finland

Centre of Excellence in Music, Mind, Body and Brain (MMBB), Faculty of Educational Sciences, University of Helsinki, Finland

Abstract

In my talk, I will introduce the development of auditory stimulation paradigms of MMN studies. I will start from traditional oddball paradigms and end up to multi-feature and melodic paradigms. Also the effects of sound structure and familiarity will be discussed. The talk will focus on MMN paradigms used in music-related studies but also some examples from language studies will be given.

Talk2: Investigating learning and maturation in the brain with naturalistic MMN paradigms

Elvira Brattico

Center for Music in the Brain, Department of

Clinical Medicine, Aarhus University, Denmark
Department of Education, Psychology, Communication, University of Bari Aldo Moro, Italy

Abstract

My talk will provide an overview of findings on MMN parameters and reconstructed sources in relation to learning realistic and complex auditory sequences (e.g. atonal music) within the experimental session or after years of training in both adults and school-age children. Methodological innovations concerning both the stimulation paradigms and the analysis approaches will be presented. I will argue that these methodological advances and the related findings provide a consistent scenario for measuring MMN-related predictive processes in real life, even outside the lab.

Talk3: The effects of music and language training on MMN generators in complex stimulation paradigms

Vesa Putkinen,
Turku PET Center, University of Turku, Turku, Finland

Abstract

The talk will cover recent findings regarding the effect of music and language interventions on the MMN in children. I will discuss how the effects of these interventions are reflected in generators of MMNs obtained to different deviants in complex musical paradigms. I will relate these findings to prior findings in adult musicians in order to illustrate how processes reflected by MMN, particularly in complex musical paradigms, are modulated by short- and long-term auditory learning.

Talk4: Clinical applications of naturalistic MMN paradigms

Niels Trusbak Haumann
Center for Music in the Brain, Department of Clinical Medicine, Aarhus University, Denmark

Abstract

The talk will introduce recent developments on applying the individual-level MMN for objective tracing of neural rehabilitation in the individual patient. Findings will be presented on the application of MMN paradigms for investigating the rehabilitation of music perception abilities of individual cochlear implant users. It will also be shown that MMN can be applied to investigate how changes in the aging brain can influence the neural processing of auditory stimuli at different levels of complexity and ecological validity.

Symposium 11

The Neuronal Basis of Predictive Coding: What we have learnt about Predictive Coding Deficits in Schizophrenia from Animal Studies

Chairperson： Patricia Michie[1], Juanita Todd[1].

[1] School of Psychological Sciences, University of Newcastle, Australia

Description of theme and target audience

Currently there is rather universal consensus in neuroscience, that a major function of the brain is to constantly predict environmental events, and the brain's neuronal circuitry is organized as a highly predictive machine (Friston and colleagues). For example, one anticipates how a word of a friend will sound, and when and how a sentence will end, even before it has ended. The predictive coding mechanism of the brain enables highly efficient and adaptive behaviour, and it is the basis for the enormous flexibility underlying interactions with our physical and social environment. Impairments in this process are likely to underlie the cognitive deficits observed in psychiatric diseases such as schizophrenia and autism. One model to study predictive coding is stimulus-specific adaptation (SSA), a change-detection measure observed at a single cell level. SSA has become a major tool for studying predictive auditory processing in recent years. It is believed to parallel Mismatch Negativity (MMN), an event-related potential (ERP) measured from the human scalp. MMN has been positioned as a promising biomarker for the diagnosis of pathologies for schizophrenia disorders. Thus, SSA, MMN and other models presented here may become a handle for understanding neuronal dysfunction in such disorders.

The auditory system is particularly important for predictive processing because it can detect signals coming from any direction within noisy backgrounds in a pre-attentive mode (e.g. during sleep). The auditory system can, thus, cope with the variability and redundancy in the auditory scene.

Th symposium will focus on what have we learnt about predictive coding deficits in schizophrenia from animal studies. There are two questions the symposium will address: (i) is there evidence of mismatch response (MMR) reduction and predictive coding deficits in animal models of schizophrenia and (ii) what have we learnt about the mechanisms of predictive coding from animal studies that are relevant to schizophrenia.

Talk 1: The effect of schizophrenia risk factors on mismatch responses in a rat model: the importance of contextual factors induced by paradigm manipulations and sex for modelling schizophrenia-like MMN impairments in rodents.

Jaishree Jalewa[1], Juanita Todd[1], Patricia T. Michie[1], Deborah M. Hodgson[1], Lauren Harms[2]

[1] School of Psychological Sciences, College of Engineering, Science and Environment, University of Newcastle, Callaghan, NSW 2308. Australia

[2] School of Biomedical Science and Pharmacy, College of Health, Medicine and Wellbeing, University of Newcastle, Callaghan, NSW 2308. Australia

Abstract

The last few decades have seen a growing interest in the mismatch negativity (MMN), an event related

potential, as a preclinical biomarker for schizophrenia due to the robust findings of reduced MMN amplitude in individuals with schizophrenia in comparison to healthy controls. In addition to the genetic contribution, the risk of developing schizophrenia is governed by two developmental factors, maternal infection and adolescence cannabis use. Given the rat brain is capable of generating human-like mismatch responses (MMRs), we investigated the effect of these two developmental risk factors on rat MMR amplitude in different auditory contexts to explore the potential causes of smaller MMN amplitudes. MMRs were assessed in awake adult male and female Wistar rats that were offspring of pregnant dams treated with either a viral infection mimetic (poly I:C) inducing maternal immune activation (MIA) or saline control. During adolescence, subgroups of the prenatal treatment groups were exposed to either a synthetic cannabinoid (adolescent cannabinoid exposure: ACE) or vehicle. The MMRs were obtained from the rats exposed to two different auditory contexts: first, the deviance difference paradigm, where the physical difference between rare and common auditory stimuli was different but the probability of the rare stimulus was constant, and second, the deviant probability paradigm, where the probability of the rare stimulus varied but the physical difference between rare and common remained constant. The design of the multiple stimulus sequences across the two paradigms also allowed an investigation of context on MMRs to two identical stimulus sequences. We found a significant MMR amplitude reduction in rats exposed to each of the risk factors for schizophrenia (MIA, ACE or both), relative to controls but only in males and only in the deviant probability paradigm, demonstrating the importance of context and sex. For the physical difference paradigm, no change in the MMR amplitude was found in either male or female rats exposed to the risk factors. Our findings suggest that the contextual factors induced by paradigm manipulations and sex are salient elements to be considered for modelling schizophrenia-like MMN impairments in rodents.

Talk 2: Why the NMDA model of schizophrenia is not the whole story based on NMDA-R antagonism in animal models and what are the data that suggest this?

Patricia T. Michie,[1] Lauren Harms,[2] Gloria G. Parras[3], Manuel S. Malmierca[3]

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[3]Cognitive and Auditory Neuroscience Laboratory, Institute of Neuroscience of Castilla y León (INCYL), Salamanca, Spain.

Abstract

There is considerable evidence that pharmacological disruption of glutamate neurotransmission alters MMN. Ketamine, a glutamate NMDA-R antagonist, reduces the peak amplitude of MMN and prolongs the peak latency in healthy participants. These findings are very relevant to clinical conditions such as schizophrenia not only because patients with a diagnosis of schizophrenia have reduced MMN but also because administration of ketamine to healthy individuals produces a psychotic syndrome very similar to schizophrenia including positive and negative symptoms and cognitive impairments. These observations lend weight to the

notion that schizophrenia is caused by dysfunction in Glutamatergic neurotransmission.

Many animal models of schizophrenia have used pharmacological challenges entailing antagonism of the glutamate NMDA-R system. However, recent data have demonstrated that the link between NMDA-R function and the Mismatch Response (MMR – the difference between deviant and standard responses) recorded in animals is not as clear as once thought. It is true that high doses of NMDA-R antagonist such as MK-801 reduces the equivalent of a late MMR in rodents but a low dose appears to facilitate both early and late components of the rat evoked response, and to increase MMRs in early components. Similar results for a low dose of MK-801 have been obtained for single-unit activity and local field potential recordings of neuronal mismatch recorded along the auditory thalamocortical pathway: a low dose in female rats resulted in an increase in neuronal mismatch in both thalamus (MGB: medial geniculate body) and auditory cortex. These observations are not consistent with a simple NMDA-R model of schizophrenia at least as reflected in MMRs. There do not appear to be parallel ketamine dose response studies in humans. However, it is known that administration of a high dose of memantine, a low affinity NMDA-R antagonist, increases MMN in both healthy controls and in patients with a schizophrenia diagnosis. Interestingly, both MK-801 and memantine exhibit nearly identical binding locations on the NR2B subunit of the NMDA-R suggesting that there may be a common mechanism for the effects of low dose MK-801 and memantine on MMN and that this common mechanism could offer potential new treatment targets for psychosis.

Financial support was provided by the Spanish Agencia Estatal de Investigación [(AEI), PID2019-104570RB-I00], the European Union's Horizon 2020 research and innovation programme under grant agreement No 952378 - BrainTwin to MSM and NHMRC grant No. APP1109283.

Talk 3: A new functional role of MMN-like response beyond simple deviance detection: using animal models to elucidate the underlying neural mechanisms of schizophrenia

Tomoyo Isoguchi Shiramatsu,[1] Hirokazu Takahashi,[1]

[1]Graduate School of Information Science and Technology, The University of Tokyo, Tokyo, Japan

ABSTRACT

Mismatch negativity (MMN) has been widely considered a major candidate biomarker of schizophrenia, because it is mediated by N-methyl-D-aspartic acid receptors. However, at present, no direct evidence has linked the MMN response and aberrant salience processing reported in schizophrenia patients, i.e., whether MMN represents empirical salience of the deviant stimulus. To test the eligibility of the MMN response as a biomarker of schizophrenia, we hypothesized and verified that the MMN in the rat auditory cortex encodes empirical salience, which depends on both empirical rarity of sound and association of sound with salient events through classical conditioning.

With a specific pure tone, the rats were (i) simply exposed to the tone, (ii) appetitive or (iii) aversive conditioned in classical manner, or (iv) experienced an extinction training following aversive conditioning. Thereafter, we recorded MMN from the auditory cortex of these rats as well as (v) naïve rats. We first focused on the frequency-dependent asymmetry of the MMN amplitude; in naïve rats, increment frequency changes

elicit asymmetrically larger MMN amplitudes than do decremental frequency changes. We found that sound exposure reversed this asymmetry, indicating that MMN encodes the empirical rarity of deviant sounds. Second, we demonstrated that the MMN amplitude increased after association of a sound with salient events, e.g., the appetitive or aversive classical conditioning, and decreased after extinction training following aversive conditioning. These results indicate that the MMN response reflects the empirical salience of sound. The present work first linked MMN with empirical salience processing and expands the possibilities of MMN as a strong clinical biomarker of schizophrenia.

