26e Réunion annuelle

Mercredi 1er novembre 2023

26th Annual Meeting

Wednesday November 1st 2023

Réseau de recherche en santé de la vision
Vision Health Research Network

Programme • *Program*

Amphithéâtre Pierre-Péladeau du CHUM

1050 rue Saint-Denis, Montréal, Québec

reseauvision.ca

visionnetwork.ca

RÉSEAU DE RECHERCHE EN SANTÉ DE LA VISION

VISION HEALTH RESEARCH NETWORK

Réseau thématique soutenu par le

Fonds de recherche Santé Québec

IRCM Institut de recherches cliniques de Montréal

Inspiré par la vie.

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1050, rue Saint-Denis, Montréal, Québec

Le RRSV est soutenu par le Fonds de recherche du Québec - Santé (FRQS) et la Fondation Antoine-Turmel.
The VHRN is supported by the Fonds de recherche du Québec - Santé (FRQS) and la Fondation Antoine-Turmel.

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Conférencier invité

Krzysztof (Kris) Palczewski, PhD

Krzysztof Palczewski est un éminent biochimiste, pharmacologue et biologiste moléculaire, connu en particulier pour ses contributions scientifiques multidisciplinaires majeures à la biologie et à la chimie de la vision des vertébrés et à la thérapie des maladies rétiniennes. Son laboratoire est le plus connu pour avoir résolu les structures de différentes formes de rhodopsine, un prototype de récepteurs couplés aux protéines G qui constituent la famille la plus vaste et la plus diversifiée de cibles médicamenteuses humaines, ainsi que d'autres protéines importantes du système visuel. En outre, son équipe a mis au point un système d'imagerie à haute résolution avec excitation à deux photons qui a permis un suivi in vivo non invasif de la fonction visuelle en temps réel. Palczewski, citoyen américain, est né en Pologne. Il a obtenu une maîtrise en chimie à l'université de Wroclaw et un doctorat en biochimie à l'université technique de Wroclaw, en Pologne. Il a gravi les échelons de la faculté d'ophtalmologie et de pharmacologie à l'université de Washington, à Seattle, avant d'occuper la chaire de pharmacologie à la Case Western Reserve University, à Cleveland, dans l'Ohio. Il est actuellement professeur Donald Bren et professeur Irving H. Leopold d'ophtalmologie à l'université de Californie, à Irvine, et directeur du Centre de recherche translationnelle sur la vision. Il a reçu de nombreux prix internationaux prestigieux et est membre de l'Académie nationale des sciences et de l'Académie nationale de médecine.

Eye on genome editing (Regard sur l'édition génomique)

Les systèmes sensoriels peuvent conserver un certain degré de plasticité tout au long de la vie d'un organisme. Dans le système visuel, la rétine interne subit un remodelage en réponse aux défauts des photorécepteurs (PR). On pense que ces altérations de la rétine interne interfèrent avec la vision normale. Les techniques d'augmentation génique et d'édition du génome CRISPR/Cas9 ont le potentiel de traiter des troubles génétiques héréditaires de la vision jusqu'ici impossibles à traiter en délivrant une copie normale du gène concerné ou en corrigeant les mutations à l'origine de ces afflictions. Bien que des traitements d'augmentation génique soient disponibles dans le commerce pour les maladies héréditaires de la rétine, de nombreuses lacunes doivent être comblées, comme la dégénérescence progressive de la rétine et la diminution de l'efficacité au fil du temps. Les technologies innovantes d'édition du génome basées sur CRISPR-Cas9 ont élargi la proportion de troubles génétiques traitables et peuvent grandement améliorer ou compléter les résultats du traitement par augmentation génique. Les progrès dans ce domaine relativement nouveau impliquent le développement de thérapies comprenant la perturbation des gènes, les stratégies d'ablation et de remplacement et les techniques de correction génétique de précision, telles que l'édition des bases et l'édition des primitives. En modifiant directement l'ADN endogène, l'édition du génome garantit théoriquement une correction permanente des gènes et des effets durables du traitement. Les améliorations apportées aux modalités d'administration visant à limiter l'activité persistante de l'éditeur de gènes ont permis d'améliorer le profil de sécurité et de minimiser l'édition hors cible. La poursuite des progrès en matière de correction précise des gènes et de stratégies d'administration associées fera de l'édition du génome le traitement privilégié des troubles génétiques de la rétine.

Coordonnées: **Krzysztof (Kris) Palczewski, PhD**
Donald Bren Professor, Distinguished Professor, University of California, Irvine
Irving H. Leopold Chair of Ophthalmology, Center for Translational Vision Research
Gavin Herbert Eye Institute
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Keynote Speaker

Krzysztof (Kris) Palczewski, PhD

Krzysztof Palczewski is a distinguished biochemical and pharmacologist and molecular biologist, known particularly for seminal multidisciplinary scientific contributions to the biology and chemistry of vertebrate vision and therapy of retinal diseases. His laboratory is the best known for solving the structures of different forms of rhodopsin, a prototype for G protein-coupled receptors that comprise the largest and most diverse family of human drug targets, and other important proteins of the visual system. Moreover, his team developed high-resolution imaging with two-photon excitation that impacted non-invasive in vivo monitoring of real-time visual function. Palczewski, a US citizen, was born in Poland. He achieved M.S. (chemistry) degrees at the University of Wroclaw, and Ph.D. (biochemistry) Technical University of Wroclaw, Poland. He rose through the faculty ranks in Ophthalmology and Pharmacology at University of Washington, Seattle before serving as Chair of Pharmacology at Case Western Reserve University, Cleveland, OH. Currently he is a Donald Bren Professor and Irving H. Leopold Professor of Ophthalmology at the University of California, Irvine, serving as Director of the Center for Translational Vision Research. He has received numerous prestigious international awards and is a member of both the National Academy of Sciences and the National Academy of Medicine.

Eye on genome editing

Sensory systems can retain a degree of plasticity throughout an organism's lifespan. In the visual system, the inner retina undergoes remodeling in response to photoreceptor (PR) defects. These alterations in the inner retina are believed to interfere with normal vision. Gene augmentation and CRISPR/Cas9 genome editing techniques have the potential to treat previously untreatable inherited genetic disorders of vision by delivery of normal copy of the gene of interest or correcting mutations that cause these afflictions. Although gene augmentation treatments are commercially available for inherited retinal diseases, there are many shortcomings that need to be addressed, like progressive retinal degeneration and diminishing efficacy over time. Innovative CRISPR-Cas9-based genome editing technologies have broadened the proportion of treatable genetic disorders and can greatly improve or complement treatment outcomes from gene augmentation. Progress in this relatively new field involves the development of therapeutics including gene disruption, ablate-and-replace strategies, and precision gene-correction techniques, such as base editing and prime editing. By making direct edits to endogenous DNA, genome editing theoretically guarantees permanent gene-correction and long-lasting treatment effects. Improvements to delivery modalities aimed at limiting persistent gene-editor activity have displayed an improved safety profile and minimal off-target editing. Continued progress to advance precise gene correction and associated delivery strategies will establish genome editing as the preferred treatment for genetic retinal disorders.

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Programmation scientifique / *Scientific program*

Horaire - Mercredi, 1er novembre 2023

Dès 7 h 30	Inscription	Entrée principale
8 h 15 – 8 h 40	**Mot d'ouverture** **Michel Cayouette**, PhD, Directeur du RRSV	Amphithéâtre Pierre-Péladeau
8 h 40 – 10 h	**Session 1 : Présentations orales (1 à 7)** Modérateur : **Jean-François Bouchard,** PhD	Amphithéâtre Pierre-Péladeau
10 h – 11 h 30	**Session 2 : Présentations par affiche (nombres impairs)** - incluant les Infrastructures communes **Pause**	Niveaux 2 et 3 Niveaux 1 et 2
11 h 30 – 11 h 55	**Session 3 : Mes recherches en un clin d'œil (8 à 13)** Modérateur : **Stuart Trenholm**, PhD	Amphithéâtre Pierre-Péladeau
11 h 55 – 12 h 25	**Session 4 : Partenaires stratégiques et collaborations** Modérateur : **Michel Cayouette**, PhD	Amphithéâtre Pierre-Péladeau
12 h 25 – 13 h 30	Dîner Cueillette des boîtes à lunch Places assises	Niveaux 1 et 2 Salles aux niveaux 1, 2 et 3
13 h 30 – 13 h 50	**Prix de reconnaissance / Hommage** **Hélène Boisjoly,** CM. M.D., MPH, FRCSC, Université de Montréal **Patrick Rochette**, PhD, Université Laval	Amphithéâtre Pierre-Péladeau
13 h 50 – 14 h 50	**Conférencier d'honneur** **Krzysztof (Kris) Palczewski,** PhD *University of California*, Irvine, CA, États-Unis *Eye on genome editing* (Regard sur l'édition génomique) Modérateur : **Przemylaw (Mike) Sapieha**, PhD	Amphithéâtre Pierre-Péladeau
14 h 50 – 15 h 55	**Session 5 : Présentations orales (14 à 19)** Modératrice : **Adriana Di Polo,** PhD	Amphithéâtre Pierre-Péladeau
16 h – 17 h 30	**Session 6 : Présentations par affiche (nombres pairs)** - incluant les Infrastructures communes **Pause**	Niveaux 2 et 3 Niveaux 1 et 2
17 h 30 – 17 h 45	**Remise des prix et mot de clôture** **Michel Cayouette**, PhD, directeur du RRSV	Amphithéâtre Pierre-Péladeau

Chaque présentation orale sera suivie d'une courte période de discussion.
La présentation du conférencier invité sera suivie d'une période de discussion de 15 min.

Programmation scientifique / *Scientific program*

Schedule - Wednesday, November 1st 2023

From 7:30 am	Registration	Main entrance
8:15 – 8:40 AM	Opening remarks **Michel Cayouette**, PhD, VHRN Director	Amphitheatre Pierre-Peladeau
8:40 – 10 AM	Session 1: Oral Presentations (1 to 7) Moderator: **Jean-François Bouchard,** PhD	Amphitheatre Pierre-Peladeau
10 – 11:30 AM	Session 2: Poster Presentations (odd numbers) - Including Common Infrastructures Break	Levels 2 and 3 Level 1 and 2
11:30 – 11 h:55 AM	Session 3: My Research in a Wink (8 to 13) Moderator: **Stuart Trenholm**, PhD	Amphitheatre Pierre-Peladeau
11:55 – 12:25 PM	Session 4: Collaborations and strategic partnerships Moderator: **Michel Cayouette**, PhD	Amphitheatre Pierre-Peladeau
12:25 – 1:30 PM	Lunch Box lunch pick up Places assises	Levels 1 and 2 Rooms at levels 1, 2 and 3
1:30 – 1:50 PM	Recognition Awards / Tribute **Hélène Boisjoly,** CM, MD, MPH, FRCSC, Université de Montréal **Patrick Rochette**, PhD, Université Laval	Amphitheatre Pierre-Peladeau
1:50 – 2:50 PM	Keynote speaker **Krzysztof (Kris) Palczewski,** PhD University of California, Irvine, CA, USA *Eye on genome editing* Moderator: **Przemylaw (Mike) Sapieha**, PhD	Amphitheatre Pierre-Peladeau
2:50 – 3:55 PM	Session 5: Oral Presentations (14 to 19) Moderator: **Adriana Di Polo,** PhD	Amphitheatre Pierre-Peladeau
4 – 5:30 PM	Session 6: Oral Presentations (even numbers) - Including Common Infrastructures Break	Levels 2 and 3 Levels 1 and 2
5:30 – 5:45 PM	Prizes and closing remarks **Michel Cayouette**, PhD, VHRN Director	Amphitheatre Pierre-Peladeau

Each oral presentation will be followed by a discussion period.
The entire poster sessions will be devoted to a discussion period between the presenter and the reviewers or other participants.