Talk 4: Cortical Microcircuit Mechanisms of Mismatch Negativity and Its Underlying Subcomponents

Jordan P. Hamm[1]

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ABSTRACT

People with schizophrenia (SZ) exhibit altered sensory cortical responses to unexpected stimuli during "oddball" sequences – i.e. reduced "mismatch negativity" (MMN). Reduced MMN is among the best replicated biomarkers of SZ, yet a comprehensive understanding of the brain systems giving rise to MMN remains an unmet target in neuropsychiatry. Neurotechnologies available in mice provide promise for interrogating cell and circuit-level functions, but evoked potentials like MMN have proven notoriously difficult to translate to mice in a straightforward manner.

Here I focus on cellular and electrophysiological signals of "deviance detection"– enhanced neural activity to contextually unexpected stimuli. Deviance detection (DD) is one of the primary components thought to drive the MMN waveform. I will present data isolating DD in mice at the level of individual neurons and theta-band oscillatory power and synchrony, and then present work testing a circuit-level model of deviance detection that integrates from cells to circuits to physiology. Specifically, I propose that during predictable sensory stimulation (such as an oddball or cascade paradigm), top-down "predictions" from higher cortex are sent to sensory cortex via feed-back projections, tonically active in the theta-band. This drives sensory cortical VIP-interneurons to modulate pyramidal neuron (PYR) excitability via SST-interneuron mediated (dis)inhibition. Stimuli which betray these top-down "predictions" (oddballs) strongly activate a subset of disinhibited PYRs to synchronize theta oscillations in feed-forward streams. Electrophysiological and two-photon calcium signals were recorded in awake head-fixed mice (male and female; VGlut-cre, VIP-cre, SST-cre; n=21 mice) during classic visual oddball and "many-standards control" sequences, which allowed the separation of genuine deviance detection signals to novel stimuli from the simple absence of stimulus specific adaptation. Additionally, chemicogenetic silencing of VIP interneurons (DREADDs) was carried out during LFP recordings to demonstrate their relevance as a local mediator of ACa-V1 synchrony and "deviance detection" signals.

Talk 5: Model-based prediction of

muscarinic receptor function from auditory mismatch negativity responses

Jakob Heinzle,[1] Dario Schöbi,[1] Klaas Enno Stephan[1,2,3]

[1]Translational Neuromodeling Unit, Institute for Biomedical Engineering, University of Zurich & Swiss Institute of Technology (ETH Zurich), Zurich, Switzerland,

[2]Wellcome Centre for Human Neuroimaging, University College London, London, UK,

[3]Max Planck Institute for Metabolism Research, Cologne, Germany

ABSTRACT

Many therapeutic strategies in psychiatry are based on drugs affecting neuromodulation, for example by dopamine or acetylcholine. These neuromodulators can affect neurophysiology by changing neuronal gain and synaptic plasticity. Clinical diagnostics would profit if this effect could be exploited in the reverse direction, i.e., to infer the status of specific neuromodulatory systems from electrophysiological measures. Here, we provide proof-of-concept that the functional status of muscarinic receptors can be inferred from electrophysiological data using generative (dynamic causal) models. To this end, we used epidural EEG recordings over two auditory cortical regions during a mismatch negativity (MMN) paradigm in a rat model. Each animal was treated with different doses of muscarinic receptor agonists and antagonists across sessions. Together with a placebo condition, this resulted in five levels of muscarinic receptor status. We employed a dynamic causal model - embodying a small network of coupled cortical microcircuits – to estimate synaptic parameters across pharmacological conditions. The resulting parameter estimates associated with synaptic efficacy showed graded muscarinic effects. Crucially, we could reverse the direction and predict the type of pharmacological manipulation, agonistic or antagonistic, from synaptic parameter estimates. This finding illustrates the potential utility of generative models of electrophysiological data as computational assays of neuromodulatory (muscarinic) function. In application to EEG data of patients from heterogeneous spectrum diseases, e.g. schizophrenia, such models might help identify subgroups of patients that respond differentially to cholinergic treatments.

Symposium 12

Mismatch response reflecting typical and atypical auditory cognition in infants

Chairperson： Vesa Putkinen[1,2] Teija Kujala[1]

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[2]Turku PET Centre, University of Turku, Turku, Finland,

Description of theme and target audience

The symposium presents recent findings of neural processes extracting higher-order auditory information in infants, such as the structure of sound sequences. This ability is a crucial prerequisite of separating concurrently active sound sources (forming auditory perceptual objects), language acquisition, and music perception. Studies presented in the symposium show evidence suggesting that the brain of even prematurely born infants encodes the complex temporal structure of rhythmic patterns, extracts the beat and hierarchical metrical frequencies, thus enhancing the grouping of frequencies important for perceiving musical and linguistic structure. At just 6 months of gestation, preterm infants are sensitive to conditional probabilities between two syllables while full-term neonates can chunk a stream composed of 4 tri-syllabic words while also retaining their first syllable. The newborn brain models the large-scale structure of sound sequences, adapting its response to deviant events according to their relevance within the current context. Developmental deficits, such as developmental dyslexia risk, detrimentally influence lower-level sound processing abilities, such as stimulus discrimination and regularity detection at birth. However, these low-level discrimination functions can still be improved by early interventions.

Talk 1: Rhythm in the premature brain: Neural encoding of auditory beat and grouping (meter) structure

Laurel J Trainor,[1,2] Sahar Moghimi,[3,4] Erica Flaten,[1] Mohammadreza Edalati,[3,4] Guy Kongolo,[3,4] Ghida Ghostine,[3,4] Fabrice Wallois[3,4]

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ABSTRACT

Rhythms are ubiquitous in biological systems—including motor control, music and language—likely because they provide a scaffold for organizing sensory input and motor output, and rhythmic regularity enhances temporal prediction. Further, deficits in rhythm perception have been linked to several developmental disorders including dyslexia, autism, and developmental coordination disorder. In a series of studies, we have shown that when presented with a rhythm pattern, in the first year after birth, infants'

brains encode the beat frequency (tempo) as well as hierarchical grouping frequencies (e.g., groups of 2 beats or duple (march) meter frequency; groups of 3 beats or triple (waltz) meter frequency), as reflected by analyses of rhythmic neural activity extracted from EEG. Furthermore, infants can be primed to perceive the same ambiguous rhythm as either in duple or triple meter, indicating they engage in top-down processing of meter. Given the importance of rhythm for sensorimotor development in general, and language and musical development in particular, we have recently measured neural EEG responses in infants born prematurely. Already by 32 weeks gestation, the premature infant brain encodes both the beat and meter frequencies (duple, triple, quadruple). Furthermore, at least for faster tempos, neural responses are phase aligned with the envelope of the auditory stimulus rhythms, and the premature brain appears to enhance representations for some important meter frequencies, suggesting particular sensitivity to grouping structure. Together these results indicate very early neural encoding of a hierarchy of beat and meter frequencies in auditory patterns, and suggest that from the beginning, auditory sensory input is rhythmically organized.

Talk 2: Statistical learning and higher-order structure in neonates

István Winkler,[1] Juanita Todd,[2] Gábor P. Háden[1,3]

[1]Institute of Cognitive Neuroscience and Psychology, Research Centre for Natural Sciences, Budapest,

[2]School of Psychological Sciences, University of Newcastle, Callaghan,

[3]Department of Telecommunications and Media Informatics, Budapest University of Technology and Economics, Budapest

ABSTRACT

Contemporary theories assume that regularities in sound are exploited by the brain to create internal models of the environment. These internal models are thought to be acquired through statistical learning and used to predict upcoming sounds. Depending on whether a sound matches or mismatches the prediction, it receives different amount of processing, which can be detected from the electrical brain activity measurable from the scalp. The difference between the two signals can thus be used to infer the existence and properties of the internal models.

Here we asked how the large-scale structure of a sequence affects the learning of a simple statistical regularity in the newborn brain. To this end, we compared the responses to common and rare sounds delivered in a long oddball sequence with the ones obtained when the probabilities of two sounds were repeatedly exchanged within a continuous sequence (the primacy bias paradigm).

Somewhat surprisingly, we found that when common and rare sounds continue in stable probabilities over a very long period, neonates respond to all sounds equivalently (no differentiation). However, when the same common and rare sounds at the same probabilities alternate over time, the neonate responses show clear differentiations. The context-dependence is consistent with the possibility that the neonate brain produces more precise internal models that discriminate between contexts when there is an emergent structure to be discovered but appears to adopt broader models when discrimination delivers little or no additional information about the environment.

The study was conducted with permission from the Medical Research Council-Committee of Scientific and Research Ethics (ETT-TUKEB), Hungary in full

adherence to the Helsinki Declaration and all national and international laws.

Talk 3: Early neural signs of dyslexia and potential means to prevent reading problems

Teija Kujala[1] Paula Virtala[1]

[1]Cognitive Brain Research Unit, Centre of Excellence in Music, Mind, Body and Brain, Department of Psychology and Logopedics, Faculty of Medicine, University of Helsinki

ABSTRACT

Developmental dyslexia, a reading-skill disorder that can emerge irrespective of normal intellect, may result from a range of perceptual-cognitive impairments, influenced by many inherited factors. Currently the most prevailing cause of dyslexia is thought to be a poor phonological system, with deficits in phoneme representations or in their access. According to another hypothesis, implicit learning problems may underlie dyslexia. All these hypotheses have received support from brain research, yet, the results are not conclusive. Being a highly prevalent disorder, often with devastating influences on the individual's life, it would be vital to find means to identify early potential signs of dyslexia and to support early language development to prevent dyslexia prior to school start. In our ongoing longitudinal DyslexiaBaby study, we evaluated neural basis of speech processing problems in children at risk for dyslexia and determined the influence of music intervention, applied during the first six months of life, on children's language development. We found diminished/absent mismatch responses (MMRs) to vowel and rule-violation changes in speech stimuli in the at-risk group and normal-like or enhanced MMRs to duration changes. In addition, in a study determining the developmental trajectory of change-elicited responses from birth to 28 months, the developmental enhancement of the late discriminative negativity (LDN) to frequency changes was stronger between 6 and 28 months in the non-risk than at-risk group. Furthermore, we found that vocal music intervention of infants at risk for dyslexia enhanced MMR:s to vowel and frequency changes in speech stimuli, suggesting strengthened neural phoneme representations and improved auditory processing. These results suggest that the trajectory of language development of infants at risk for language impairments could be illuminated with MMR and related responses, and improved with vocal music intervention in early infancy.

Poster Session

Group1 MMN in Basic Fields (Animal, Neural and Brain)

Moderator: Eiichi Jodo[1], Misako Komatsu[2], Tomoyo Shiramatsu[3],

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[2]RIKEN Center for Brain Science, Saitama, Japan,

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P-1 Sensitivity to Complex Statistical Regularities in Neuronal Culture

Amit Yaron,[1] Zhuo Zhang,[2] Tomoyo Isoguchi Shiramatsu,[2] Zenas C. Chao [1], Hirokazu Takahashi[2]

[1] International Research Center for Neurointelligence (WPI-IRCN), The University of Tokyo Institutes for Advanced Study

[2] Graduate School of Information Science and Technology, The University of Tokyo

ABSTRACT

Neurons in the sensory cortex are sensitive to the probability of stimuli. Responses to predictable stimuli tend to be weaker than responses to unexpected ones even if the physical characteristics of the stimuli are the same. Some of these effects can be accounted for by adaptation in local circuits. However, sensitivity to a higher level of stimuli configurations is hypothesized to rely on more complex neuronal structures.

To investigate what local network dynamics can achieve, we used dissociated cultures of cortical neurons. These cultures, while much simpler in structure and number of neurons, still preserve a lot of the activity characteristics of the animal cortex.

The neuronal cultures were grown on a CMOS electrode array that enabled us to record up to 1000 electrodes out of 10000 and stimulate up to 10. We adapted a paradigm previously used in rats in which a sequence of stimuli is presented in either a periodic or random order. The sequences consisted of two stimuli. These were two tones in the case of the original experiment, recorded from the auditory cortex of rats. In this case, the stimuli were a stimulation of separate electrode groups located in different parts of the culture.

In each session, one of the stimuli was presented rarely (5%-20%, 'deviant') and the other was common (95%-80%, 'standard') and the order of presentation was either random or periodic. We compared the response of the neurons to each of the stimuli when it was in each of the conditions (deviant, standard, periodic, random). In this poster, I will describe the preliminary results we got from several cultures.

P-2 Loss of asymmetry of the descending vs ascending deviant MMN response in the alternating paradigm.

Jaishree Jalewa[1], Juanita Todd[1], Patricia T. Michie[1], Deborah M. Hodgson[1], Lauren Harms[2]

[1] School of Psychology, University of Newcastle, Australia.

[2] School of Biomedical Sciences and Pharmacy, University of Newcastle, Australia.

ABSTRACT

Mismatch negativity (MMN), an enhanced response to unexpected deviant stimuli compared to expected standard stimuli, has recently gained strong interest from both preclinical and clinical researchers due to the findings of reduced MMN amplitude in schizophrenia. An enhanced understanding of the factors that influence MMN amplitude could lead to a better understanding of neural mechanisms underpinning the changes in schizophrenia. Human studies have demonstrated a first-impression/primacy bias in auditory processing, where the MMN amplitude to two tones shows differential patterns of modulation over the course changing sound sequences, based on their relative probabilities when first encountered at sequence onset. Using a multi-time scale sequence paradigm, we investigated if rat mismatch responses (MMRs) are sensitive to the contextual information at the sequence onset similar to human MMN.

Stainless steel screw electrodes were implanted on the caudal and rostral surface of the rat skull. MMRs were studied in awake, freely moving male and female Wistar rats using wireless telemetry. All experiments were approved by the Animal Care and Ethics Committee, University of Newcastle, NSW, Australia (Ethics approval number: A-2016-610). The multitime scale sequence paradigm comprised of four sequences that were presented with 1 min silence breaks in between. Each sequence was made up of four stimulus blocks with two physically different sounds (6636 Hz, 12233 Hz) that alternated STD (87.5%) and DEV (12.5%) roles over a stable time period of 4 min block length. We found no sensitivity to primacy bias in rats, however, we did find that the alternating paradigm removed the frequency asymmetry in low vs high deviant responses, similar to a previous finding by Shiramatsu & Takahashi, 2018. Our results suggest that the context of the auditory stimulation influences the process of automatic change detection in the rat auditory system.

P-3 Human brain network involved in auditory deviance detection. An intracranial EEG study.

Alejandro Omar Blenkmann[1], Anne-Kristin Solbakk[1], Sabine Leske[1], Anais Llorens[2], Ingrid Funderud[1], Santiago Collavini[3], Pål G. Larson[4], Jugoslav Ivanovic[4], Torstein Meling[4], Tristan Bekinschtein[5], Silvia Kochen[3], Robert T Knight[2], Tor Endestad[1]

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ABSTRACT

The neural network underlying human auditory deviance detection is not fully understood. To address this, we recorded SEEG from 22 adult patients with drug resistant epilepsy who had depth electrodes implanted in all brain lobes (1193 channels). The study was approved by local Research Ethics Committee and patients gave informed written consent to participate. Patients passively heard a stream of bilaterally presented tones while reading. We used the Optimum-1 paradigm, that consisted of 300 standard tones interleaved with 300 randomly presented deviant tones per block (3 to 10 blocks per patient). Deviant tones differed from standards in: 1) intensity (louder or

softer), 2) frequency (higher or lower), 3) sound source location (right or left), 4) shorter duration, or 5) silent gap in the middle (Näätänen et al., 2004). Electrode coordinates were obtained from MRI and CT images using iElectrodes toolbox (Blenkmann et al., 2017). Channels were bipolar referenced and high frequency band activity (HFA, 75-145 Hz) extracted.
Compared to the baseline period, significant HFA responses to tones in general were observed in 31% of the channels.
We used an ANOVA to quantify the HFA response variance across trials that could be explained by the different factors of the stimuli: Intensity, Laterality, Frequency, Duration and Gap. We estimated the amount of explained variance by using ω2. Eighteen percent of the channels showed a significant increase of the condition-specific explained variance. Some channels showed condition-specific activations to one particular deviant, while others showed activations to a combination of two or more deviants.
The channels showing responses to tones in general and condition-specific effects were mostly observed bilaterally in temporal cortex. Frontal, anterior cingulate, and parietal cortices were also involved to a lesser extent. Our results reveal that a distributed brain network is involved in auditory processing and deviance detection.

P-4 Deviance Detection Properties in Dissociated Cultures of Neurons

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ABSTRACT

Mismatch negativity (MMN) is a neural response to a novel event that violates a rule. According to the "sensory memory" hypothesis, MMN reflects deviation properties of the nervous system elicited by deviant stimuli that violated the properties of the neural "memory traces" established by the previous standard stimulation. Omitted stimuli in steady trains of identical stimuli also elicit MMN in gross neural activity in the non-invasive human recording.

Here we investigate deviant detection properties including mismatch response and omission response in dissociated culture of neurons, i.e., one of the most primitive neural systems. Dissociate cultures of neuronal networks were made on CMOS arrays, where electrical stimuli were provided to characterize neuronal responses in the oddball paradigm, omission paradigm, and many standards control (MSC) with an inter-stimulus interval of 500 ms. The high-density CMOS array has a high spatio-temporal resolution that allows precise recording of action potentials from the identified cell bodies of neurons. We also investigated how the initiation of stimulation in the early developmental stage affected neural responses in each paradigm.

Our preliminary results showed that the responses of neurons to the deviant stimulation exhibited a significant difference from those of standard stimulation in the oddball experiment, especially in the late response (mediated by a number

of synapses). In several cultures, the stimulus-specific adaptation (SSA) index indicated that the early responses (directly elicited by microstimulation) of deviant stimulation were smaller than those of standard stimulation. The late responses evoked by deviants were much stronger than those by the standard stimuli. The late responses of MSC were smaller than those elicited by deviant stimuli, suggesting that some neurons had the deviant detection capability in the dissociate culture of neurons. We could not find omission responses in the present conditions. These results suggest that neuronal dissociated cultures have some primitive intelligence.

P-5 Altered hierarchical predictive processing after lesions to the orbitofrontal cortex

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ABSTRACT

The functional role of the orbitofrontal cortex (OFC) has been related foremost to inhibitory control, emotion regulation and reward processing. Recently, this perspective drastically changed, proposing that the OFC instead generates predictions about specific outcomes linked to events and actions. We tested the causal involvement of the OFC in hierarchical predictive processing by studying the event-related potentials (ERPs) of patients with focal OFC lesions (n = 12) and healthy controls (n = 14) while performing the well-known auditory local-global oddball paradigm. The structural regularities of the stimuli were controlled at two hierarchical levels; within trials (i.e., local level rule) and across trials (i.e., global level rule). Local and global level rules operate at different timescales while defining predicted individual tones and sequences of tones, respectively. In both groups, deviant tones at the "local" level produced an early mismatch negativity (MMN), followed by a frontally distributed P3a component, which might reflect a prediction error (PE) process at lower hierarchical areas. Sequences of identical tones, which were unpredicted by the global rule (i.e., "global" level), elicited only a posterior P3b. Deviant tones in sequences unpredicted by the global rule (i.e.,"local+global" levels) produced a long-lasting MMN, followed by a P300 complex (frontal P3a and posterior P3b), indicating the contribution of higher-order predictions, and their violations. In OFC patients, ERPs elicited by the predicted standard tones were unaffected compared to controls. However, OFC patients showed attenuated MMN response to "local" violation (i.e., prediction error) and attenuated P3a responses to "local+global" violations, while the P3b was unaffected. Importantly, OFC patients exhibited a normal P3b response to "global" violation. Altogether, these ERP findings suggest that the processing of both low and high-level prediction errors is impacted by OFC damage.

The study design and protocol were

approved by the Regional Committees for Medical and Health Research Ethics, South-East Norway as part of a larger study.

P-6 Development during the 1st year of hearing:Typically hearing vs. cochlear implanted children

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ABSTRACT

How do auditory perceptual abilities develop in deaf children with cochlear implants (CIs)? How does their hearing development compare to typically hearing children?

Cochlear implants are powerful auditory prostheses that stimulate the auditory nerve with electric pulses. Thus, they can provide access to the auditory world even in cases of severe deafness. Deaf children who receive implants early in life are often able to catch up with oral language acquisition sufficiently to attend mainstream schools. Yet, despite these achievements, hearing with CIs still presents technical limitations, such as for example lower pitch resolution.