Comité organisateur & scientifique / *Organizing & Scientific Committee*

Jean-François Bouchard
Élodie Boisselier
Isabelle Brunette
Michel Cayouette
Frédéric Charron
Sylvain Chemtob
Adriana Di Polo
May Griffith
Aaron Johnson
Arjun Krishnaswamy
Jacqueline Orquin
Arnaud Saj
Przemylaw (Mike) Sapieha
Stuart Trenholm
Valérie Lavastre
Michèle Cy

Comité d'évaluation / *Evaluation Committee*

Typhaine Anquetil
Alexander Baldwin
Mathilde Bizou
Guillaume Blot
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Yukohiro Shiga
Matthieu Vanni
Ariel Wilson

Remerciements / *Acknowledgments*

Le comité de direction du Réseau de recherche en santé de la vision tient à remercier les personnes suivantes
pour leur aide dans l'organisation de la réunion annuelle :

***

The Vision Health Research Network organizing committee would like to thank the following people for their help in organizing the Annual Meeting:

Geneviève Cyr
Florence Dotigny
Isabelle Lahaie
Christelle Gross
Patrick J. Rochette
Stéphanie Proulx
Christian Casanova
Sébastien Méthot

Mme Hélène Lambin, conceptrice graphique

Institut de recherches cliniques de Montréal (IRCM)

Comité étudiant du RRSV / *VHRN Student Committee*

Deborah Villafranca-Baughman
Anne Xuan-Lan Nguyen
Mélanie Hébert
Rabah Dabouz
Jiaru Liu
Sheetal Pundir

Subsides / *Sponsors*

Cette journée a reçu une subvention à visée éducative des compagnies et organismes suivants:

***

This research day received an educational grant from the following companies and organizations:

Catégorie ARGENT/ *SILVER Category*

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SUN PHARMA

Catégorie BRONZE / *BRONZE Category*

GLAUKOS

BAUSCH + LOMB

Partenaire / *Partner*

Fondation Antoine-Turmel

Développement professionnel continu

La Direction du développement professionnel continu de la Faculté de médecine de l'Université de Montréal est pleinement agréée par l'Association des facultés de médecine du Canada (AFMC) et par le Collège des médecins du Québec (CMQ).

Déclaration de formation continue au Collège des médecins du Québec : Les médecins qui participent à cette activité peuvent déclarer **7,25** heures de développement professionnel reconnu dans la catégorie A, sous l'onglet « Activité reconnue par un organisme québécois agréé en formation continue ».

La présente activité est une activité d'apprentissage collectif agréée (section 1), au sens que lui donne le programme de Maintien du certificat du Collège royal des médecins et chirurgiens du Canada; elle a été approuvée par la Direction du DPC de la Faculté de médecine de l'Université de Montréal pour un maximum de **7,25** heures.

Pour tout autre professionnel participant, ce programme donne une attestation de participation pour un maximum de **7,25** heures.

Les participants doivent réclamer à leur ordre professionnel respectif un nombre d'heures conforme à leur participation.

***

Continuing Professional Development

*The Continuing Professional Development (CPD) Office of the Faculty of Medicine of Université de Montréal, a fully certified CPD provider by the Collège des médecins du Québec, recognizes a maximum of **7,25** hours of category 1 credits to participants of this activity.*

*This event is an Accredited Group Learning Activity (Section 1) as defined by the Maintenance of Certification Program of the Royal College of Physicians and Surgeons of Canada and has been approved by the CPD Office of the Faculty of medicine of Université de Montréal for a maximum of **7,25** hours.*

*For all other participating professionals, this program provides a certificate of participation for a maximum of **7,25** hours.*

*This event is an Accredited Group Learning Activity (Section 1) as defined by the Maintenance of Certification Program of the Royal College of Physicians and Surgeons of Canada and approved by the CPD Office of the Faculty of medicine of Université de Montréal. You may claim a maximum of **7,25** hours.*

Historique

Le Réseau de recherche en santé de la vision œuvre, depuis 1995, sous l'égide du Fonds de la recherche du Québec - Santé (FRQS). Cet organisme gouvernemental a favorisé la création de réseaux de recherche au début des années 1990 afin de permettre aux chercheurs du Québec d'accroître leur collaboration et de participer davantage et collectivement à l'avancement des connaissances et à l'accroissement de la compétitivité du Québec dans des domaines ciblés par la politique de santé du Québec.

L'objectif du Réseau est d'accroître la capacité de recherche et la compétitivité du Québec en recherche en santé de la vision sur la scène internationale avec comme but ultime d'améliorer la santé visuelle des patients et de la société. À cette fin, le Réseau subventionne des infrastructures communes et plateformes (telles que des banques de cellules ou de tissus, des banques de données, ressources à utilisateurs multiples). Le programme de bourses de recrutement du Réseau a pour but de stimuler l'intérêt des étudiants pour la recherche en vision dès la première session, afin qu'ils continuent dans cette voie. Enfin, le Réseau participe à la préparation des étudiants en vue des concours de bourses des grands organismes subventionnaires.

Le Réseau de recherche en santé de la vision regroupe aujourd'hui près de 150 chercheurs cliniciens et chercheurs fondamentalistes du Québec. Les chercheurs et cliniciens du Réseau œuvrent au sein ou en collaboration avec les huit universités du Québec: Concordia, INRS, McGill, Laval, Montréal, Sherbrooke, Université du Québec à Montréal et Université du Québec à Trois-Rivières. Les membres du Réseau sont rattachés aux quatre départements universitaires d'ophtalmologie de la province, à l'École d'optométrie de l'Université de Montréal, à plus d'une douzaine de départements universitaires de sciences fondamentales (psychologie, biologie, pharmacologie, biophysique) et à plus d'une douzaine de départements hospitaliers et centres de recherche clinique (Centre Hospitalier Universitaire de Montréal, Centre Hospitalier Universitaire de Québec, Centre de recherche Côte des Neiges, Centre de recherche Lucie-Bruneau, Centre Universitaire en Santé de l'Estrie, Centre Universitaire en Santé McGill, Centre de recherche de l'Hôpital Maisonneuve-Rosemont, Centre de recherche de l'Hôpital Sainte Justine, Centre de recherche de l'Hôpital juif de Montréal, Laboratoire d'organogenèse expérimentale, Centre de recherche de l'Hôpital pour enfants de Montréal, l'Institut neurologique de Montréal).

La Réunion annuelle du RRSV s'adresse à tous les chercheurs et collaborateurs de recherche, cliniciens et fondamentalistes, professeurs et étudiants, assistants et techniciens impliqués en recherche en vision au Québec. Cette réunion donne l'occasion de découvrir ce qui se fait en recherche en santé de la vision au Québec. Il s'agit d'une opportunité unique et privilégiée de rencontrer vos collègues des divers milieux et institutions québécoises, de partager vos connaissances et de « réseauter ».

La Réunion annuelle du RRSV est la seule occasion de réunir tous nos membres et nous sommes très fiers de constater, d'année en année, une participation croissante à cet événement.

History

The Vision Health Research Network is funded by the Fonds de la recherche du Québec en santé (FRQS). This governmental agency instigated the creation of research networks in the early 1990's in order to promote collaboration within the research community in Quebec and to give Quebec a competitive edge in matters targeted by our health policy.

The Network's aim is to increase research capacity and competitiveness of Quebec in vision health research on the international scene with the ultimate goal of improving visual health of the patients and community. Therefore, the Network subsidizes common infrastructures and platforms (such as cells or tissues banks, databases, resources to multiple users). The Recruitement Scholaship's program intend to stimulate students' interests in vision research during their first session and encourage them pursuing their studies in this direction. Finally, the Network helps students to better perform in competitions for awards from important granting agencies.

Today, the Network includes almost 150 clinical and fundamental researchers. The researchers and clinicians work or collaborate with the eight universities in Quebec: Concordia, INRS, McGill, Laval, Montreal, Sherbrooke, Université du Québec à Montréal, Université du Québec à Trois-Rivières. Members are affiliated with the four departments of ophthalmology in Quebec and a dozen fundamental science departments (psychology, biology, pharmacology, biophysics) and clinical research centers (Centre Hospitalier Universitaire de Montréal, Centre Hospitalier Universitaire de Québec, Centre de recherche Côte des Neiges, Centre de recherche Lucie-Bruneau, Centre Universitaire en Santé de l'Estrie, Centre Universitaire en Santé McGill, Centre de recherche de l'Hôpital Maisonneuve-Rosemont, Centre de recherche de l'Hôpital Sainte Justine, Centre de recherche de l'Hôpital juif de Montréal, Laboratoire d'organogenèse expérimentale, Centre de recherche de l'Hôpital pour enfants de Montréal, l'Institut neurologique de Montréal).

The VHRN Annual Meeting is open to all researchers and research collaborators, clinicians and fundamentalists, teachers and students, assistants and technicians involved in vision research in Quebec.This meeting will give you the opportunity to discover what is happening in vision health research in Quebec. It is a unique and privileged opportunity to meet colleagues from diverse backgrounds and Quebec institutions, to share your knowledge and « networking ».

The VHRN Annual Meeting is the only opportunity to bring together all our members and we are very proud to see, year after year, increasing participation in this event.

Fondation Antoine-Turmel

Le Programme DMLA en bref

Créé en 2013 par le Réseau de recherche en santé de la vision (RRSV), le programme DMLA a vu le jour grâce à la générosité de la Fondation Antoine-Turmel et à un partenariat fructueux entre la Fondation, le RRSV, et le Fonds de recherche du Québec en Santé (FRQS). Ce programme est entièrement dédié à la recherche sur la dégénérescence maculaire liée à l'âge (DMLA) sous toutes ses formes (fondamentale, clinique translationnelle, épidémiologie/santé publique, réadaptation). Il mobilise l'ensemble des ressources disponibles dans le milieu de la DMLA et implique l'ensemble des intervenants (chercheurs, cliniciens, décideurs, organismes à but non lucratif, partenaires et patients) susceptibles de faciliter la recherche sur la DMLA et l'implantation de ses résultats.

Objectifs spécifiques

Les sujets atteints de DMLA ou à risque de le devenir sont au cœur de ce programme.

Le but est de favoriser le développement de connaissances nouvelles afin:

- de développer de meilleurs traitements pour les sujets atteints de DMLA
- de ralentir significativement le cours de cette maladie
- d'en retarder le début, et même d'en prévenir l'apparition
- de développer des programmes de réadaptation pour les patients atteints d'une DMLA avancée afin de leur permettre de mieux vivre avec leur maladie

Ce programme a grandement contribué au développement d'une masse critique de chercheurs québécois en DMLA et à positionner le Québec dans ce domaine de recherche au Canada et sur la scène internationale.

Les présentations ayant un lien avec la DMLA sont identifiés par ce logo : DMLA

Présentations orales	Présentations par affiche
2 - 13	20 – 22 - 23
	36 – 48 – 49
	52 – 53 - 54
	56 – 58 - 63
	64 – 71 - 73
	77 – 81 - 84

Fondation Antoine-Turmel

The AMD Program at a glance

Created in 2013 by the Vision Health Research Network (VHRN), thanks to the generosity of the Antoine-Turmel Foundation, the AMD program is the result of a successful partnership between the VHRN, the Foundation and the Fonds de Recherche du Québec en Santé (FRQS). This program is dedicated to research in age-related macular degeneration (AMD) in all its forms (fundamental, clinical, and translational research, epidemiology/public health and rehabilitation). The AMD program mobilizes all available resources in the AMD community and involves all stakeholders (researchers, clinicians, policy makers, non -profit organizations, partners, patients) which might facilitate AMD research and implementation of its results.

Specific objectives

Patients suffering from AMD or who are at risk are at the center of this program.

The goal is to promote the development of new knowledge to:

- develop better treatments for patients with AMD
- significantly slow the course of this disease
- delay its start, and even to prevent its onset
- develop rehabilitation programs for patients with advanced AMD to enable them to live better with their disease

This program has significantly contributed to the development of a critical mass of AMD research in the province of Quebec and to position in this province in this research area in Canada and internationally.

AMD related prensetations are identified by this logo: DMLA

Oral Presentation	Poster presentations
2 - 13	20 – 22 - 23
	36 – 48 – 49
	52 – 53 - 54
	56 – 58 - 63
	64 – 71 - 73
	77 – 81 - 84

Présentations orales

Objectifs et horaire

Oral presentations

Objectives and schedule

RÉSEAU DE RECHERCHE
EN SANTÉ DE LA VISION

VISION HEALTH
RESEARCH NETWORK

Objectifs

Présentations orales

1) Informer les étudiants, professeurs, chercheurs et cliniciens des dernières découvertes en santé et sciences de la vision au Québec ainsi qu'à l'international.
2) Favoriser les échanges portant sur les recherches récentes dans le domaine de la santé et des sciences de la vision au Québec entre les étudiants, professeurs, chercheurs et cliniciens en santé de la vision au Québec ainsi qu'à l'international.
3) Donner l'occasion aux étudiants du domaine de la santé et la science de la vision de tous niveaux (stagiaires, BSc, MSc, PhD, SPD, étudiants MD, résidents, fellows) et de tous les secteurs (recherche clinique, épidémiologique, translationnelle et fondamentale) de présenter les résultats de leurs recherches.

« Mes recherches en un clin d'œil »

1) Reconnaître les aptitudes en communication des étudiants gradués de 1er, 2e et 3e cycle, étudiants en médecine, stagiaires postdoctoraux et résidents en médecine en santé et sciences de la vision.
2) Illustrer les travaux de recherche en santé et sciences de la vision de manière juste et créative.
3) Démontrer un exposé concis et convainquant devant un public diversifié.