Here, we investigated how auditory perceptual abilities develop in the youngest population of bilateral CI users (median age at implantation: 13.5months, range: 10-31 months) after they have gained a hearing experience of 6 months and 12 months. To do so, we adapted the musical multi-feature paradigm of Vuust et al. (2011) and implemented deviations in pitch, timbre, intensity, rhythm and a combination of rhythm and pitch – dimensions that are both relevant for music appreciation as well as oral communication. We then compared their ERPs to typically hearing infants with an equivalent hearing experience of 6 and 12 months. The study passed the ethics committee of the Technische Universität Dresden (EK 392122010). All parents gave their informed consent.

Our results indicate that, as expected, the implanted children are more heterogeneous in their performance. Yet, despite the higher variance, the mismatch response of the implanted population is remarkably close to that demonstrated by typically hearing infants. This finding remains even for those children who assuredly had no auditory experience prior to implantation. We conclude that the majority of implanted children discerns the investigated dimensions well, even when sensory stimulation of the auditory cortex has been missing for the first one or two years of life.

P-7 Network of the mismatch negativity in a gap multideviant paradigm

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ABSTRACT

Background and Aim. A recent study aimed at highlighting differences in the connectivity patterns of the MMN succeeded in highlighting 11 potential

areas for MMN generation for deviant stimuli over time. The objective of this study will be to identify the target areas involved specifically in the processing of temporal resolution in the context of the multi-deviant paradigm. Methods. Twenty healthy normal hearing subjects will be tested to record the generation of the MMN and to measure its connectivity. Participants won't be harmed during electroencephalography and will be compensated. Stimuli will be presented using a multi-deviant paradigm which consists of alternating a standard and 7 deviants in a pseudo-random order. The standard is a continuous 200 ms white noise (0Hz – 22kHz) and the deviants a 200 ms white noise with silent intervals of different durations (2, 5, 7, 10, 20, 30 and 40 ms). Each deviant has a 7.1% chance of being compared to the standard (50% of stimuli). Stimuli are presented every 500ms through ER2 headphones. Target areas will be confirmed through a connectivity analysis. Independent components will be localized and clustered, then segmented in regions of interest (ROIs). Connectivity matrix will allow to determine links between ROIs and binarization of links will allow to construct the network model. Results. We expect the right Heschl's gyrus, the right dorsolateral prefrontal cortex, and the left dorsoanterior cingulate cortex to be activated in the generation of the MMN associated with the gapped stimuli. These results would concord with previous studies on the MMN using non-gapped stimuli. Conclusion. The cortical connectivity of temporal resolution is still not fully elucidated in the literature. Here we plan to use the MMN and the multi-deviant paradigm to demonstrate the cortical areas involved in processing auditory temporal cues.

P-8 Mismatch responses to sound source elevation eviants in mice

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ABSTRACT

Mismatch responses to sound source elevation have been shown in human EEG, but no comparable study has been performed in the rodent model. By employing a high density rodent EEG system we were able to demonstrate the presence of attention-independent mismatch responses to elevation deviants in flip-flop oddball sequences in isoflurane-anesthetised rodents. The auditory ERP and corresponding mismatch responses observed in mice resembled those commonly obtained in humans, with important latency differences. Furthermore, elevation discrepancies between standard and deviant smaller than 120° failed to elicit mismatch responses. Our results validate mice as a model for auditory deviance detection studies based on the variation of spatial features. However, similarities between human and rodent deviance detection phenomena should be investigated taking into account inherent circuital differences in their cortical generators. To enable such translation we are acquiring optical imaging data of the neuronal populations involved in the generation of auditory elevation mismatch responses. The experimental procedures employed in this study were approved by the local ethics boar

Group2 Auditory MMN

Moderator: Masumi Inagaki[1], Kazunari Ikeda[2], Shuntaro Itagaki[3], Yuhei Mori[3].

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P-9 Neural Indices of Top-Down Meter Perception: A Comparison of Infants and Adults

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ABSTRACT

Just as speech sounds are temporally organized according to language-specific rhythm patterns, music is temporally organized according to an extracted beat and metrical hierarchy (i.e., beat groupings). A 6-beat pattern can be ambiguous, perceived as either three 2-beat groups (duple meter, like a march) or two 3-beat groups (triple, like a waltz). We used EEG to examine if the brains of Western infants and adults maintain a duple or triple interpretation of this 6-beat pattern after being primed by adding loudness accents on either every second, or every third beat, respectively. After priming, we presented the unaccented (metrically ambiguous) rhythm, to which we added occasional pitch changes on beat 4 (strong in triple meter, weak in duple) and beat 5 (strong in duple, weak in triple). The procedures were approved by the McMaster Research Ethics Board. Infants (N = 24) had larger mismatch responses to pitch changes on metrically strong compared to weak beats in the unaccented rhythm, according to how they were primed (Flaten et al., 2022). Preliminary results in adults (N = 46) show a trend for larger mismatch negativity (MMN) for pitch changes on metrically strong compared to weak beats ($p = .08$), similarly to infants. However, additionally, adults in the duple group showed a trend ($p = .063$) for overall larger MMN amplitudes than those in the triple group; and, regardless of priming group, in adults the attention-related P3a response was larger for beat 5 (strong in duple meter; weak in triple) deviants ($p = .008$). These results suggest that infants and adults both maintain a primed metrical interpretation of a metrically ambiguous rhythm pattern through top-down processes, but that adults show a greater bias than infants for duple over triple meter, consistent with enculturation to Western music, in which duple meter is common.

P-10 Symbolic vs. Gradient Phonemes

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ABSTRACT

Are phonemes discrete or gradient? Are they symbols consisting of distinctive features (Chomsky & Halle, 1968) or probability distributions over acoustic properties (Smolensky, Goldrick, &

Mathis, 2014)? We addressed these questions using a withincategory varying standards MMN paradigm. The purely symbolic theory predicts that in a varying standards design, a within-category deviant should fail to elicit an MMN, because an allophone is non-distinct from its phoneme category. The varying standards recruit only the phoneme representation as the standards have no constant phonetic representation (Phillips et al., 2000). In contrast, the gradient/symbolic hybrid theory predicts that an MMN should be observed for a within-category deviant, as long as the deviant is an outlier with respect to the Gaussian distribution of acoustic/phonetic properties of the standards (Garrido, Sahani, & Dolan, 2013).

Methods: 63 participants were divided into two groups. The varying-standards group (N=33) heard 600 standard [tæ]s with randomly varying VOTs of 42ms, 48ms, and 55ms, interspersed with 100 deviant [tæ]s with 119ms VOT. A control group (N=30) heard 600 single non-varying token standards, a [tæ] with 48ms VOT, with the same 100 deviant [tæ]s with 119ms VOT. For the second group, a within-category MMN is expected under both views of phonemes, driven by a phonetic memory trace of the specific VOT value. A further

cross-category condition served as an additional control, with roving standards used to construct an identity-MMN for comparison.

Results: Only a main MMN effect was observed and no interaction with group/standard type. This contradicts a symbolic phoneme theory and is consistent with a theory where phonemes store acoustic information, such that 119ms is an outlier. An alternative interpretation is that all conditions create a statistical memory trace based on the distribution of the standards, subject to perceptual limits, contradicting the varying standards assumption.

P-11 Ambiguous culture or unambiguous nature? Neural correlates of melodic expectations

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ABSTRACT

It is widely acknowledged that culture, in part, shapes our engagement with music.Cultural origin as well as cultural ambiguity provides a context for us to modulate our anticipation of musical events, a process inducing signature neural responses, e.g., N1 and mismatch negativity (MMN), as expectations align, or not, with incoming stimuli.The aim of this study was to 1) correlate musical expectancy with

neurophysiological activity in various cultural contexts, and 2) to investigate the perceptual contribution of both enculturation and physical pitch-properties on the neural correlates when listening to musical events of high and low expectancy. Provided with an information-theoretic quantification of cultural expectancy, an electroencephalography (EEG) study with 64 Chinese and Western melodies that were either culturally ambiguous or unambiguous were administered to 30 Chinese participants. All participants gave written informed consent approved by the Institute of Psychology, the Chinese Academy of Sciences prior to experiment start.

We found that 1) the N1 and P2 amplitudes linearly correlated with the degree of (un)expectedness, particularly favoring an in-culture origin (Chinese); 2) the N1 and P2 amplitudes significantly differed between high and low expectancy, especially when expectations were computed based on the sizes of intervals between sounds. Additionally, by applying a linear temporal response function to melody sounds and their neural correlates, we were able to show that expectations represented as intervalsizes predict the neural signal more accurately than a culture-sensitive 'scale-degree' representation of melodic expectations. In conclusion, N1 and P2 amplitudes correlate with melodic expectancy whilst encompassing cultural sensitivity, although relative physical properties of sound constitute a superior influence on melodic expectations of music.

COI

The Authors declare that there is no conflict of interest.

P-12 Hearing thresholds related to auditory MMN

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ABSTRACT

We investigated the relationship between hearing thresholds and auditory MMN, as the physiological prerequisites are expected to affect the magnitude of discriminating the change in auditory input.

65 healthy volunteers (28.4±8.7 years; 46 female, 19 male) with normal hearing participated in the study. Their hearing levels (dB) were registered with an audiometer (Interacoustics AS608) on 500, 1000 and 1500 Hz for both ears separately. The MMN was elicited with an oddball paradigm (1000 and 1200 Hz tones as standard and deviant stimuli; reverse design) and EEG recorded using a 64-electrode Biosemi ActiveTwo system.

The results show that the subjects with lower hearing thresholds on 500 Hz have an earlier and larger MMN amplitude peak, suggesting that namely the lower hearing frequencies are the ones indicating possible decrease in also change detection. This comes from namely younger subjects (under 30) with better (lower) hearing thresholds on 500 Hz, who were better at discriminating a change from 1000 to 1200 Hz. Interestingly, the reversed MMNs (standard 1200, deviant 1000 Hz) did not systematically correlate with the hearing thresholds. The results shed light to the underpinnings of the decrease in auditory perception that happens e.g. during aging or in case of injuries, showing that physiological changes go together with also more complex change detection processes in the brain.

The research was funded by the Estonian Research Council grant PRG1151 to KK, and approved (No 319/T-22) by the Research Ethics Committee of the University of Tartu.

P-13 Complementary Time Thresholds in MMN Elicitation with Global Duration Increase

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ABSTRACT

The mismatch negativity (MMN) in usual oddball procedures (i.e., appearance of deviant tones in standard tone series) shows a time limitation basedon deviant tone duration. The MMN is difficult to be observed when a deviant tone is lasting longer than 400 ms. In a global oddball procedure (i.e., both standard and deviant events are tone groups), however, there is no such time limitation. The global MMN can be evoked with a deviant tone group lasting longer than 400 ms. The present study firstly elucidated a global oddball procedure being able to inhibit the MMN with a deviant tone group lasting longer than 400 ms.