Partenaires stratégiques et collaborations

1) Identifier quelques partenaires stratégiques parmi les partenariats structurels récemment proposés dans la programmation scientifique 2024-2032 du RRSV
2) Favoriser le développement de collaborations intersectorielles et interdisciplinaires entre les membres du RRSV et ces partenaires
3) Faciliter la proximité avec les patients avec les membres du RRSV afin de favoriser leur implication dans la création et la conception de la recherche

Conférencier invité

1) Identifier les concepts de plasticité dans les systèmes visuels en réponses aux défauts des photorécepteurs aux étudiants, résidents, professeurs, chercheurs et cliniciens.
2) Se familiariser avec les dernières avancées sur les techniques innovantes en matière d'édition génomique, plus particulièrement impliquées dans les troubles génétiques héréditaires de la vision.
3) Expliquer le rôle innovant de l'édition génomique comme traitement privilégié pour des corrections précises
4) Favoriser les échanges d'idées sur les recherches récentes portant sur l'édition génomique entre étudiants de tous les niveaux (stagiaires, étudiants de premier cycle, M. Sc., Ph. D., SPD, étudiants en médecine, résidents, *fellows*), professeurs, chercheurs et cliniciens.

Objectives

Oral presentations

1) Inform students, professors, researchers, and clinicians about the newest discoveries in vision health and sciences research in Québec and for international outcomes.
2) Stimulate the exchange of ideas about recent research in vision health and sciences research in Québec between students, professors, researchers, and clinicians about the newest discoveries in vision health research in Québec and for international outcomes.
3) Provide an opportunity for the students in vision health and sciences research of all levels (interns, undergraduate, MSc, PhD, research fellows, MD students, residents, medical fellows) and of all sectors (clinical, epidemiological, translational, and basic research) to present the results of their research in vision health.

« My Research in a Wink »

1) Recognize the communication skills of undergraduate and graduate students, medical students, postdoctoral fellows and medical residents in vision health and science.
2) Illustrate vision health and sciences research in a fair and creative manner.
3) Demonstrate a concise and compelling presentation to a lay audience.

Collaborations and strategic partnerships

1) Identify some strategic partners for VHRN members among the structural partnerships recently proposed in the VHRN's 2024-2032 scientific program.
2) Promote the development of intersectoral and interdisciplinary collaborations between RRSV members and these partners.
3) Facilitate proximity to patients with members of the VHRN to encourage their involvement in the creation and design of research.

Keynote speaker

1) Identify the concepts of plasticity in visual systems in response to photoreceptor defects to students, residents, professors, researchers, and clinicians.
2) Familiarize yourself with the latest advances in innovative genome-editing techniques, particularly those involved in hereditary genetic vision disorders.
3) Explain the innovative role of genome editing as a preferred treatment for precise corrections.
4) Promote the exchange of ideas on recent genome-editing research between students at all levels (trainees, undergraduates, MSc, PhD, SPD, medical students, residents, fellows), professors, researchers, and clinicians.

Présentations orales / *Oral presentations*

Résumé / *Abstract*

Session 1
8 h 40 – 10 h

Présentations orales
Oral presentations

Modérateur / *Moderator:* **Jean-François Bouchard, PhD**

1	**8 h 40**	Comparison between micropulse transscleral cyclophotocoagulation and continuous-wave transscleral cyclophotocoagulation in glaucoma patients: a tertiary centre experience Jiaru Liu, **Tasnim Tabassum**, Yulen Shen, Harmanjit Singh, Frédéric Lord, Georges M Durr, Younes Agoumi, Qianqian Wang
2	**8 h 51**	Études de corrélation génotype/phénotype du gène JAG1 de la voie de signalisation NOTCH dans la susceptibilité à la dégénérescence maculaire liée à l'âge (DMLA). Comparaison entre la forme atrophique et la forme exsudative dans la population canadienne-française **Audrey-Anne Lapierre**, Félix Plamondon, Philippe Morneau-Cartier, Kristina Bushyla, Patrick Laplante, Mélanie Doucet, Pascal Belleau, Rose Arseneault, Marc-André Rodrigue, Stéphane Dubois, Mario Malenfant, Vincent Raymond
3	**9 h 02**	Contrast detection efficiency in pink noise is consistent for targets having sinusoidal, square-wave, and missing-fundamental luminance profiles **Jeong Ung Song**, Alexander Baldwin
4	**9 h 13**	One-year clinical outcomes of Preserflo MicroShunt compared to Non-Penetrating Glaucoma Surgery Georges Durr, Paul Harasymowycz, Maria Camila Aguilar, **Andrea Dahoud**
5	**9 h 24**	Understanding the immune determinants of corneal repair: A novel population of macrophages in the corneal epithelium **Marc Groleau**, Nina Wang, Ajitha Thanabalasuriar
6	**9 h 35**	FAM172A regulates eye development through an interaction with AGO2 **Elizabeth Leduc**, Séphora Sallis, Félix-Antoine Bérubé-Simard, Malika Oubaha, Nicolas Pilon
7	**9 h 46**	Developing the World Health Organization International Classification of Functioning, Disability and Health Core Sets for Deafblindness **Walter Wittich**, Atul Jaiswal, Ricard López, Sonja van de Molengraft, Renu Minhas, Shirley Dumassais, Shreya Budhiraja, Abinethaa Paramasivam, Frank Kat, Mahadeo Sukhai, Daniela Anze, Allan Wareham, Meredith Prain, Keith R. McVilly, Sarah Granberg

Présentations orales / *Oral presentations*

Session 3
11 h 30 – 11 h 55

Mes recherches en un clin d'œil
My Research in a Wink

Modérateur / *Moderator:* **Stuart Trenholm, PhD**

8	**11 h 30**	Règles pour la quantification des nerfs cornéens suivant la neurotisation cornéenne **Victoria Anne Purdy-Millaire**, Lamia Ammarkhodja, Michèle Mabon, Isabelle Hardy, Akram Rahal, Jean Meunier, Isabelle Brunette
	*AFFICHE / *POSTER* #29 – Session 6 – 16 h – 17 h 30	
9	**11 h 34**	Impact de la cécité sur les comportements sociaux et la plasticité cérébrale au niveau cellulaire chez la souris de souche ZRDBA **Clément Delcamp**, Elena Morales-Grahl, Cyrine Trabelsi, Gilles Bronchti, Johannes Frasnelli, Syrina Al Aïn
	*AFFICHE / *POSTER* #30 – Session 6 – 16 h – 17 h 30	
10	**11 h 38**	Mapping Pulsatile Optic Nerve Head Deformation using OCT: *Validation and clinical applications* **Marissé Masís Solano**, Emmanuelle Richer, Alejandra Martinez Petro, Santiago Costantino, Mark Lesk
	*AFFICHE / *POSTER* #31 – Session 6 – 16 h – 17 h 30	
11	**11 h 42**	L'anatomie du système endocannabinoïde dans le cortex visuel: implications pour l'étude de la perception visuelle (et plus encore) **Catarina Micaelo Fernandes**, Hamza Haïmeur, Jean-François Bouchard, Maurice Ptito
	*AFFICHE / *POSTER* #32 – Session 6 – 16 h – 17 h 30	
12	**11 h 46**	The Effects of Chronic Steroid Exposure on Primary Human Trabecular Meshwork Cells: Implications for Steroid Induced Ocular Hypertension and Glaucoma **Luis Sanchez**, Jie J. Zheng
	*AFFICHE / *POSTER* #33 – Session 6 – 16 h – 17 h 30	
13	**11 h 50**	Suprachoroidal Injection: A Novel Approach for Targeted Drug Delivery **Yang Wu,** Marian Zaharia
	*AFFICHE / *POSTER* #36 – Session 2 – 10 h – 11 h 30	

Présentations orales / *Oral presentations*

Résumé / *Abstract*

Session 4: 11 h 55 – 12 h 25

Partenaires stratégiques et collaborations
Collaboration and Strategic partnerships

Modérateur / *Moderator:* **Michel Cayouette, PhD**

p1	**11 h 55**	***University of British Columbia (UBC) - Research Excellence Cluster in Vision*** **Joanne Mastubara**, PhD Ruanne Lai, PhD
p2	**12 h 01**	***Fighting Blindness Canada (FBC)*** **Larissa Monitz**, PhD, *Director of Research and Mission Programs* Jennifer Jones, PhD, *President, and Chief Executive Officer (CEO)*
p3	**12 h 07**	INO (Institut national d'optique) : Centre d'expertise en optique-photonique **Éric Trudel**, PhD, Directeur unité d'affaires - Biomedtech
p4	**12 h 13**	Canadian National Institute for the Blind (CNIB) **Kathleen Beitz,** *research assistant, volunteer at CNIB* Kathy Rabideau, *Chief Financial Officer* Mahadeo A. Sukhai, PhD, *Vice President, Research, and International Affairs & Chief Accessibility Officer*
p5	**12 h 19**	École nationale d'aérotechnique (ENA) / Centre technologique en aérospatiale (CTA) / Cégep Édouard Montpetit **Mathieu Boulanger**, PhD, Directeur scientifique et Chef de secteur en intelligence artificielle

Présentations orales / *Oral presentations*

Session 5
14 h 50 – 15 h 55

Présentations orales
Oral presentations

Modératrice / *Moderator:* **Adriana Di Polo, PhD**

14	**14 h 50**	Lactate Receptor, HCAR1 Deficiency Leads to Cellular Stress Compromising Choroidal Integrity of the Developing Outer Retina **Monir Modaresinejad**, Xiaojuan Yang, Emmanuel Bajon, Xin Hou, Jose Carlos Rivera, Sylvain Chemtob
15	**15 h 01**	Early Blood-Retina Barrier Dysfunction in Glaucoma **Isaac Alejandro Vidal Paredes,** Heberto Quintero, Yukihiro Shiga, Jorge Cueva Vargas, Nicolas Belforte, Florence Dotigny, Adriana Di Polo
16	**15 h 12**	Surgical treatment of high myopia: A short-term safety, efficacy, and predictability comparative analysis of current vision correction procedures **Cristina Bostan**, William J. Dupps, Bradley J. Randleman
17	**15 h 20**	Information integration across saccades plays a prominent role during goal-directed viewing of everyday scenes **Katarzyna Jurewicz**, Buxin Liao, Suresh Krishna
18	**15 h 32**	Mimicking the tear film using Langmuir monolayers - an approach to better understand the mucoadhesive property of gold nanoparticles **Giulia Elisa Guimarães Gonçalves**, Audrey Turmel, Élodie Boisselier
19	**15 h 43**	The Long Term Structural and Functional Impact of Retinopathy of Prematurity **Valentina Parra**, Tianwei Ellen Zhou, Elizabeth You Jin Youn, Allison Dorfman, Anna Polosa, Patrick Hamel, Thuy Mai Luu, 7, Anne Monique Nyut, Sylvain Chemtob, Shigufa Kahn Ali, Anik Cloutier, Cynthia Xin-Ya Qian

Présentations par affiche

Objectifs et liste

Poster presentations

Objectives and list

RÉSEAU DE RECHERCHE
EN SANTÉ DE LA VISION

VISION HEALTH
RESEARCH NETWORK

Objectifs des présentations par affiche

1) Informer les étudiants, professeurs, chercheurs et cliniciens des dernières découvertes en recherche en santé de la vision au Québec

2) Favoriser les échanges portant sur les recherches récentes dans le domaine de la santé de la vision au Québec entre les étudiants, professeurs, chercheurs et cliniciens

3) Donner l'occasion aux étudiants du domaine de la rétine et du segment postérieur de tous les niveaux (stagiaires, BSc, MSc, PhD, SPD, étudiants MD, résidents, fellows) et de tous les secteurs (recherche clinique, épidémiologique, translationnelle et fondamentale) de présenter les résultats de leurs recherches

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Objectives for poster presentations

1) *Inform students, professors, researchers, and clinicians about the newest discoveries in the retina & the posterior segment, the visual impairment & rehabilitation, the cornea & the anterior segment and the brain & perception fields*

2) *Stimulate the exchange of ideas about recent research in the retina & the posterior segment, the visual impairment & rehabilitation, the cornea & the anterior segment and the brain & perception fields, between students, professors, researchers, and clinicians*

3) *Provide an opportunity for the students in the retina & the posterior segment, the visual impairment & rehabilitation, the cornea & the anterior segment and the brain & perception fields of all levels (interns, undergraduate, MSc, PhD, research fellows, MD students, residents, medical fellows) and of all sectors (clinical, epidemiological, translational, and basic research) to present the results of their research in the form of an interactive poster*

Liste des présentations par affiche / *Poster Presentations List*

Session 2 **10 h – 11 h 30**	**Nombres impairs** ***Odd numbers***

Session 6 **16 h – 17 h 30**	**Nombres pairs** ***Even numbers***

Infrastructures communes / *Common Infrastructures*

Résumé / *Abstract*

20-IF[1]	Banque de renseignements cliniques et de matériel biologique de recherche en ophtalmologie au CUO-Recherche clinique du Centre de recherche du CHU de Québec-Université Laval **Sébastien Méthot**, Geneviève Dallaire, Marcelle Giasson, Ali Dirani *Description de l'infrastructure – lien vers le site internet du RRSV* *Infrastructure description - VHRN web site link*
21-IF	COVID-19 Eye Registry (COVER) – Registry of Ophthalmological Manifestations of COVID-19 **Mélanie Hébert**, Soumaya Bouhout, Ellen E. Freeman, Marie-Josée Aubin *Description de l'infrastructure – lien vers le site internet du RRSV* *Infrastructure description - VHRN web site link*
22-IF	Base de données d'images rétiniennes chez les malvoyants: Drusen et dégénérescence maculaire liée à l'âge **Aaron Johnson** *Description de l'infrastructure – lien vers le site internet du RRSV - Infrastructure description - VHRN web site link*
23-IF	Plateforme d'analyse computationnelle de cellules individuelles **Gael Cagnone**, Jean-Sébastien Joyal *Description de l'infrastructure – lien vers le site internet du RRSV- Infrastructure description - VHRN web site link*
24-IF[1]	A New Database ("IRD REGISTRY") for Quebec Patients with Inherited Retinal Degenerations (IRD); Bringing Science and the Clinic Closer Together Glenda Vargas, Christine Gannon, Ayan Ibrahim, Irma Lopez, **Goreth Leite**, Shigufa Kahn-Ali, Cynthia X. Qian, Robert Koenekoop *Description de l'infrastructure – lien vers le site internet du RRSV* *Infrastructure description - VHRN web site link*
25-IF	Tissus oculaires pour la recherche en vision **Christelle Gross**, Kelly Coutant, Pascale Charpentier, **Stéphanie Proulx** *Description de l'infrastructure – lien vers le site internet du RRSV* *Infrastructure description - VHRN web site link*
26-IF	Banque québécoise pour la recherche sur le mélanome uvéal **Solange Landreville** *Description de l'infrastructure – lien vers le site internet du RRSV* *Infrastructure description - VHRN web site link*
27-IF	ORVIS: Un répertoire d'outils de mesure pour la réadaptation de la vision Sylvie Cantin, Catherine Houtekier, **Walter Wittich** *Description de l'infrastructure – lien vers le site internet du RRSV* *Infrastructure description - VHRN web site link*
28-IF	Banque de données pour la caractérisation fonctionnelle, anatomopathologique et chirurgicale de la cornée Marie-Claude Robert, **Michel Haagdorens**, Isabelle Brunette, Mona Harissi-Dagher, Jean Meunier, Julia Talajic *Description de l'infrastructure – lien vers le site internet du RRSV* *Infrastructure description - VHRN web site link*

[1] : *Le.la présentateur.trice sera présent.e à son affiche en AM seulement (Session 2)*

Liste des présentations par affiche / *Poster Presentations List*

Présentations par affiche / *Poster Presentations*

Session 2 **10 h – 11 h 30**	**Nombres impairs** ***Odd numbers***

Session 6 **16 h – 17 h 30**	**Nombres pairs** ***Even numbers***

Résumé / *Abstract*

29[2]	***Mes recherches en un clin d'œil / A wink on my research no. 8*** *« Règles pour la quantification des nerfs cornéens suivant la neurotisation cornéenne »* Conception d'une approche méthodologique à l'analyse quantitative de la réinnervation suivant une chirurgie de neurotisation cornéenne : Enjeux, progrès et implications pratiques de la sélection et du traçage d'images de microscopie confocale in vivo **Victoria Anne Purdy-Millaire**, Lamia Ammarkhodja, Michèle Mabon, Isabelle Hardy, Akram Rahal, Jean Meunie, Isabelle Brunette
30[2]	***Mes recherches en un clin d'œil / A wink on my research no. 9*** Impact de la cécité sur les comportements sociaux et la plasticité cérébrale au niveau cellulaire chez la souris de souche ZRDBA **Clément Delcamp**, Elena Morales-Grahl, Cyrine Trabelsi, Gilles Bronchti, Johannes Frasnelli, Syrina Al Aïn
31[2]	***Mes recherches en un clin d'œil / A wink on my research no. 10*** *"Mapping Pulsatile Optic Nerve Head Deformation using OCT: Validation and clinical applications"* Optic nerve pulsatile displacement in open angle glaucoma after intraocular pressure manipulation measured by optical coherence tomography **Marissé Masís Solano**, Emmanuelle Richer, Alejandra Martinez Petro, Santiago Costantino, Mark Lesk
32[2]	***Mes recherches en un clin d'œil / A wink on my research no. 11*** L'anatomie du système endocannabinoïde dans le cortex visuel : implications pour l'étude de la perception visuelle (et plus encore) **Catarina Micaelo Fernandes**, Hamza Haïmeur, Jean-François Bouchard, Maurice Ptito
33[2]	***Mes recherches en un clin d'œil / A wink on my research no. 12*** The Effects of Chronic Steroid Exposure on Primary Human Trabecular Meshwork Cells: Implications for Steroid Induced Ocular Hypertension and Glaucoma **Luis Sanchez**, Jie J. Zheng
36[1]	***Mes recherches en un clin d'œil / A wink on my research no. 13*** Suprachoroidal Injection: A Novel Approach for Targeted Drug Delivery **Kevin Yang Wu**, Marian Zaharia

[1] : *Le.la présentateur.trice sera présent.e à son affiche en AM seulement (Session 2)*
[2] : *Le.la présentateur.trice sera présent.e à son affiche en PM seulement (Session 6)*

Cornée et segment antérieur / *Cornea and Anterior Segment*

34[1]	Efficacy and Safety of Kahook Dual Blade Goniotomy and Trabecular Micro-bypass Stent (iStent Inject) in Combination with Cataract Extraction: A Retrospective Study **Kevin Yang Wu**, Michaël Marchand-Gareau

35	Interdisciplinary Quality Improvement in Oculoplastic Surgery: Transforming Biopsy Follow-Up through PDSA Cycles **Kevin Yang Wu**, Patrick Daigle
38	Identification automatique des différentes couches de la cornée sur les images de microscopie confocale par apprentissage profond **Lamia Ammarkhodja**, Isabelle Brunette, Jean Meunier
40	Étude des mécanismes moléculaires et cellulaires modulant l'expression du gène de la Clusterine durant la guérison des plaies cornéennes **Christelle Gross**, Bianca G Socol, Lucie Germain, Sylvain L Guérin
41	Sélection et criblage de gènes candidats comme modificateurs de l'âge d'apparition du glaucome primaire à angle ouvert au locus MOG2 sur le chromosome 20p12 **Philippe Morneau-Cartier**, **Félix Plamondon**, Audrey-Anne Lapierre, Kristina Bushyla, Patrick Laplante, Mélanie Doucet, Pascal Belleau, Rose Arseneault, Stéphane Dubois, Jean-Louis Anctil, Gilles Côté, Marcel Amyot, Michael A. Walter, Vincent Raymond
42	One-year Comparison of a 45 µm Lumen and 63 µm Lumen Gel Microstent Implantation **Valentina Parra**, MD, Andrea Dahoud, MD, Georges Durr, MD, FRCSC
43	Optimisation de la culture de cellules endothéliales cornéennes sur substrat à rigidité physiologique pour l'étude des jonctions intercellulaires **Samantha Sasseville**, Stéphanie Proulx

Rétine et segment postérieur / *Retina and Posterior Segment*

44[1]	Right eye orbital schwannoma with histopathological features of benignity adjacent to hypercellular areas Christian El-Hadad, Abdulmajeed Deheem Alharbi, Emily Marcotte, **Andrea Dahoud**

Cornée et segment antérieur / *Cornea and Anterior Segment*

45	One-year clinical outcomes of Hydrus Microstent implantation Georges Durr, **Andrea Dahoud**, Shawn Yuan
46	Pre-clinical study of an injectable biocompolyer-based hydrogel as a promising treatment for alkali burnt cornea blindness **Mostafa Zamani Roudbaraki**, Michel Haagdorens, Isabelle Brunette, Malcolm Latorre, Mohand Ouamar Bellil, Jesto Raju, Christos Boutopoulos, Marie-Claude Robert, May Griffith

Rétine et segment postérieur / *Retina and Posterior Segment*

47	Ikzf2 regulates amacrine cell diversification in the developing mouse retina **Pedro Santos-França,** Awais Javed, David Luke, Christine Jolicoeur, Michael Housset, Michel Cayouette
48	Targeting mast cell alleviates subretinal inflammation and photoreceptor loss in a model of retinal degeneration **Pénélope Abram**, Rabah Dabouz, Sylvain Chemtob

49	Dysfunctional microglial heme metabolism prevents retinal vascular remodeling and impairs vision in proliferative retinopathy **Tapan Agnihotri**, Gael Cagnon, José Carlos Rivera, Nahid Tamanna, Charlotte Betus, Anli Re, Nicholas Kim, Jinsung Kim, Emilie Heckel, Sheetal Pundir, Perrine Gaub, Walter Szarek, Hymann Schipper, Gregor U. Adelfinger, Kostas Pantopoulos, Jean-Sébastien Joyal
50	Deciphering the role of mTOR pathway in differentiated pericytes in proliferative retinopathies **Typhaine Anquetil,** Gael Cagnone, Atik Fuad, Jean-Sébastien Joyal, Alexandre Dubrac
51	L'absence du récepteur GPR55 accélère le déclin des fonctions visuelles chez la souris **Ismaël Bachand**, Sabrina Ramdane, Jean-François Bouchard
52	Transfer learning for choroid segmentation **Charles Belanger Nzakimuena**, Marissé Masis Solano, Mark R. Lesk, Santiago Costantino
53	The impact of fetal alcohol exposure on retinal response in vervet monkeys **Guillaume Bellemare**, Jean-François Bouchard
54	Enhancing autophagy rescues pathological angiogenesis and improves vision in neovascular age-related macular degeneration **Louis Berillon**, Émilie Heckel, Charlotte Betus, Gaël Cagnone, Tapan Agnihotri, Anli Ren, José Carlos Rivera, Sylvain Chemtob, Flavio A. Rezende, Przemyslaw Sapieha, Lois Smith, Jean Sébastien Joyal
55	Rôle neuroprotecteur des corps cétoniques dérivés de l'endothélium dans les rétinopathies prolifératives **Charlotte Betus,** José Carlos Rivera, Candace Yang, Gaël Cagnone, Emilie Heckel, Tapan Agnihotri, Nahid Tamanna, Anli Ren, Grant Mitchell, Jean-Sébastien Joyal
56	Impact of kinin B1 receptor antagonism on visual function and choroidal neovascularization and inflammation in a mouse model of age-related macular degeneration **Menakshi Bhat**, Shima Shirzad, Abdel-Rahamane Kader Fofana, Fernand Gobeil, Rejean Couture, Elvire Vaucher
57	SGOL1 regulates angiogenesis and endothelial senescence in the retina **Mathilde Bizou**, Damien Maggiorani, Joséphine Lenfant, Emilie Heckel, Gregor Andelfinger, Jean-Sébastien Joyal, Alexandre Dubrac
58	K2000 deletion mitigates pathological angiogenesis in mouse model of ischemic retinopathy **Guillaume Blot**, Gabrielle Girouard, Vera Guber, Agnieszka Dejda, Ariel Wilson, Przemyslaw (Mike) Sapieha
59	Uncovering the role of Podocalyxin-like Protein (Podxl) in photoreceptor polarity and function **Samantha Boudreau**, Michael Housset, Michael Hughes, Kelly McNagny, Michel Cayouette
60	Cell division orientation regulates tissue size in the developing retina and neocortex **Benoit Boulan**, Marine Lacomme, Ko Currie, Michel Cayouette
61	Optimizing LNP Composition to co-delivery miRNAs and chemotherapy agents **Catarina Maria Cataldi Sabino de Araujo**, Victor Passos Gibson, Houda Tahiri, Pierre Hardy