Present participants provided their informed consents. The ethics committee of Tokyo Gakugei University approved the research. The authors declare no conflict of interest. For two experiments in this study, EEG responses were elicited by a group of tone bursts (1000 Hz, 60 ms, 70 dB SPL) with an interval between the tone groups at 1000 ms for each sequence. As a deviant group (10% occurrence), one more tone was added on a standard group. In Experiment 1 (N = 14), three deviant groups had durations at 240 (two tones), 420 (three tones), and 600 (four tones) ms, respectively in each block. In Experiment 2 (N = 12), all deviant groups consisted of five tones. Three deviant groups had durations at 780, 1140, and 1500 ms, respectively in each block.

Outcomes in Experiment 1 demonstrated that the MMN amplitude was prominent for deviant duration at 240 ms whereas it was clearly diminished for durations at 420 and 600 ms. In contrast, Experiment 2 resulted in evident MMN elicitation at all durations for deviant groups. The present results suggest that, based on temporal contexts, time limitations for the MMN occurrence are complementary in global duration increase.

P-14 Mismatch responses to violations of musical features in children compared to adults

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ABSTRACT

There is much research on the neurophysiology of predictive processes related to music in adults. However, much less is known on the developmental trajectory of these neural responses. To bring some knowledge into this area, we recorded the electroencephalograms (EEG) of thirty-five 8-years-old children and ten adults without formal training in music using a 32-electrode active system. All subjects voluntarily participated in the study, approved by our Institutional Review Board. Both the adults and the legal tutors of the children consented to the publication

and dissemination of the results. Participants were watching a muted video while a repetitive four-note pattern, known in music as the Alberti bass, was presented using piano tones. In our non-standard Musical Multi-Feature paradigm, we manipulated every third note of the pattern by introducing feature errors: changes in timbre (flute-timbre, violin-timbre), frequency (lower pitch, a slide glissando) and volume (lower intensity, omission). After preprocessing the EEG recordings, we compared the mismatch responses (MMR) to these six different violations in children and adults. While the feature errors elicited typical mismatch negativities (MMN) in adults, they generally elicited frontally positive MMR in children. All the MMR of children had greater absolute mean amplitudes and longer latencies than those of adults, with the exception of omission, which elicited a frontally negative response in children. Additionally, we assessed music discrimination in both groups and found that children showed lower musical competence for melody than for rhythm, whereas for adults the scores did not differ between melody and rhythm tests. In sum, this study demonstrates qualitative differences in the morphology of the MMR to violations of acoustic features of the musical sounds, which are strongly dependent on age, and calls for further longitudinal research to determine the temporal course of the maturation of these prediction error signals.

P-15 Harmonic and inharmonic sounds: which ones elicit greater prediction errors?

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ABSTRACT

Our brain is constantly making predictions based on models that anticipate what will occur in the world surrounding us (Friston, 2010). In audition, pitch is important for object identification and categorization, from human voices to environmental sounds. Most of the natural sounds we experience everyday are harmonic, like animal vocalizations or musical instruments. These sounds are complex tones that follow the harmonic series, comprising a fundamental frequency (f0) and integer multiples of it called harmonics (e.g. 2f, 3f…). In contrast, inharmonic sounds deviate from the harmonic series because the harmonics are not integer multiples. In this electroencephalographic study, we investigate differences in the neural responses predicting harmonic and inharmonic sounds. We hypothesize that violations of predictions for harmonic sounds elicit stronger responses than violations of predictions for inharmonic sounds. Using a 32-electrode active system, we measured the neural responses in an auditory oddball-roving paradigm eliciting mismatch negativities. Participants freely consented to participate in the study, approved by our Institutional Review Board. They watched a silent movie and listened to a series of artificially generated complex tones presented in trains of stimuli that changed in pitch after some repetitions. There were three counterbalanced conditions: harmonic sounds, inharmonic sounds with the same jitter rates applied to the harmonics, and inharmonic sounds with

distinct jitter rates (similar to McPherson & McDermott, 2018). Our preliminary analyses showed differences in the MMNs of the three conditions in line with our hypothesis. There were higher MMNs for violations of harmonic sounds. Furthermore, the MMN of violating inharmonic sounds was greater when the jitter rate was constant. In sum, these early findings suggest that harmonic sounds have higher precision-weighting of the prediction errors. We will present the full dataset in the conference and discuss the implications of a predictive coding of pitch.

P-16 Standard tone stability as a manipulation of precision in the oddball paradigm: modulation of prediction error responses to fixed-probability deviants

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ABSTRACT

Electrophysiological sensory deviance detection signals, such as the mismatch negativity (MMN), have been interpreted from the predictive coding framework as manifestations of prediction error (PE). From a frequentist perspective of the classic oddball paradigm, deviant stimuli are unexpected because of their low probability. However, the amount of PE elicited by a stimulus can be dissociated from its probability of occurrence: when the observer cannot make confident predictions, any event holds little surprise value, no matter how improbable. Here we tested the hypothesis that the magnitude of the MMN elicited to an improbable sound (D) would scale with the precision of the prediction derived from the repetition of another sound (S), by manipulating repetition stability. We recorded the EEG from 20 participants while passively listening to 4 types of isochronous pure tone sequences differing in the probability of the S tone (880Hz) while holding constant the probability of the D tone (1046Hz; p(D)=1/11): Oddball (p(S)=10/11); High confidence (7/11); Low confidence (4/11); and Random (1/11). Tones of 9 different frequencies were equiprobably presented as fillers (p(S)+p(D)+p(F)=1). Using a non-parametric, cluster-based correlation analysis controlling for multiple comparisons, we found that the amplitude of the ERP became more negative with increasing S probability, in a time-electrode window consistent with the MMN (ca. 120-200ms; frontal), suggesting that the strength of a PE elicited to an improbable event indeed increases with the precision of the predictive model.

P-17 What can music preference teach us about the auditory mismatch negativity?

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ABSTRACT

The mismatch negativity (MMN) is often regarded as a prime example highlighting the role of

predictions in neural information processing. Predictive coding posits that the MMN represents precision-weighted prediction errors that are transpired along the cortical hierarchy. Such predictions are thought to depend on a neural generative model of the learnt statistical regularities present in the immediate sensory environment. As a result, this model is usually instantiated with a flat prior and assumed to reset after each experiment.

However, humans have the ability to learn statistical regularities over extended timescales and beyond the confines of an experiment. One prominent example in the auditory domain is music. Listeners acquire statistical knowledge of a particular musical style via long-term exposure to different exemplars, often with multiple repetitions. Interestingly, recent research has shown that the dynamic interplay between the precision and violation of listeners' predictions affects their preferences to music and modulate activity in the mesolimbic reward network. This implies that precisionweighted prediction errors may not only have perceptual, but also affective consequences.

Here, we summarise key findings from latest neuroimaging studies investigating an expectancy-driven mechanism of musical preference. In particular, we focus on the modelling approaches used to quantify precision and prediction errors in music, as well as highlight the role of neural connectivity in musical pleasure. We further highlight the similarities and differences between violations to musical and oddball stimuli, with the goal of coming towards a shared neural model that explains observed phenomena on both domains.

P-18 Spatial Variability Does Not Reduce MMN Amplitude

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ABSTRACT

Mismatch Negativity (MMN) is proposed as a neuronal example of a precision weighted prediction error signal. MMN amplitude is sensitive to many sound sequence characteristics including variability. This study was designed to test whether initial precision estimates would update dynamically with changes of variability, or if they were set, resulting in lasting effects carried throughout the sound sequence. Specifically, we expected that initial exposure to a condition of high variability (HVC) would result in smaller MMN amplitude compared to an initial low variability condition (LVC). An auditory oddball paradigm was used, with tones played at 1000 Hz, with length distinguishing standards (50 ms) and deviants (100 ms). Variability was introduced into the HVC by having the tones occur randomly in one of nine locations perceived front right through front to left created using inter-aural time differences. In the LVC tones occurred in only the three most central of these locations. One group heard HVC, LVC, a five-minute break, LVC, HVC and the other LVC, HVC, a five-minute break, HVC, LVC. Continuous EEG was recorded while participants heard the sound sequence with attention focused on a subtitled DVD. MMN amplitude did not differ significantly between HVC and LVC, nor between the different groups. These findings suggest that spatial variability is not treated the same as loudness, frequency or timing variability, which have all been shown to modulate MMN amplitude. The final finding of interest was MMN amplitude declined linearly across the recording, showing no "resetting" effect of the five-minute break. This finding contrasts

previous studies where MMN amplitude appears to reset at the beginning of pattern alternating sequences suggesting that the long-term context is important to MMN amplitude modulations.

P-19 The relationship of stream segregation and the temporal integration.

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ABSTRACT

<Aims>Both stream segregation and temporal integration are considered important for auditory scene analysis in the brain. Several previous studies have indicated that stream segregation may precede temporal integration when both processes are required. It's also reported that stream segregation should cancel temporal integration of close sounds, as indicated by omission-MMN elicitation, when the frequency difference is 1000 Hz or larger. But it's not concern that this frequency difference(1000Hz) is fundamental for any other base tone.

<Method> Ten healthy Japanese men provided written informed consent to participate in this study. All participants had normal hearing and were free of any medication at the time of study. Only male participants were selected to eliminate sex bias. The study was approved by the Ethics Committee of Fukushima Medical University. We created ten blocks of tone sequences and divided to two groups. Group A had base tone being fixed at 3000Hz and opposite tones were set at 3000Hz, 2750Hz, 2500Hz, 2250Hz, and 2000Hz. Group B had base tone being fixed at 2000Hz and opposite tones were set at 3000Hz, 2750Hz, 2500Hz, 2250Hz, and 2000Hz. These tones were alternated with a constant SOA of 120 ms.

<Result and Discussion>In group A, MMN was elicited when the frequency difference is 500 Hz or smaller. On the other hand, in group B, MMN was elicited when the frequency difference is 750 Hz or smaller. Our result suggest that the frequency difference which cases stream segregation is differ from the base tone.

P-20 Does frequency mismatch negativity reflect when frequency changes delayed from stimulus onset?

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Abstract

Purpose: Frequency change MMN has not been examined to determine how MMN is affected when the frequency change occurs delayed from stimulus onset. In this study, we examined MMN when the frequency change occurred delayed from the onset of the stimulus. METHODS: We used two pure tone stimuli of 1000 Hz and 1200Hz. The standard stimulus (std) was 1000 Hz for 170 ms. The deviant stimulus (dev) was a pure frequency change stimulus in which the frequency changes from the onset of the stimulus and 5 types of

deviant stimuli in which a 1000 Hz sound was inserted before the frequency change. We presented the stimuli 4000 times (std;2800 /dev 200*6type) and measured the MMN. This study was approved by the Ethics Committee of Fukushima Medical University, and oral and written consent was obtained from the participants. RESULTS: We measurement MMN from 6 healthy subjects have been completed. In the result, the peak latency delayed due to delayed frequency change.