62	Calcium clearance deficits linked to endoplasmic reticulum stress are signature features of early retinal ganglion cell damage in glaucoma **Yukihiro Shiga**, Aline Giselle Rangel Olguin, Sana El Hajji, Nicolas Belforte, Heberto Quintero, Florence Dotigny, Luis Alarcon-Martinez, Arjun Krishnaswamy, Adriana Di Polo
63	Age-related choroidal involution is associated with a local reduction of endothelial progenitor cells in vascular bed through the acquisition of senescence phenotype: impact in ischemic retinopathies Isabelle Lahaie, Yosra Er-Reguyeg, Sylvain Chemtob, **Michel Desjarlais**
64	The effect of the adipose tissue-eye axis on choroidal neovascularization via PRDM16 **Roberto Diaz Marin**, Frédérik Fournier, Masayuki Hata, Vincent De Guire, Sergio Crespo-Garcia, Przemyslaw Sapieha
65	PAR6 role in retinal blood vessel development **Elise Drapé**, Blanche Boisseau, Mathilde Bizou, Alexandre Dubrac
66	Langerhans islets transplantation in the eye to promote neuronal regeneration during glaucoma **Sana El Hajji**, Clara Goubault, Yukihiro Shiga, Laura Reininger, Melanie Ethier, Vincent Poitout, Adriana Di Polo
67	L'impact de la pandémie COVID-19 sur l'accès aux soins en glaucome au CHUM Jiaru Liu, **Omar El Ouarzadi,** Yulen She, Xiabo Zhang[1], Younes Agoumi, QianQian Wang
68	Deciphering the role of endothelial and pericytes mTOR in retina angiogenesis Alice Lecours, **Atik Fuad**, Typhaine Anquetil, Alexandre Dubrac
69	Investigating the role of p21CIP1/WAF1 in retinal vascular disease **Gabrielle Girouard**, Gael Cagnone, Yusuke Ichyama, Roberto Diaz Marin, Guillaume Blot, Rachel Juneau, Frédérique Pilon, Vera Guber, Agnieszka Dejda, Sergio Crespo Garcia, Jean-Sébastien Joyal, Przemyslaw Sapieha
70	Light instructs planar cell polarity in mammalian cone photoreceptors **Michael Housset**, Dominic Filion, Nelson Cortes, Hojatollah Vali, Craig Mandato, Christian Casanova, Michel Cayouette
71	Modulation de la voie BMP/TGF-β pour la prévention de la néovascularisation choroïdienne **Soumaya Hachana**, Annie Lam-Nguyen, Bruno Larrivée
72	Photoreceptor Reprogramming to Prevent Retinal Degeneration **Fatima Kassem**, Michael Housse, Michel Cayouette
73	Identification of proteins secreted by choroidal melanocytes under normal and oxidative stress conditions **Samira Karami**, Julien Blouin, Julie Bérubé, Solange Landreville, Stéphanie Proulx
74	Evaluation of MRI methods' capacity for imaging the anterior visual pathway **Gurucharan Marthi Krishna Kumar**, Ziqi Hao, Janine Mendola, Amir Shmuel
75	The Impact of Choroideremia on Female Carriers - A Global Survey Steven Bonneau, **Merve Kulbay**, Shigufa Kahn-Ali, Cynthia X. Qian

76	Modélisation et caractérisation des mécanismes impliqués dans une dégénérescence rétinienne héréditaire associée à BCOR **Camille Michaud**, Christine Jolicoeur, Yacine Kherdjemil, Michel Cayouette
77	Le diagnostic de la DMLA humide: avec ou sans OCT-A **Kevin Messier**, Vanessa Bachir, Marilou Paquet, Élodie Bouchard
78	The effect of calcium on the membrane interaction of S100A16 protein and its potential localisation in the photoreceptor cells **Francis Noël**, Xiaolin Yan, Melody Vaillancourt, Stefan W. Vetter, Élodie Boisselier
79	Electrostatic interactions play a key role in the membrane binding of the C-terminal segment of G-protein coupled receptor kinase 4 **Marc-Antoine Millette**, Ana Coutinho, Manuel Prieto, Christian Salesse
80	Glia-derived lipid metabolites drive pathological angiogenesis in proliferative retinopath **Anli Ren**, José Carlo Rivera, Gael Cagnone, Tapan Agnihotri, Nahid Tamanna, Charlotte Betus, Yan Gong, Jean-Sébastien Joyal
81	Studying the role of homocysteine metabolism in the aging retina **Aurélien Perdriel**, Laurence Pelletier, Kariane Laramée, Sergio Crespo-Garcia
82	Purification of lecithin retinol acyltransferase and characterization of its membrane and substrate binding **Sarah Roy**, Line Cantin, Jordan Grondin, Giulia Gonçalves, Olivier Gosselin, Marie-Ève Gauthier, Stéphane M. Gagné, Christian Salesse
83	Denoising OCT videos based on temporal redundancy **Emmanuelle Richer**, Marissé Masis Solano, Farida Cheriet, Mark R. Lesk, Santiago Costantino

Déficience visuelle et réadaptation / *Visual impairment and rehabilitation*

84[1]	Effect of laser-induced choroidal neovascularization on visual function in mice **Shima Shirzad**, Abdel-Rahamane Kader Fofana[1], Menakshi Bhat, Elvire Vauche

Cerveau et perception / *Brain and perception*

85	Recourir à la neurophotonique pour concevoir un modèle de cécité corticale chez la souris **Catherine Albert**, Bruno Oliveira[3], Jean-François Bouchard, Matthieu Vanni
86	Modeling perception across eye movements, and an open-source gaze tracker **Yohaï-Eliel Berreby,** Dinesh Samuel Sathia Raj, Suresh Krishna
87	The processing of spatial frequencies through time in visual word recognitio **Clémence Bertrand Pilon**, Martin Arguin
88	Longitudinal monitoring of the spontaneous activity of the dorsal cortex during late blindness in mice using calcium imaging **Ismaël Djerourou**, Maurice Ptito, Matthieu Vanni

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RÉSEAU DE RECHERCHE EN SANTÉ DE LA VISION

VISION HEALTH RESEARCH NETWORK

Résumé des présentations orales / *Oral presentations abstracts*
Cornée et segment antérieur / *Cornea and anterior segment*

1 - Comparison between micropulse transscleral cyclophotocoagulation and continuous-wave transscleral cyclophotocoagulation in glaucoma patients: a tertiary centre experience

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Goal: We aim to compare the efficacy and the safety between continuous wave transscleral cyclophotocoagulation (CW-TSCPC) and micropulse transscleral cyclophotocoagulation (MP-TSCPC) in glaucoma patients at the Centre hospitalier de l'Université de Montréal (CHUM). This project is a retrospective comparative study.

Method: Consecutive eligible patients who underwent CW-TSCPC and MP-TSCPC at the CHUM between June 2017 and June 2021 are included. Clinical parameters including visual acuity (VA), intraocular pressure (IOP), number of glaucoma medications (NGM) and adverse events were collected at 1 month, 3 months, 6 months, 12 months, and 24 months. Success was defined as having a reduction in IOP of ≥ 20%, the absence of drastic decrease in VA and the absence of additional glaucoma surgeries.

Results: A total of 111 eyes underwent CW-TSCPC with a median energy of 96 J, and 99 eyes underwent MP-TSCPC with a median energy of 300.48 J. Independent of the treatment types, there was significant reduction in NGM from 6 months onward ($p < 0.05$) compared to baseline. For IOP, there was significant time effect ($p=0.045$) as well as treatment type effect ($p=0.00$). The mean IOP ± standard deviation for the MP-TSCPC group changed from 22.36 ± 7.10 mmHg at baseline to 16.22 ± 6.04 mmHg (25.95% reduction) at 1 month and 18.89 ± 9.83 mmHg (11.51%) at 24 months. The corresponding values for the CW-TSCPC group were 30.88 ± 11.58 mmHg, 16.02 ± 8.92 (44.26% reduction) and 16.14 ± 10.80 (47.32% reduction). In the CW-TSCPC group, 71.7% patients had an IOP reduction ≥ 20% at 6 months and 92.9% at 24 months. In the MP-TSCPC group, there were 55% patients at 6 months and 44.4% at 24 months. The evolution of visual acuity was similar for both groups and did not change significantly from baseline. Based on the afore-mentioned success criteria, CW-TSCPC had a significantly longer median survival time of 12 months than MP-TSCPC of 6 months ($p < .05$). Lastly, there were more observed adverse events with CW- TSCPC than with MP-TSCPC though the difference was not statistically significant ($p=0.063$).

Conclusion(s): Both CW-TSCPC and MP-TSCPC were effective in reducing IOP and medication burden while maintaining visual acuity. CW-TSCPC performed better than MP-TSCPC in survival time but showed cumulatively more adverse events.

Funding: None

Résumé des présentations orales / *Oral presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

2 - Études de corrélation génotype/phénotype du gène JAG1 de la voie de signalisation NOTCH dans la susceptibilité à la dégénérescence maculaire liée à l'âge (DMLA). Comparaison entre la forme atrophique et la forme exsudative dans la population canadienne-française

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But : La dégénérescence maculaire liée à l'âge (DMLA) est la principale cause de cécité dans la population vieillissante du Canada. L'âge et le tabagisme demeurent les principaux facteurs de risque environnementaux. Par ailleurs, à l'instar des études mondiales, nos investigations ont démontré que des *Single Nucleotide Polymorphisms* (SNP) dans les gènes encodant le facteur du complément H (CFH) et la protéine 2 de susceptibilité à la maculopathie liée à l'âge (ARMS2) augmentent le risque de susceptibilité génétique pour la maladie. Deux formes de DMLA existent: la forme exsudative et la forme atrophique. La forme exsudative, qui touche environ 10% des patients, se caractérise par une néovascularisation choroïdienne (CNV). Les mécanismes qui stimulent la néovascularisation restent inconnus. Cependant, les recherches indiquent un enrôlement pathologique des voies de signalisation angiogéniques, telles que celle du facteur de croissance de l'endothélium vasculaire (VEGF). D'autres études suggèrent que la protéine endothéliale Jagged1, qui stimule le sentier de signalisation NOTCH, contrôlerait l'angiogenèse vasculaire de l'œil en amont de la voie du VEGF. Le but de notre recherche est de tester si le gène *JAG1*, qui encode la protéine Jagged1, possède des génotypes spécifiques à chaque forme de DMLA. Nous avons débuté une étude d'association génotype/phénotype afin de tester si des haplotypes particuliers de *JAG1* permettraient de diviser les deux formes de la maladie.

Méthode : *JAG1*, *jagged canonical Notch ligand 1*, est un gène relativement gros localisé sur le chromosome 20p12. Il comporte 26 exons, couvrant plus de 37,000 nucléotides. Nous avons utilisé l'ADN de 12 membres d'une famille canadienne-française pour mettre au point le criblage génétique de *JAG1*. Le séquençage fut effectué par la méthode *Sanger*. Sept familles canadiennes-françaises avec effets fondateurs et plus de 150 cas non apparentés de DMLA humide ou atrophique seront par la suite étudiés.

Résultats : Vingt-quatre (24) SNPs furent découverts dans des régions non codantes du gène. Aucun de ceux-ci ne changeait la séquence des acides aminés de Jagged1. Plusieurs SNPs présentaient une fréquence élevée de l'allèle mineur avec une valeur de 21 à 50 % chez les personnes séquencées, alors que la valeur attendue était autour de 5% (allèles majeurs + mineurs= 100%). Nos résultats démontrent donc plus de polymorphismes nucléotidiques (SNP) que prévu, ce qui devrait faciliter la découverte d'haplotypes spécifiques à chacune des formes de DMLA. De façon intéressante, plusieurs SNPs se retrouvaient aussi de l'exon/intron 24 à l'exon 26, dans une région qui contient un amplificateur (enhancer) potentiel qui augmente l'expression du gène et le niveau de la protéine.

Conclusion(s) : Nous avons mis au point et optimisé le séquençage de *JAG1*. La découverte d'haplotypes spécifiques à chaque forme de la maladie pourrait permettre de stratifier la DMLA en deux types génétiques. Le génotypage du gène *JAG1* chez les Canadiens français nous permettra de mieux comprendre les mécanismes physiopathologiques de la maladie et d'améliorer la prévention et le traitement de la DMLA.

Financement : Réseau de Recherche en Santé de la Vision du FRQS, Fondation des maladies de l'œil

3 - Contrast detection efficiency in pink noise is consistent for targets having sinusoidal, square-wave, and missing-fundamental luminance profiles

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Goal: The minimum contrast required to detect low-contrast patterns is determined (in part) by the internal noise in the visual system. The impact of this noise can be measured indirectly using the equivalent input noise method. This measures the amount of external noise that must be applied to a stimulus to overcome the effect of the internal noise in the visual system. Measurements of performance both with and without noise define a noise-masking function which can be used to obtain both the effective "noisiness" of the input to visual processing, and the efficiency with which that input is processed.

Most previous noise-masking studies use white noise as their mask. White noise has a power spectrum which is flat across spatial frequency. In the visual system, the spatial frequency channels have a bandwidth that increases proportionally with their central frequency. This means that white noise disproportionately stimulates higher spatial frequency channels. Pink noise, on the other hand, has a 1/f spectrum which means that it will equally stimulate the spatial frequency channels in the visual system (and in that way is more similar to the power spectrum of natural scenes).

Method: This study compares the impact of white and pink noise on the detection of grating targets with different spectral properties. These are sinusoidal gratings at 1.5 c/deg, square-wave gratings with a fundamental at 1.5 c/deg and subsequent odd harmonics, and missing-fundamental or "scalloped" gratings having only those odd harmonics. Our noise stimuli are one-dimensional, varying along the same (vertical) axis as our targets.

Results: Human performance is compared against a simple "template observer" model that takes the expected target as a linear template. We compare efficiency against the performance of this model. We find that i) human performance is more efficient in pink noise than in white noise, and ii) the inefficiency in white noise is more pronounced for the scalloped grating (where the target energy is present only in spatial frequency bands of 4.5 c/deg and above). Efficiency in pink noise was comparable for our three targets.

Conclusion: We conclude that pink noise is suitable for noise-masking studies that compare measurements made with target stimuli of different spectral properties.

Funding: Pilot Project for Early-Career Investigators (VHRN)

Résumé des présentations orales / *Oral presentations abstracts*
Cornée et segment antérieur / *Cornea and anterior segment*

4 - One-year clinical outcomes of Preserflo MicroShunt compared to Non-Penetrating Glaucoma Surgery

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Goal: To determine the 12-month performance and safety of Preserflo MicroShunt in the treatment of glaucoma compared to non-penetrating glaucoma surgery.

Method: Retrospective, multicenter, 2 surgeon, comparative study. All patients with intraocular pressure (IOP) above target who received either standalone Preserflo or standalone non-penetrating glaucoma surgery (NPGS) between 2020 and 2023 were included. Patients were evaluated at baseline and 1 day, 1 week and 1,3,6,12 months postoperatively. Primary outcomes were intraocular pressure and number of glaucoma medications variations from baseline to 12 months postoperatively. The secondary outcomes were complete (no medications) and qualified (with medications) success of surgery at 1 year for IOP thresholds of 6 to 21 mmHg included, 6 to 18 mmHg included, and 6 to 15 mmHg included. Risk factors for failure, surgical complications and need for additional glaucoma surgery were also evaluated.

Results: 135 glaucomatous eyes were included in the study. 81 eyes received Preserflo MicroShunt (group A) and 54 eyes had NPGS (group B). In group A, 48.1% of patients had primary open angle glaucoma (POAG) and mean preoperative MD (SD) was -14.0 (6.8) compared to 74 % of POAG and a mean preoperative MD (SD) of -11.9 (7.7) in group B. In group A, mean preoperative IOP (SD) went from 25.5 (7.0) mmHg on 3.6 (1.2) medications to 15.4 (7.4) mmHg on 1.1 (1.6) medications after 12 months. In group B, mean preoperative IOP (SD) was 23.5 (7.8) mmHg on 3.9 (1.1) medications and was reduced to a mean IOP (SD) of 14.2 (5.1) mmHg on 1.7 (1.7) medications after 12 months.

In group A, success rates with IOP 6-21 mmHg, 6-18 mmHg and 6-15 mmHg without medications went from 30.8 %, 30.8% and 27.5% to 76.1%, 77.6% and 74.30% with medications respectively. After 1 year, 77.8% of patients with 12 months of follow-up achieved 20% IOP reduction from baseline, of which 57.1 % did without any drops. 54.3% were drop-free after 1 year of follow-up.
In group B, success rates with IOP 6-21 mmHg, 6-18 mmHg and 6-15 mmHg without medications went from 12.7 %, 12.7 % and 10.5 % to 60.7 %, 54.8 % and 49.1% with medications respectively. After 1 year, 73.1% of patients with 12 months of follow-up achieved 20% IOP reduction from baseline, of which 42.1 % did without any drops. 32.8% were drop-free after 1 year of follow-up.

As for complications, group B had a higher proportion of IOP spikes (18.5%) as well as of bleb leak (15.7%). There were 7 (12.9%) reoperations compared to 6 (7.4%) in group A. However, group A reported a greater number of clinical hypotony (17.3%) and choroidal detachment cases (19.8%).

Conclusion(s): Preserflo MicroShunt and NPGS both have similar lowering IOP and medication rates after 1 year postoperatively. However, patients with Preserflo MicroShunt seem to show higher success rates compared to the NPGS group as well as a greater proportion of patients achieving 20% IOP reduction from baseline after 1 year. However, clinical hypotony and choroidal detachments were higher in the Preserflo group.

Funding: No funding

5 - Understanding the immune determinants of corneal repair: A novel population of macrophages in the corneal epithelium

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Goal: Corneas play a crucial role in vision by functioning as the major lens for focusing light into the eye. However, corneas are exposed to the external environment and are susceptible to trauma. Interestingly, minor corneal abrasions we encounter daily resolve without the need for medical intervention. However, when immunosuppressants are used on the cornea following an abrasion, the rate of which the wound heals is reduced, suggesting the involvement of the immune system in corneal regeneration. Our goal is to study the immune cells which are responsible for mediating wound healing in the cornea and how they contribute to wound healing.

Method: For the injury model, the corneas of anesthetized C57BL/6J mice received a corneal abrasion using the tip of a 26G needle. The abrasion was done by scraping off the epithelium in three lines across the cornea. Following the abrasion, eyes were fixed a different time point for immunohistochemical staining to assess wound healing and immune cell infiltration and localization. To deplete tissue-resident macrophages, eye drops of clodronate liposomes were given the injured corneas which caused apoptosis in phagocytic cells. Flow cytometry was performed on singe cell suspensions of collagenase digested corneas to determine cell phenotypes. To confirm the presence of target immune cells in primates, marmoset corneas were also used for immunohistochemical staining.

Results: Our group has uncovered a novel population of CX_3CR1 positive resident macrophages dispersed on the corneal epithelium of healthy mice. These macrophages are very large, around 55µm in dimeter, mononuclear, and circular. Additionally, when looking into marmosets, a primate, they also have these large, epithelial macrophages at the surface of the cornea. This suggests that these epithelial macrophages are conserved through multiple species and has a strong likelihood of being present in humans, which have a similar corneal anatomy as marmosets. Following an abrasion, these macrophages quickly enter into the wound within an hour and a subpopulation emerges that expresses Ly6C, a marker associated with pro-inflammatory macrophages. Four hours after the abrasion, the wound has mostly been healed and these macrophages begin to become dispersed throughout the cornea again. Interestingly, when the epithelial macrophages were depleted using clodronate liposomes, the wound remained opened by four hours, suggesting that they play a key role in regeneration for corneal epithelial injuries.

Conclusion(s): We have identified a population of macrophages in the cornea which respond to epithelial injuries and can contribute to the regenerative process. Furthermore, these macrophages are also present in primates. By furthering our understanding of these epithelial macrophage, they may serve as a new target for immune regulating treatments which could then help treat major corneal wounds that often result in vision impairment and blindness.

Funding: Supported by Fighting Blindness Canada and NSERC

Résumé des présentations orales / *Oral presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

6 - FAM172A regulates eye development through an interaction with AGO2

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Background: CHARGE syndrome is a rare genetic disorder characterized by ocular **c**oloboma, **h**eart problems, choanal **a**tresia, **r**etarded growth and development, **g**enital anomalies, and **e**ar defects. The *Toupee (Tp)* mouse line phenocopies this syndrome through a hypomorphic allele of *Fam172a*.

In the FVB background, bright field observations revealed that *Fam172a*$^{Tp/Tp}$ embryos exhibit the ocular coloboma characteristic of CHARGE syndrome. Transfer of the *Toupee* allele in the C57Bl/6N background worsened these ocular defects, with the additional presence of microphthalmia (small eye) and anophthalmia (no eye). MRI scans also revealed enophthalmos (sunken eye), while flat mounts and histologic studies evidenced choroidal defects in all *Fam172a*$^{Tp/Tp}$ mice as well as angle-closure glaucoma in a few individuals. Finally, immunostaining of retinal flat mounts showed late onset loss of ganglion cells in the *Fam172a*$^{Tp/Tp}$ mice.

Goal: Such a broad spectrum of ocular abnormalities suggests a central role for *Fam172a* in the gene regulatory network of the developing eye, which we sought to elucidate.

Methods/Results: To better understand the functions of *Fam172a*, the predicted domains of the FAM172A protein were analyzed, revealing an intriguing Arb2 (Argonaute binding protein 2) domain. Accordingly, co-immunoprecipitation and BiFC (Bimolecular fluorescence complementation) experiments revealed that FAM172A interacts with AGO2 through its Arb2 domain, while analysis of double mutant mice confirmed a genetic interaction between *Fam172a* and *Ago2* in the context of eye development. BiFC assays using a version of FAM172A with mutated NLS (nuclear localization signal) and/or inhibitors of nuclear pore transport further indicated that FAM172A is required for importing AGO2 in the nucleus.

Using CUT&RUN (cleavage under targets and release using nuclease), we recently found that once FAM172A enters the nucleus, it binds the promoter of many genes important for eye development. Furthermore, bulk transcriptomic analysis of *Fam172a*$^{Tp/Tp}$ embryos revealed dysregulation of the Hippo, WNT and retinoic acid signaling pathways, all of which are required for proper eye development. Administration of retinoic acid to pregnant dams confirmed that dysregulation of the retinoic acid pathway at least partially underlies the defects observed in *Fam172a*$^{Tp/Tp}$ animals.

Conclusion(s): This work suggests that FAM172A, through its interaction with AGO2 and/or via an interaction with the promoter of target genes, impacts critical eye developmental pathways, among which the retinoic acid pathway.

Funding: IRSC

7 - Developing the World Health Organization International Classification of Functioning, Disability and Health Core Sets for Deafblindness

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Goal: The World Health Organization (WHO) developed the International Classification of Functioning, Disability and Health (ICF) to provide a universal terminology that facilitates communication among stakeholders. However, the over 1,400 available codes are cumbersome to utilize in an applied setting. A sub-selection of categories, referred to as ICF Core Sets, provides a more practical tool to describe functioning and disability in specific health conditions, and allows for unified priorities and terminologies globally. Core Sets exist in comprehensive and brief versions, as well as specific formats for children and youths. The development of Core Sets is a regulated multi-study process, based on the collection of data and perspectives around the globe. We are presenting an overview of the process of developing Core Sets for deafblindness and provide an update on the most recent outcomes.

Method: Core Set development consists of a systematic review, an expert survey, qualitative interviews with persons that have lived experience, and a clinical multi-site evaluation of each Core Set, followed by a consensus conference representing all stakeholders. Data sources for all phases aim to represent the perspectives of all six WHO regions (Africa, The Americas, South-East Asia, Europe, Eastern Mediterranean, Western Pacific). Data are linked onto the ICF categories and codes, using an established standardized WHO procedure that provides frequency distributions of items that are considered most relevant to deafblindness.

Results: The systematic review (researcher perspective) indicated that the frequency of codes across Body Functions, Activities and Participation, and Environmental factors are relatively equally distributed. Among environmental factors, research on technology, devices and accessibility adaptations were prioritized. The expert survey (professional perspective) revealed priorities with regards to human resources and support. These discrepancies may in part be explained through funding priorities, and resources differences between the Global North and Global South. Qualitative interviews on priorities by persons with deafblindness (lived experience perspective) are completed and now in the coding process. Almost three quarters (73.3%) of the entire ICF classification categories were included when coding the survey results and literature review. This proportion emphasizes the importance of a multidimensional tool, such as the ICF, for assessing functioning and health for persons with deafblindness. The clinical evaluation (service delivery perspective) is scheduled to start in November 2023, followed by the consensus conference in 2024.

Conclusion(s): The complexity of the effects of combined difficulties with vision and hearing supports the unique nature of deafblindness as being more than the sum of its parts. Next, qualitative interviews with individuals living with deafblindness, across the age and severity spectrum, will give insights as to whether the research and/or expert priorities match that of persons with lived experience.

Funding: This work is funded by Deafblind International, the Deafblind Ontario Services Foundation, the FRQS Vision Health Research Network, and by a Global Partnerships grant from Canadian Hearing Services.