P-21 Examination of healthy subjects affected by mismatch negativity in the second half of change of the sound stimuli

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Abstract

【Aims】It is unclear how the mismatch negativity (MMN) is affected by changes in the second half of a sound stimulus. In this study, we examined the response of the preattentive process by manipulating the second half of the stimulus using the MMN as an index.

【Methods】Participants: Healthy adults were subjects. Stimuli: We presented two consecutive pure tones as one stimulus. Both sounds were pure tones 85 ms in duration with a 5-ms linear rise/fall time and they were presented over earphones at 80 dB SPL. The standard stimulus was 3000 Hz-3000 Hz. The deviant stimulus was varied in the second half. In small frequency change deviant blocks, 3000Hz-2800Hz sounds (10%) and 3000Hz-missing sounds (10%) were rare deviants. In large frequency change deviant blocks, 3000Hz-500Hz sounds (10%) and 3000Hz-missing sounds (10%) were rare deviants. In omission deviant blocks, 3000Hz-3000Hz sounds were highly probable and 3000Hz-missing sounds (10% or 20%). Procedure: The participants viewed were silent movie. EEG recording: EEG data were recorded from 16 electrodes. Analysis: MMN for the deviant stimulus was calculated. Ethical consideration: This study was approved by the Research Ethics Committee of Fukushima Medical University. In addition, oral and written consent is obtained from the subject.

【Results】The MMN were elicited by three types of changes (small frequency change, large frequency change, and omission) in the second half of the stimulus. We will discuss the different pattern of MMN.

P-22The mismatch negativity to abstract relationship can be modulated by attention

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ABSTRACT

The mismatch negativity (MMN) implicating a comparison process between the deviant and the memory trace of the standard can be elicited by not only changes in physical features but also violations of abstract patterns. It is considered pre-attentive, yet the use of the passive design makes it difficult to exclude the possibility of attention leak. In contrast to how this issue has been well addressed with the MMN to physical changes, much less research investigated the attentional effect on the MMN to abstract relationships. Here we conducted two electroencephalography (EEG) experiments to study whether and how the MMN to abstract relationships is modulated by attention. We replicated the oddball paradigm of Kujala et al. (2001) by presenting occasional descending tone pairs among frequent ascending tone pairs, while additionally implementing a strict control of attention. Participants' attention was either directed away from or toward the sounds. The MMN to abstract relationships appeared regardless of attention, confirming the pre-attentive assumption. Meanwhile, attention enhanced its frontocentral component when the deviant-standard distinction lied in order reversal but not in the extraction of a relational rule. These results supported that attention is not required to generate the MMN but to modulate the gain of the MMN generator. It is unlike the attentional modulation on the P3b, which was elicited in attended condition only. The concurrent collection of these two neurophysiological markers in both unattended and attended conditions might be potentially suitable for testing clinical populations showing heterogeneous deficits in auditory function independent/dependent of attention.

Group3 Language perception& processing

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P-23 Effect of environmental exposure to foreign speech perception: a cross-linguistic study

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ABSTRACT

Passive exposure to foreign speech sounds modifies change detection brain responses inadults. A previous study has showed that learning-related plasticity is demonstrated in Finnish participants in change detection (mismatch negativity, MMN) and attention shifting (P3a, P3b) ERPs as increased amplitudes and decreased latencies after implicit exposure to tonal speech sounds. However, it is unknown whether native Finnish and Chinese people differ in their perception of speech sounds´ duration, a feature relevant for Finnish but not for Chinese, and whether long-term environmental exposure can improve perception. Here we measure behavioral categorization and discrimination ability for Chinese tones and vowel durations in native Finnish, native Chinese living in China (having no training or exposure to quantitative languages), and native Chinese who have lived in Finland for more than six months. Written informed consent was obtained from the volunteers before their participation, and all the experiments were carried out according to the Helsinki declaration. The ethical committee of the University of Jyväskylä approved the research protocol. The results showed that Chinese living in Finland were better in the duration discrimination test compared to the Chinese group naïve to Finnish. A clear category boundary was found for the native speech sounds, while this boundary was not clearly observed for non-native speech sounds. The results indicated that passive environmental exposure to foreign speech improves the discrimination ability of speech sound duration.

P-24 Native language impacts the perception of linguistic as well as non-linguistic stimuli

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ABSTRACT

In the current study, we aimed to understand how linguistic but also nonlinguistic auditory input can be decoded by native and language naïve speakers, more specifically, how native language affects the ability to process changes in duration and pitch. 30 volunteers (18-27 years old) [15 Estonian and 15 Russian native speakers] took part in an EEG experiment using quantity contrast stimuli (patterns common for Estonian but not for Russian). A linguistic stimulus set with variants of the Estonian word ‘SATA’ and a matching pure tone stimulus set were used. Stimuli differed from each other by the duration of the first vowel [ɑ] (110, 170, 290 ms) and pitch change (level vs falling tone). The auditory mismatch negativity (MMN) responses were compared with the

GAMM analyzes. The results demonstrated a difference between processing non-linguistic and linguistic input the pure tone stimulus elicited a more persistent MMN with larger amplitude in both language groups, while the linguistic stimuli elicited a more pronounced MMN response among the Estonian native speakers. Russian native speakers did not differentiate much between stimuli with changes in duration or pitch, while for Estonians these differences were meaningful and elicited different MMN responses: the MMN peaked earlier for changes in pitch, and the amplitude was bigger for change in duration. Importantly, similar tendencies were apparent even with the comparable non-linguistic stimuli. These results show how native language patterns shape and train our brains to focus on and understand certain information. Linguistic properties common for the native language become a target for language perception and the brain tries to find similar patterns even from non-linguistic sounds. The study was approved by the Research Ethics Committee of the University of Tartu and was supported by funding from the Estonian Research Council grants PRG770 and PRG1151.

P-25 Maturation of Speech-evoked Mismatch Responses to Persian Initial Consonant Deviants

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ABSTRACT

Behavioral measures of phonological discrimination may not provide a fully comprehensive view of speech-sound discriminations at cortical level. In the current study, the maturation of auditory brain mismatch responses (MMRs) to initial consonants of Persian words were measured using a multiple-deviant paradigm in 5 and 7-year-old Persian-speaking children. A total of 750 standard stimuli and 750 deviants were randomly presented by two loudspeakers during electroencephalography (EEG) recording. All Parents filled an informed consent. Children verbally agreed to participate in the experiment. In younger children, the data demonstrated a positive mismatch response (p-MMR) in 242-261 ms after the onset of stimulus in the fronto-central electrodes. However, in older children a co-existence significant p-MMR (253 ms), mismatch negativity (MMN) (357-395), and late discriminative negativity (LDN) (587-612 ms) responses were observed in fronto-central scalps. Our results indicated higher amplitudes of MMRs in contrasts of manner and voicing than in those of place of articulation. Moreover, the word discrimination and phonological analysis scores were significantly correlated with the MMRs. The p-MMR observed in younger children might be an index of immature neural phonological discrimination which may wane with increasing age. The LDN observed in older children is likely elicited by changes in attentional focus to initial consonant contrasts. The co-existence p-MMR-MMN-LDN sequences should be cautiously interpreted since it was appeared only in one deviant in older children.

Group4 Somatosensory MMN & Visual MMN

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P-26 Somatosensory mismatch response is elicited by location but not by intensity changes

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ABSTRACT

Automatic deviance detection has been widely explored in terms of mismatch responses. The somatosensory mismatch response (sMMR) has been investigated less often regarding the different types of changes than its auditory counterpart. In the present study, we aimed to produce new information on somatosensory deviance detection by examining whether sMMR is elicited in the intensity and location deviance conditions. We measured ERPs to changes in somatosensory stimuli in healthy adults (n = 31) applying an ignore oddball condition. In the location deviance condition, the electrical stimuli were delivered to the forefinger and little finger, and in the intensity deviance condition, the stimulation was delivered to the forefinger with different intensities. Stimulus intensities were adjusted for each participant according to the subjective somatosensory threshold. Response amplitudes were measured and analysed with repeated measures of ANOVA. The experiment was conducted in accordance with the Declaration of Helsinki. Ethical approval for the study was obtained from the ethical committee of the Central Finland Health Care District. We found somatosensory MMR to changes in stimulus location but in the somatosensory intensity deviance condition, sMMR was not elicited. In the intensity deviance condition, the somatosensory stimuli of a higher intensity elicited a larger response amplitude regardless of the stimulus type (standard, deviant), which indicates that the response reflected only stimulus saliency rather than deviance detection. Hence, while somatosensory deviance detection occurred for location, in the somatosensory intensity encoding, encoding of stimulus properties instead of the rarity of the stimuli was prioritized. According to our results, it seems that intensity is not a suitable stimulus feature for studying sMMR, but location deviance might serve as an indicator of change detection and for instance brain ageing.

The authors declare no conflict of interest.

P-27 Differences of the somatosensory mismatch negativity between hand and foot stimulation.

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ABSTRACT

[Objective] Studies of somatosensory mismatch negativity (S-MMN) has been almost reported by stimulation to the hand. Differences of the S-MMN components elicited by the stimulation to the hand and the foot were compared in this study. [Methods] This study was performed after approval by the institutional ethics committee Uekusa-Gakuen university (No:22-01) and written informed consent was obtained from all participants. Twelve healthy right-handed volunteers (mean age 21.2 ± 0.4 years, six female) were enrolled in the experiment. Electrical stimuli were delivered via ring electrodes placed on the finger (stimulating electrode proximal, placed above the proximal phalanx; anode placed above the distal phalanx). Standard and deviant stimulations were delivered to the first and fifth left finger respectively in the experiment 1, and to the big and small left toe respectively in the experiment 2. The experiment order was counterbalanced in subjects also gender consideration. The standard and deviant tones were randomly presented at a presentation ratio of 5:1, respectively. 610 stimuli were given to the participants. These stimuli were separated by an intertrial interval of 1000 ms with variation ± 10 ms to prevent the sychoronization of responses. EEGs were recorded using a portable EEG system (BioSemi Inc) with 32 pin-type Ag-AgCI active electrodes inserted into a 32-channel head cap following the international 10-20 EEG system. A reference electrode was placed nose. [Result & Conclusion] Analyses are in progress.