Mes recherches en un clin d'œil / *A wink on my research*

Résumé de l'AFFICHE / *Abstract POSTER # 29*

8 - Règles pour la quantification des nerfs cornéens suivant la neurotisation cornéenne

Conception d'une approche méthodologique à l'analyse quantitative de la réinnervation suivant une chirurgie de neurotisation cornéenne : Enjeux, progrès et implications pratiques de la sélection et du traçage d'images de microscopie confocale in vivo

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Introduction : La microscopie confocale in vivo (IVCM) permet de visualiser en temps réel les structures cellulaires et les nerfs de la cornée. Des logiciels d'analyse des images d'IVCM de la cornée ont été développés par différentes groupes au fil des années, principalement pour l'étude de l'innervation d'une cornée normale, ou pour l'analyse des variations anatomiques des nerfs cornéens dans un contexte d'yeux secs ou de diabète. Un éventail de paramètres reliés à la morphologie des nerfs de la cornée a ainsi été généré. Toutefois, ces techniques de traçage et d'analyse ne sont pas applicables en cas de neuropathie cornéenne modéré à sévère, voire dans le cadre de la réinnervation d'une cornée préalablement dénervée suite à une chirurgie ou à une maladie.

But : Le but de cette étude est de développer une méthode de traçage et d'analyse des images d'IVCM permettant l'étude morphométrique quantitative des nerfs du plexus sub-basal de la cornée suite à une neurotisation chirurgicale par transposition avec ou sans greffe nerveuse d'une cornée préalablement anesthésiée par la perte de son innervation.

Méthode : Des dizaines de milliers d'images d'IVCM provenant de 8 patients suivis de façon sériée pendant 3 à 24 mois suite à une neurotisation cornéenne chirurgicale ont été revues. Les raisons pour lesquelles les techniques standards d'analyse des nerfs cornéens ne convenaient pas à ces cornées ont été cernées, celles-ci incluant notamment leur courte longueur, la finesse, l'irrégularité, le peu d'embranchements, et l'imprévisibilité de l'orientation de ces nouveaux nerfs. Les défis rencontrés lors de l'élaboration de cette approche ont inclus la surreprésentation des zones innervées, la visibilité réduite due à la pathologie de base ayant résulté en une kératopathie neurotrophique, les similitudes potentielles entre les nouveaux nerfs et d'autres structures cornéennes (expl: cellules dendritiques, fibrose des fibres de collagène, dépôts lipidiques) et la sélection d'images représentatives parmi le grand nombre d'images d'IVCM disponibles. Afin de vérifier une fiabilité des résultats, nous avons décidé de comparer les résultats de traçage et d'analyse obtenus par deux observateurs indépendants. Enfin, nous avons vérifié la corrélation anatomo-fonctionnelle entre les résultats de l'analyse morphométrique des nouveaux nerfs et la sensibilité cornéenne mesurée par esthésiométrie de Cochet Bonnet (Luneau, France).

Résultats : Les résultats préliminaires suggèrent que cette approche sera pertinente et utile à l'étude de la réinnervation de la cornée et de la réhabilitation des patients ayant subi une chirurgie de neurotisation cornéenne. Les prochaines étapes qui nous permettraient de valider cette méthodologie incluent une corrélation de ces paramètres à la sensibilité, afin d'étudier le lien entre le degré d'innervation et la sensibilité cornéenne.

Conclusion(s): Cette méthodologie, convenable à l'étude des nerfs cornéens de patients post-CN, mènera ultimement à une meilleure compréhension des mécanismes physiologiques de la réinnervation cornéenne et pourrait avoir un impact clinique significatif, par l'amélioration de la technique chirurgicale et des soins post-opératoires.

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Mes recherches en un clin d'œil / *A wink on my research*

Résumé de l'AFFICHE / *Abstract POSTER # 30*

9 - Impact de la cécité sur les comportements sociaux et la plasticité cérébrale au niveau cellulaire chez la souris de souche ZRDBA

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Introduction : La perte de la vision précoce induit une amélioration des modalités sensorielles non-visuelles (tactile, auditive, nociceptive). Chez l'humain, l'amélioration des fonctions olfactives chez des personnes atteintes de cécité précoce reste controversée, alors que les études conduites chez plusieurs modèles animaux de cécité (rongeurs) rapportent de meilleures performances olfactives couplées à une réorganisation cérébrale des aires olfactives. Étant donné que les rongeurs utilisent principalement les signaux olfactifs pour s'adapter à leur environnement physique et social (animaux macromastes), l'amélioration des fonctions olfactives induite par la cécité congénitale pourrait avoir un impact sur leur adaptation comportementale dans différents contextes sociaux, tels que sur la reconnaissance sociale, la communication et les interactions sociales.

But : Cette étude a pour objectif d'étudier l'impact de la cécité congénitale sur les comportements sociaux et la plasticité cérébrale au niveau cellulaire de la souris au cours du développement.

Méthode : Nous avons utilisé la souche de souris ZRDBA (qui génère des souris anophtalmes et voyantes en proportion égale au sein d'une même portée), à différents âges du développement : J20, J35, J60 et J90. Des mesures comportementales et d'ultrasons ont été enregistrées lors de tests de sociabilité (test à trois chambres), d'un test d'exploration (arène ouverte) et de tests d'attractivité/préférence envers des stimuli urinaires de congénères. De plus, une étude immunohistochimique a été effectuée pour caractériser les corrélats neurobiologiques sous-jacents à la compensation sensorielle induite par l'absence du sens visuel. Grâce à des marqueurs spécifiques, la densité des neurones, des astrocytes, et des oligodendrocytes a été évaluée dans toutes les aires du cerveau entier, et ont été comparée entre les souris voyantes et anophtalmes. Les cerveaux ont également été traités à la protéine c-fos, afin d'identifier le circuit neuronal activé lors de l'exposition à l'urine d'un congénère, et de comparer les deux phénotypes entre eux.

Résultats : Les résultats préliminaires suggèrent que les souris anophtalmes ont une meilleure discrimination sociale et des comportements exploratoires plus prononcés, que leurs congénères voyants. D'un point de vue cellulaire, nous attendons à observer des différences majeures entre les souris voyantes et anophtalmes, et plus spécifiquement dans les aires de traitement de l'information visuelle et olfactive (en termes de densité et activation neuronale). De plus, nous serons à même d'établir le premier atlas cérébral lié à l'environnement cellulaire d'un cerveau entier de souris dépourvue d'entrées visuelles.

Conclusion(s) : En somme, ces adaptations comportementales et cérébrales, résultant de l'absence du sens visuel, seraient supportées par une amélioration des processus attentionnels et/ou une compensation sensorielle (majoritairement olfactive).

Financement : RRSV, RBIQ et CRSNG

10 - Optic nerve pulsatile displacement in open angle glaucoma after intraocular pressure manipulation measured by optical coherence tomography

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Goal: to apply a non-invasive optical coherence tomography (OCT) based technique to quantitatively assess the pulsatile displacement of the optic nerve head (ONH) tissue in glaucoma patients before and after lowering intraocular pressure (IOP) Study design: Cohort study

Method: Participants with diagnosis of primary open angle glaucoma (POAG), treated with medical or surgical treatment with a minimum IOP drop of 5mmHg.Application of a simple algorithm to measure maps of local pulsatile displacement in the ONH based on high-frequency OCT imaging. Displacement was measured in a cohort of 12 participants before and after IOP lowering treatment (both medical and surgical intervention). Intraocular pressure was measured by dynamic contour tonometry (Pascal).

Results: Participants with POAG diagnosis (5 mild and 7 advanced) were imaged before and after intervention. Treatment election was not part of the study design as it was part of the standard medical care. Subjects with moderate glaucoma were treated medically and surgery was performed in advanced cases. Mean age was 68±4years. Mean IOP drop was 5.79mmHg. Before intervention there was a median pulsatile displacement of 6.02±1.2µm compared to a displacement of 4.76±1.4µm after IOP decrease ($p<0.005$). Therefore, there is a 20% decrease in pulsatile displacement after intervention. Multivariate analysis showed no significant correlation with age, sex, stage disease stage or absolute IOP change for this cohort.

Conclusion(s): Our non-invasive and clinically available method demonstrates decrease in the ONH tissue after IOP lowering. This could lead to possible biomechanical understanding of the therapeutic response in glaucoma patients. Further research is required to replicate the results but the clinical applications of our novel method show great translational value.

Funding: FQRS, NASA, CSA

Mes recherches en un clin d'œil / *A wink on my research*

Résumé de l'AFFICHE / *Abstract POSTER # 32*

11 - L'anatomie du système endocannabinoïde dans le cortex visuel: implications pour l'étude de la perception visuelle (et plus encore)

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But : Les récepteurs CB1 neuronaux exercent une influence majeure sur l'équilibre optimal entre l'excitation et l'inhibition, nécessaire au bon fonctionnement du cerveau. La consommation chronique de cannabis entraîne une diminution progressive du CB1R cortical qui perturbe cet équilibre. Chez l'homme, cela a été associé à des changements dans la perception visuelle suggérant des altérations du fonctionnement de bas niveau de la voie dorsale et des processus de niveau supérieur, tels que l'intégration et la modulation contextuelle. La caractérisation de la distribution anatomique du système endocannabinoïde dans le système visuel devient donc importante pour élucider comment la signalisation endocannabinoïde peut modifier la perception.

Méthode : À cette fin, nous avons utilisé la coloration immunohistochimique DAB pour analyser et comparer la distribution du récepteur CB1 et de l'enzyme FAAH à travers les cortex strié et extrastriés (V1, V2, V4, V5) du singe vervet. Nous avons également examiné plus en détail la relation entre ces protéines du système eCB et des éléments clés excitateurs et inhibiteurs du microcircuit cortical par double et triple immunofluorescence. La distribution laminaire de CB1R et FAAH était caractérisée par un marquage modéré à dense des couches supragranulaires et infragranulaires et un faible marquage de la couche 4. Au niveau cellulaire, le CB1R et la FAAH présentaient une distribution complémentaire.

Résultats : Le CB1R a été essentiellement trouvé dans des axones, dont l'origine somatique a été identifiée (au moins partiellement) comme des interneurones coexprimant le CB1R et la cholécystokinine. Ces axones entouraient souvent des cellules pyramidales et des interneurones exprimant la parvalbumine, qui exprimaient la FAAH dans leurs somas et dendrites proximales.

Conclusion(s) : L'expression du CB1R dans les couches extragranulaires place le système eCB dans une position privilégiée pour intégrer l'activité de *feedforward* et *feedback*. Cette modulation peut être liée aux mécanismes cognitifs descendants d'organisation perceptuelle, car elle semble augmenter suivant la hiérarchie visuelle et s'étendre aux deux voies de traitement visuel. Dans ce contexte, le système visuel pourrait potentiellement fournir un modèle expérimental pour tester les effets des cannabinoïdes sur le fonctionnement cérébral et le comportement.

Financement : Conseil de recherches en sciences naturelles et en génie du Canada; Instituts de recherche en santé du Canada; Portuguese Foundation for Science and Technology; Réseau de recherche en santé de la vision

12 - The Effects of Chronic Steroid Exposure on Primary Human Trabecular Meshwork Cells: Implications for Steroid Induced Ocular Hypertension and Glaucoma

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Goal/Background: Steroid induced ocular hypertension is a serious adverse effect of prolonged steroid therapy in patients. If left untreated, steroid induced ocular hypertension may progress to steroid induced glaucoma, involving glaucomatous optic neuropathy and permanent vision loss. Chronic steroid administration elevates intraocular pressure in approximately 40% of the general population. If this increase is of sufficient magnitude and duration, steroid induced ocular hypertension may develop. This condition is associated with the abnormal contractility of the cells residing within the trabecular meshwork, the tissue responsible for intraocular pressure regulation. Numerous studies have provided insight into the molecular mechanism changes that occur in the trabecular meshwork as a result of prolonged steroid exposure. These changes include but are not limited to alterations in extracellular matrix metabolism, cytoskeletal organization, and gene expression. However, the specific functional changes occurring at the cellular level as a result of these molecular alterations, which contribute to trabecular meshwork dysfunction and ultimately ocular hypertension, remain poorly characterized.

Method: To address the need for a comprehensive evaluation of contractile cell function, we have adapted and optimized an assay, hereinafter referred to as fluorescently labeled elastomeric contractible surfaces (FLECS), to assess the functional effects of steroids on human trabecular meshwork cells *in vitro*. The FLECS assay provides a flexible tool for obtaining contractility measurements of thousands of cells at the single-cell level on substrates with tunable stiffness.

Results: In this study, we present, for the first time, single-cell-level contractile variations in human trabecular meshwork cells in primary culture and in an *in vitro* model of chronic steroid exposure. Furthermore, we report alterations in single-cell contraction kinetics associated with modifications in extracellular matrix substrates and stiffness, as well as the addition of a pan-ROCK inhibitor.