P-28 Comparisons of ERP Responses to Auditory and Visual Stimulus Omissions

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ABSTRACT

Omitted stimulus potentials (OSPs) are elicited when a predicted stimulus is unexpectedly omitted. OSPs are thought to reflect a discrepancy between the prediction about the upcoming sensation and the actual sensory input. Their nature, however, is not fully understood. Therefore, the purpose of the present study was to compare OSPs in different sensory modalities. The experimental protocol was approved by the Behavioral Research Ethics Committee of the Osaka University Graduate School of Human Sciences. University students (N = 29) were asked to press a button at a regular interval of 1 to 2 s. In different blocks, a visual stimulus (an LED light) or an auditory stimulus (a 1000 Hz pure tone) was presented immediately after each button press. The stimuli were infrequently omitted (p = 0.2). In a control condition, participants pressed a button that was not followed by any stimulus. Event-related potentials (ERPs) were recorded from 64 scalp sites, time-locked to the onset of the button press that was followed by the stimulus omission. Difference waveforms were calculated by subtracting the ERP waveforms obtained in the control condition from the ERP waveforms recorded in the auditory and visual conditions. The results showed that stimulus omissions in both modalities elicited two successive negative components, omission N1 (oN1) and omission N2 (oN2), and a late positive component, omission P3 (oP3). The latencies of these components were shorter in the auditory condition than the visual

condition. The oN1 and oN2 components were predominantly distributed at the temporal sites in both modalities, while the oP3 component had a centroparietal distribution in the auditory modality and a more posterior distribution in the visual modality. These results suggest that, even without actual sensory input, unexpected stimulus omissions involve modality-specific processing with different time courses.

P-29 Proof of different processing resources for unattended and attended stimuli

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ABSTRACT

Mismatch negativity is a characteristic difference wave that emerges as a result of processing of unattended stimuli. It emerges in different modalities and has been demonstrated to be independent on the main task where the conscious attention of the observer has been directed. In our study 65 participants took part in visual and auditory MMN tasks with the same visual nBACK working memory task with letters (T, D, B, R, K, H, S, previously used in Sultson et al., 2019) in the centre of the screen. Before the MMN tasks, a nBACK task without any additional stimuli was run to introduce the procedure and equalize the practice effects for the MMN sessions (that were presented in a balanced order). We have recently demonstrated (Kreegipuu et al., 2022) that this design elicited both, MMN for auditory stimuli (1000 Hz vs 1200 Hz), and vMMN for capital letters (T and B). We ask here whether the mismatch negativity stimuli outside the attentional focus have any affect on the central task. Neither number of correct old-new responses nor response times in the nBACK task were significantly related to accompanying mismatch negativity stimuli meaning that unattended processing of auditory or visual stimuli did not affect the working memory performance in the focus of the attention. Still, there was a slight reduction in the amplitude of the averaged ERP curve in the occipital areas for the central stimuli in the vMMN condition showing that in the brain level there was some interaction in the processing of similar attended and unattended visual stimuli.

The research was funded by the Estonian Research Council grant PRG1151 to KK, and approved (No 319/T-22) by the Research Ethics Committee of the University of Tartu.

P-30 What does VMMN tell about predictive model updating?

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ABSTRACT

When individuals observe a visual object that changes its position along with certain sequential regularities, the brain automatically forms a perceptual prediction regarding the future position of the visual object based on a predictive model encoding the sequential regularities. Because of such perceptual prediction, when the visual object deviates from the regularities, the brain rapidly and automatically generates prediction error responses that can be measured as visual mismatch negativity (VMMN) of event-related potentials. Regarding the functional significance, VMMN has been theoretically associated with the updating of predictive model, but direct empirical evidence is still sparse. To address the relationship between VMMN and predictive model updating, the present study examined the relationship between VMMN and a prediction-related perceptual

illusion called representational momentum (RM). That is, the present study regarded the size of RM modulation caused by stimulus deviations as the correct value of the degree of predictive model updating and examined the relationship between the sizes of VMMN and RM modulation caused by stimulus deviations (i.e., sudden backward and forward rotations embedded in regular rotations of a bar, respectively, in Experiments 1 and 2). The results showed that the size of VMMN generally showed a similar trend to the size of RM modulation, suggesting the significant involvement of VMMN in the predictive model updating. In more details, the size of VMMN underestimated the size of RM modulation, supporting the notion that the size of VMMN could be regarded as a conservative indicator of an occurrence of predictive model updating as well as a between-condition difference in the degree of predictive model updating.

P-31 Automatic processing of two simultaneous oddball sequences: a visual mismatch negativity study

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ABSTRACT

The human cognitive system automatically processes the environmental regularities of the surrounding world, and makes predictions based on this information. When an irregular event violates these predictions in the visual modality, the brain produces an event-related potential (ERP) component, the visual mismatch negativity (vMMN). There is some evidence that vMMN may be elicited by simultaneously presented, but independent task-irrelevant oddball sequences, using the same type of stimuli. In this study, we investigated whether the capacity of the system underlying vMMN was capable of processing two different oddball sequences simultaneously. On this end we presented a human face to one side of the screen and a geometric diamond pattern to the other side of the screen. We applied the OFF-ON method of stimulation, i.e., the whole stimuli and only parts of the stimuli were alternatively presented. One part of the stimuli vanished frequently (standard), the other parts infrequently (deviant). VMMN emerged to both the disappearance (OFF) and the re-appearance (ON) of the stimulus parts, both in case of the face and geometric diamond figures, either on the left or the right side. The results show that unlike in the case of two similar lateral stimuli presented at the two hemifields (Csikós et al., in preparation), in case of two highly different objects the system registered both sequences, and reacted to the violation of all sequential regularities.

Group5 Clinical MMN

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P-32 Associations of childhood maltreatment with mismatch negativity and P300 in adults with autism spectrum disorder

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ABSTRACT

Childhood maltreatment is defined as experiencing of physical, emotional and sexual abuse and neglect in childhood. Maltreatment in childhood leads to substantial psychosocial problems later in life in the general population. Individuals with autism spectrum disorder (ASD) have a higher risk of experiencing stressful and traumatic events, such as maltreatment, during childhood. Although childhood maltreatment reportedly leads to psychosocial problems in adults with ASD, the biological associations between childhood experiences and brain function in this population remain understudied. Here, we evaluated the relationships between childhood experiences and event-related potential (ERP) components during the auditory odd-ball task in adults with ASD (N = 21) and typically developed (TD) individuals (N = 22). We found that the higher the severity of sexual abuse, the larger the amplitude of P300 at Fz, Cz, C3, and C4 in individuals with ASD. Conversely, the severity of child maltreatment was associated with P300 latency at Cz and C3 in TD individuals. Moreover, full IQ was significantly associated with the MMN amplitude at Fz, Cz, C3, and C4 in TD individuals. These findings provide the first evidence that ERPs could be used to study the impacts childhood experiences on the brain of individuals with ASD and that childhood sexual abuse has salient impacts on brain function in this population. This study was approved by the Institutional Review Board of Nara Medical University and conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants prior to participation in the study.

P-33 Evaluation of cognitive function using the event related potential in adolescent anorexia nervosa.

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ABSTRACT

Anorexia nervosa (AN) is recognized as a severe mental disorder characterized by restrained eating, dysfunctional thoughts, preoccupation concerning food and body image disturbance. Cognitive dysfunctions such as attentional bias and inhibitory function have been reported in AN. In adults with AN, P300 amplitude was found to be reduced compared with that of healthy controls. However, to the best of our knowledge, there are no reports on components of event-related potential (ERP) in adolescents with AN compared with healthy controls. The aim of the present study is to investigate this assumption about P300 and mismatch negativity (MMN) components in adolescents with AN, as measured by ERP. Nine participants, diagnosed with AN according to DSM-5, were compared with 9 age- sex- and IQ-matched healthy control subjects. The adolescents with AN were evaluated with the Eating Attitudes Test (EAT). Based on the guidelines for evoked potential measurement, the P300 and MMN were obtained by auditory odd-ball task. Frequent non-target stimuli were presented as 1,000 Hz bursts (P = 0.8), and infrequent target stimuli were presented as 2,000 Hz tone bursts (P = 0.2) when P300 were recorded. Thirty responses to infrequent stimuli were averaged. When MMN were recorded, standard stimuli were presented as 1,000 Hz tone bursts (P = 0.9), and deviant stimuli were presented as 1,100 Hz bursts (P = 0.1). Fifty responses to deviant stimuli were averaged. Results showed that the latency of P300 in the AN group was significantly longer compared to healthy controls. The amplitude of the P300 was also significantly smaller compared to the healthy control group. There were no between-group differences in MMN. There were no significant correlations between scores on EAT and P300.The results of this study suggest that the P300 has the potential to objectively assess cognitive dysfunction in adolescents with AN. This study was approved by the Institutional Review Board at Nara Medical University.

P-34 Maturation of Neural Speech Processing, Prelinguistic Skills and The Effects of Early Music Exposure in Infants At Risk for Dyslexia

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ABSTRACT

Dyslexia refers to the deficit in accurate word recognition and spelling despite normal cognitive functions and intelligence. It is a common learning disability and can affect 3-17% of the population. It is essential to identify the early biomarkers of dyslexia and conduct effective interventions. In a large-scale longitudinal DyslexiaBaby project, 206 participants with (n=156) or without (n=50) familial dyslexia risk were followed up from newborn stage to school age. We investigate biomarkers of atypical linguistic processing and its maturation as well as effects of music intervention, which was previously shown to improve auditory processing, phonological awareness, and reading skills in typically and atypically developed participants. The music intervention was conducted six months after birth targeting the infants at dyslexia risk. The infants were pseudo-randomized to a vocal music listening group, an instrumental music group, and a control group. The study has been approved by a relevant ethical review board. The results showed that 1) MMRs elicited by speech-sound changes increase by 6 months and decrease by 28 months, and that this

maturation can be affected by the familial dyslexia risk; 2) there was a strong association between the speech-elicited ERPs and MMRs and the subsequent maturation of pre-linguistic skills during infancy; 3) the neural MMR responses reflecting speech-sound discrimination were absent or diminished in dyslexia risk group, suggesting atypical neural speech processing in infants at dyslexia risk; 4) infants after 6-months passive vocal music listening exhibited larger MMRs than infants after instrumental music listening or infants without music listening, indicating an enhanced processing of speech-sound discrimination. The findings provide evidence on the links between the neural MMR responses, pre-linguistic skills, and the familial dyslexia risk, as well as beneficial effects of vocal music exposure on linguistic processing already in the first six months after birth.

P-35 Alzheimer's disease – neuro-desynchronisation as a potential resourceful paternal set for AI

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ABSTRACT

The poster is focused mostly on the potential development of artificial intelligence by extracting fixed patterns and regularities from biomedical field that enable the improvement and refinement of advanced analyses. Is conducted through the prism of the neurocognitive regularities of Alzheimer's diseases according to its description of being a global desynchronisation of functioning. Following that idea, global neurodegenerative changes may provide potential resources that, through mathematical and algebraic transformations (creating a potential set of neurocognitive patterns), may serve as a foundation for the development of artificial intelligence – especially, following the example of deep learning applications in the field of microbiology regarding proteins).

These hypothetical assumptions based on scientific studies correspond directly to my research that is focused on resting state EEG according mostly to the coherence analyses, cross frequency coupling, entropy or LZC analysis. I emphasis memory processing and memory information maintenance among past marijuana users and poly drug users. My hypothesis (also regarding the similarities between poly drug users and Alzheimer's disease patients according to the lack of complexity among oscillations) are based on the scientific evidence and observations regarding different organic aspects of Alzheimer's disease, beneficial effects of medical marijuana also in case of AD. Moreover, they are based on deep learning applications (in the context of pattern recognition mostly in the filled of microbiology but also of astrophysics regarding mapping the galaxy using the results of Lagrangian analysis – and they create a symbolic comparison of micro and macro cosmos patterns that can be revealed through mathematical/logical analysis). I highlight theta and gamma bands due to their responsibilities and participation in both memory performance as well as in the presence of desynchronisation in neurodegenerative diseases). But another reason is the vivid requirement of the memory phenomenon for both: proper functioning and beneficial constructive development.

P-36 Interim analysis of duration - mismatch negativity in adult with autism spectrum disorder versus attention deficit hyperactivity disorder

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ABSTRACT

【Background】The mismatch negativity (MMN) has been considered to reflect automatic cognitive function to auditory stimulation. Particularly MMN to duration deviants (d-MMN) is known to be a trait maker of schizophrenia. Amplitude attenuation of MMN reported in pediatric Attention-deficit hyperactivity disorder(ADHD) (Cheng, 2015). The amplitudes of d-MMN were decreased in children/adolescent patient with ASD compared with healthy controls(HCs)(Chen, 2020). The purpose of this study is to examine the difference in cognitive function in adult developmental disorders using duration MMN.

【Method】The subjects were 20 to 40 years old adult ADHD, adult ASD, and healthy subjects (HC). We used auditory oddball task as stimuli for d-MMN measurement. The number of stimulations was 4000. This study was carried out in accordance with the latest revision of the Declaration of Helsinki and approved by the ethics committee of Fukushima Medical University.

【Results】Interim analysis was performed using 18 cases of ADHD, 10 cases of ASD, and 19 cases of HC. The latency of ASD shortened compared with HC.

【Conclusion】Shortening latency suggests that the hypersensitivity in ASD. And no decrease amplitude in the ASD group suggests that the automatic cognitive function might be improved by growth.

P-37 A longitudinal comparative study of MMN in Mild cognitive impairment and Parkinson's disease

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ABSTRACT

Alzheimer's disease (AD) and Parkinson's disease (PD)-related disorders often share many common cognitive and psychiatric symptoms and risk factors, and the pathology is often mixed. Because mild cognitive impairment (MCI) is an intermediate stage in the trajectory from normal cognition to dementia, it is very important to predict the progression of MCI. Mismatch negativity (MMN), which reflects automatic auditory discrimination and is sensitive to neurodegenerative changes, is also expected to be a biomarker to predict pathological progression from MCI to AD. Although there have been reports of significant attenuation of MMN in AD compared to PD, there are many unknowns about the differences and characteristics. Few previous studies have been conducted on MCI and PD, MMN using as a biomarker. In this study measured MMN in MCI and PD patients annually and compared the amplitude and latency of MMN. MMN was measured for patients with MCI (n = 8) and PD (n = 12) in the first year, and for patients with MCI (n = 5) and PD (n = 8) in the second year, respectively. We assessed the change of amplitude and latency of the MMN for MCI and PD. This is the first study to longitudinally compare MMN in MCI and

PD. The latency of the duration MMN for MCI was significantly more delayed. The results suggest that the duration MMN might be indicate as potential biomarker for pathological progression in older adults at risk of dementia. This study was approved by the Ethics committee of Fukushima Medical University, and written consents were obtained from all subjects. There is no COI to be disclosed.

P-38 Effects of night and shift work disrupting circadian rhythms on duration mismatch negativity

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ABSTRACT

【Aims】The purpose of this study is to examine whether night and shift work, which disrupts circadian rhythms, affects the duration mismatch negativity(dMMN), by age group.

【Methods】This study was approved by the Ethics Committee of Fukushima Medical University, and a written consent was obtained from all subjects. The subjects were both male and female nurses in their 20s to 50s working at Fukushima Medical University Hospital. We measured dMMN in 10 subjects in their 20s, 11 in their 30s, and 7 in their 40s. They had dMMN measured on holidays and after night shifts. The sound sequence composition of the auditory stimuli set to 80% standard stimuli (1000 Hz, 100 ms) and 20% deviant stimuli (1000 Hz, 50 ms). The peak amplitudes and latencies of dMMN during 130-200 ms from the onset of deviation were measured respectively.

【Results and Conclusion】We compared dMMNs on holidays with after night shifts, considering work hours and age groups. We found that night and shift work had little effect on dMMN.

P-39 Impaired mismatch negativity reflects the inability to perceive beat interval in patients with schizophrenia

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ABSTRACT

Anecdotal evidence shows that patients with schizophrenia have difficulty in perceiving rhythm during music training in occupational therapy (OT). However, the neural correlates underlying this

phenomenon have not been fully explored. Recently, auditory mismatch negativity (MMN) has been used as a neurophysiological probe in various schizophrenia studies. The present study aimed to assess the ability of rhythm perception, and investigate the correlation between the ability of rhythm perception and MMN in patients with schizophrenia. This study was approved by the Ethics Committee of Fukushima Medical University, and a written consent was obtained from all subjects. The Harvard Beat Assessment Test (H-BAT) and MMN test were performed in 21 patients with schizophrenia who were admitted to our department. The perception part of beat interval test (BITper) in the H-BAT measures the threshold for perceiving gradual changes of beat interval. In patients with schizophrenia, the MMN amplitude [frontal (Fz) and central (Cz)] negatively correlated with the thresholds of the BITper, reflecting the inability to perceive the change in beat interval. This study indicates that impaired MMN in schizophrenia reflects a distorted perception of rhythm.

P-40 Effects of benzodiazepine dosage on mismatch negativity.

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ABSTRACT

【Aims】 Benzodiazepines (BZs) are known as drugs with high dependence and abuse risk. There are also reports of possible cognitive decline due to its use. The purpose of this study was to objectively determine whether BZ dosage affects inattentive auditory discrimination reflected by mismatch negativity (MMN).

【Methods】 The subjects for this study were patients in their 20s to 60s who were taking BZ and age-matched healthy controls (HC). Two types of stimuli were presented: a standard tone of 1000 Hz for 100 ms, and two types of deviant stimuli: a tone of 1200 Hz for 100 ms and a tone of 1000 Hz for 50 ms, were randomly presented 4000times at a ratio of 8:1:1, and frequency change and duration change MMN were measured. For statistical analysis, the Kruskal-Wallis test analysis was performed for three groups: BZ 5 mg or more (N=6), BZ less than 5 mg(N=3), and HC control groups(N=3).

【Results and Conclusion】 There was a significant difference in the amplitude of duration MMN between BZ 5 mg and BZ <5 mg (p=0.047). The result suggested that the amount of BZs amounts affects the amplitude of duration MMN rather than frequency MMN. This study was approved by the Ethics Committee of Fukushima Medical University, and written consents were obtained from all subjects. There is no COI to be disclosed.

P-41 Interim report on the change of MMN before and fter weight recovery in AN.

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ABSTRACT

【Aims】The purpose of this study is to longitudinally evaluate changes in mismatch negativity (MMN) and frontal lobe functions and cognition specific to eating disorders in patients with Anorexia Nervosa before and after weight recovery.

【Methods】This study was approved by the Ethics Committee of Fukushima Medical University, and a written consent was obtained from all subjects. The first measurement was taken during a period of low body weight (<65% of standard body weight) and the second measurement was taken after weight gain (>65% of standard body weight) in the same patient diagnosed with neurogenic emaciation (AN). In the healthy control group, body weight was not considered and the first and second measurements were taken several months apart. Stimuli (dev:50ms) deviating in sound duration from the standard stimulus (std:100ms) with a presentation frequency of 8:2 were used to measure duration MMN. The peak in the negative direction 140-250ms after stimulus onset was used as the MMN, and the amplitude
and latency were evaluated.

【Results】The 7 cases of AN for which we have already measured MMN show no
significant differences in latency or amplitude before or after weight recovery.

P-42 The effect of oxytocin nasal spray on cognitive dysfunction in schizophrenia measured by mismatch negativity

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ABSTRACT

Objectives: As a treatment for cognitive dysfunction in schizophrenia, oxytocin nasal sprays potentially improve social cognition, facial expression recognition, and sense of smell. Mismatch negativity (MMN) is an event-related potential (ERP) reflecting auditory discrimination while MMN deficits reflect cognitive function decline in schizophrenia. The purpose of this study was to determine whether oxytocin nasal spray affects auditory MMN.

Methods: Forty healthy subjects and twenty-six schizophrenia subjects were randomly assigned to either the oxytocin or placebo group. ERPs were recorded during the oddball task for all subjects before and after a 24 international unit (IU) intranasal administration, and MMN was compared between the two groups.

Results: Healthy subjects who received oxytocin had significantly shorter MMN latencies than those who received a placebo. There was no significant effect on schizophrenia subjects.

Conclusions: The shortened MMN latencies that were observed after oxytocin nasal spray administration in healthy subjects suggest that oxytocin may promote the comparison-decision stage.

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EFX72K007D
EFX P-13329v03

2022年2月作成

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患者様の想いを見つめて、薬は生まれる。

顕微鏡を覗く日も、薬をお届けする日も、見つめています。
病気とたたかう人の、言葉にできない痛みや不安。生きることへの希望。
私たちは、医師のように普段からお会いすることはできませんが、
そのぶん、患者様の想いにまっすぐ向き合っていたいと思います。
治療を続けるその人を、勇気づける存在であるために。
病気を見つめるだけではなく、想いを見つめて、薬は生まれる。
「ヒューマン・ヘルスケア」。それが、私たちの原点です。

ヒューマン・ヘルスケア企業 エーザイ

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