Conclusion(s): These findings provide compelling supportive evidence for a model in which increased contractility, accompanied by changes in extracellular matrix components, cytoskeletal organization, and stiffness, may contribute to elevated intraocular pressure and, consequently, ocular hypertension.

Funding: This research was supported by Research to Prevent Blindness (RPB), and the National Eye Institute (NIH-R01-EY)

13 - Suprachoroidal Injection: A Novel Approach for Targeted Drug Delivery

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Goal: The primary objective of this review article is to scrutinize and elucidate the potential advantages and limitations of suprachoroidal injection as a novel technique for targeted drug delivery to the posterior segment of the eye. This method is particularly pertinent for treating posterior segment and retinal diseases, which present unique challenges in drug delivery and bioavailability due to the eye's complex anatomical barriers.

Method: The literature review employs a systematic approach, reviewing preclinical and clinical studies published from 2019 to 2023 that focus on suprachoroidal injection techniques. It evaluates this method in comparison to traditional routes of administration like eye drops and intravitreal injections. Specific criteria for assessment include drug concentration, bioavailability, duration of action, and potential side effects, particularly those related to corticosteroids.

Results: Suprachoroidal injection emerges as a promising route for drug delivery, boasting advantages such as higher drug concentrations in the target tissues, increased bioavailability, and a prolonged therapeutic window. This technique also minimizes the risk of corticosteroid-related adverse events like cataracts and intraocular pressure elevation due to compartmentalization of the drug. However, the review identifies several limitations and challenges in current practice, including technological constraints, the need for refined injection techniques, and concerns regarding cost and accessibility.

Conclusion(s): Suprachoroidal injection offers a compelling alternative for targeted drug delivery to the eye's posterior segment, with advantages that could significantly improve treatment efficacy and patient compliance. However, to fully realize its therapeutic potential, there is an urgent need for addressing its current limitations. These include technological advancements for drug formulation and administration, refinement in injection techniques, and considerations of economic and accessibility factors. Future research efforts should also explore the integration of this approach with emerging biotechnological products, gene therapies, and cell-based treatments, with the aim of revolutionizing personalized therapies in the field of ophthalmology.

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Résumé des présentations orales / *Oral presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

14 - Lactate Receptor, HCAR1 Deficiency Leads to Cellular Stress Compromising Choroidal Integrity of the Developing Outer Retina

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Goal: The retina is one of the most energy-demanding tissues. The choroid in the outer retina supplies RPE and photoreceptors and underlying RPE has a fundamental role in the homeostasis of the outer retina. Deficiencies in RPE have been shown to cause retinal dysfunction leading to visual impairment. Glucose abundance in the retina is converted to lactate through glycolysis. Metabolic intermediates such as lactate have been found to exert specific functions via signaling receptors. Lactate receptor, HCAR1 can be involved in adaptation to metabolic changes. HCAR1 plays an important role in various processes such as controlling inner-retinal vascularization during development. Given the relevance of HCAR1 in retinal angiogenesis, we investigated whether HCAR1 in the outer retina regulates the integrity of the choroidal vasculature during development.

Method: HCAR1 KO mice were used in this study. HCAR1 expression in the outer retina of WT C57BL/6J mice was confirmed by Immunohistochemistry. Lectin staining was used to determine the choroidal vascular thickness. Angiogenesis was measured by stimulation of HCAR1 by lactate *in vivo* or *ex vivo*. mRNA levels were evaluated by qRT-PCR. Protein levels implicated in oxidative and ER stress were analyzed by western blot. The proliferation assay was assessed by the Ki-67 marker.

Results: HCAR1 is expressed in the RPE of WT mice. HCAR1 deficient mice show significantly thinner choroidal vasculature in KO mice compared to WT, suggesting that HCAR1 deficiency causes gradual choroidal involution. Lactate stimulation promoted choroidal angiogenesis in WT mice, demonstrating RPE-HCAR1 function in angiogenesis. Moreover, there is a lower proliferation rate in RPE/choroid of KO mice. Angiogenic factors showed higher expression levels while the protein levels of the most important growth factors decreased in KO mice leading to a lower proliferation rate. One of the causes of discrepancy between expression and translation is ER stress. KO mice exhibit higher levels of proteins implicated in ER stress and Integrated Stress Response (ISR). ER stress in KO mice is associated with translational attenuation. Finally, intravitreal injection of an ISR inhibitor in KO mice normalized the choroidal thickness defect.

Conclusion(s): RPE-HCAR1 promotes choroidal angiogenesis. HCAR1 KO mice exhibit a transient ISR and lower proliferation rate in the choroid during development. HCAR1 stimulation with lactate induces choroidal angiogenesis in WT mice, suggesting an important role for HCAR1 in choroidal vascular integrity.

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Résumé des présentations orales / *Oral presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

15 - Early Blood-Retina Barrier Dysfunction in Glaucoma

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Goal: Neurodegeneration due to loss of retinal ganglion cells (RGC) is the hallmark of glaucoma, the leading cause of irreversible blindness worldwide. Ocular hypertension (OHT) is a major risk factor for disease development. Recent evidence has demonstrated a vascular component in glaucoma pathophysiology. However, the early mechanisms that lead to vascular impairment and neuronal loss are not fully understood. The neurovascular unit (NVU) cells, including neurons, endothelial cells, pericytes, and glia, regulate blood-retina barrier (BRB) integrity. Although the NVU controls BRB permeability, its early pathological disruption in glaucoma remains unexplored. Therefore, this project aims to determine if BRB dysfunction is a process of early glaucomatous degeneration.

Method: The magnetic microbead glaucoma model was used to induce OHT in mice. Age-matched sham-operated mice were used as controls. To assess vascular leakage into the retinal parenchyma, longitudinal in-vivo fluorescein leakage was visualized by weekly fundus angiography for 4 weeks. 2 weeks after microbead injection (OHT-2w), a timepoint when OHT is stable but before apparent RGC loss occurs, retro-orbital injections of fluorescent 3K, 10K, and 70K MW dextran were performed, followed by peripapillary (around the optic nerve) and whole-retina unbiased stereological confocal imaging of the 3 retinal vascular plexuses.

Results: Fundus angiography showed a progressive increase in fluorescein leakage beginning at OHT-1w. Whole-retina sampling and peripapillary imaging at OHT-2w showed a significant increase in 3K, 10K, and 70K MW dextran leakage into all vascular plexuses of the inner retina.

Conclusion(s): The leakage of fluorescent tracers into the retinal parenchyma at OHT-2w indicates that increased BRB permeability occurs before RGC cell death. Region-specific peripapillary area imaging corroborated the whole-retina analysis results, suggesting that vascular leakage is generalized across the retina, affecting regions close and far from the optic nerve disc. Our results showed that BRB disruption is an early event in experimental glaucoma.

Résumé des présentations orales / *Oral presentations abstracts*
Cornée et segment antérieur / *Cornea and anterior segment*

16 - Surgical treatment of high myopia: A short-term safety, efficacy, and predictability comparative analysis of current vision correction procedures

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Goal: In myopia, the eye's focusing power (diopters, **D**), is greater than that needed to see distant objects clearly. Myopia is considered a leading cause of blindness by the World Health Organization. High myopic errors (6.00D or higher) affect 3% of world's population, with an expected 5-fold increase by 2050. Myopia can be treated surgically to restore vision. Procedures include laser reshaping of the eye's anterior focusing element - the cornea - to decrease its power (phototherapeutic keratectomy, **PRK**; laser in situ keratomileusis, **LASIK**; small incision lenticule extraction, **SMILE**), and implantation of a diverging intraocular collamer lens (**ICL**) to decrease the eye's overall power. These procedures have equivalent outcomes in low-to-moderate myopia. It is unclear how they compare in highly myopic patients, whose vision benefits from correction most. The purpose of this study was to compare the 3-month safety, efficacy, and predictability of PRK, LASIK, SMILE, and ICL in the treatment of high myopia.

Method: We retrospectively reviewed 579 procedures (241 PRK, 134 LASIK, 158 SMILE, 46 ICL) performed consecutively for myopia between 6.0D and 15.0D. One eye per patient was included. Main outcome measures were 3-month safety index (postoperative/preoperative CDVA), efficacy index (postoperative UDVA/preoperative CDVA), and predictability (%eyes with final achieved refractive error within 0.5D of target). One-way ANOVA and Chi-square tests compared variables between groups.

Results: Groups had similar baseline demographics, uncorrected (**UDVA**) and corrected distance vision (**CDVA**). The average baseline myopic error was higher for ICL (-10.00±2.49D) and lower for LASIK (-6.88±0.83D) compared to PRK (-7.58±1.24D) and SMILE (-7.49±1.00D) ($p<0.001$). The safety index was higher for ICL ($p<0.01$) than for all laser procedures. The efficacy index was highest for ICL, followed by LASIK, PRK, and SMILE ($p<0.01$). In posthoc analyses, the difference in efficacy was significant between ICL and SMILE and LASIK and SMILE ($p<0.01$). Predictability was highest for ICL, followed by LASIK, SMILE, and PRK, but without significant differences between groups ($p=0.06$).

Conclusion(s): This is the first comparative outcome study of all four procedures in high myopia. Despite higher baseline myopic errors, ICL had the best safety and efficacy, and trended toward better predictability compared to laser procedures.

17 - Information integration across saccades plays a prominent role during goal-directed viewing of everyday scenes

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Goal: One of the fundamental issues in visual perception is how and how much visual mechanisms integrate visual information across fixations and whether visual operations within each fixation are independent. Here, we examine how humans actively scan the visual environment when performing goal-directed visual search on photographs of complex everyday scenes. We focus specifically on the evidence for information integration and transfer across saccades under these more naturalistic conditions, as revealed by saccades preceded by short intersaccadic intervals.

Method: We analyzed data from COCO-Search18 and COCO-FreeView, two open datasets of eye-movements made by observers performing either category-search (COCO-Search18) with 18 search target categories or free-viewing (COCO-FreeView) on a subset of over 4000 unique images from the MS-COCO dataset.

Results: We show that short-latency second saccades, defined as second saccades preceded by an intersaccadic interval less than 125 ms, occur frequently (45 % of saccades on average) in goal-directed visual search with naturalistic images. Short-latency second saccades foveate the search target more often than saccades executed after intersaccadic intervals longer than 125 ms (regular-latency saccades), and this advantage for short-latency saccades is substantially larger when they start far away from the target. Consistent with this advantage, short-latency saccades are also elicited more often when they start further away from the target (i.e. the target is more eccentric during the fixation preceding the second saccade). Short-latency saccades show both a target-foveation and a target-discrimination advantage, indicating that information about both target location and target identity is transferred across the first saccade. Short-latency second saccades are much more frequent during goal-directed visual search with the search target present - active searching, the top-down salience of the search-target, and easier-to-find search targets all contribute to increasing the frequency of short-latency saccades.

Conclusion(s): The results show that human searchers use a satisficing strategy when actively searching photographs of complex everyday scenes for a categorically defined target. Two eye-movements are often made when waiting a little longer before the first movement would have likely allowed the target to be foveated with just one eye-movement. Short-latency saccades and information transfer across saccades work towards ensuring that the cost of making additional saccades to distractor stimuli is minimal; this would not be the case if perception began anew at each fixation. Information integration and transfer across saccades plays a prominent role during naturalistic vision.

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Résumé des présentations orales / *Oral presentations abstracts*
Cornée et segment antérieur / *Cornea and anterior segment*

18 - Mimicking the tear film using Langmuir monolayers - an approach to better understand the mucoadhesive property of gold nanoparticles

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Goal: Knowing that 90% of the drugs used in ophthalmology are administered with ocular drops onto the mucosal layer of the cornea and just a low percentage of the active molecules of these formulations can reach their therapeutic targets (< 0.02%), this project aims to study how to improve the retention time of these drugs at the cornea through the mucoadhesion understanding. In this sense, recent works have shown the development of ultrastable mucoadhesive gold nanoparticles (AuNPs) which can be used as drug delivery systems. At this project, we study these AuNPs from a molecular point of view using Langmuir monolayers to mimic the pre corneal tear film and subsequently to evaluate the different interactions between its components and nanoparticles. It is expected that our results may help to determine and to rank the parameters influencing the mucoadhesion as well as to select the different molecular groups associated to that.

Method: 1. AuNPs stabilized by thiolated polyethylene glycol were used on this project as well as mucins from bovine submaxillary glands. Zwitterionic lipids from the tear film such as DPPC and DPPE were selected to form the monolayers. 2. For preparing the films, aliquots of a lipid solution at 0.2 mg/mL were spread at an air-water interface. Subsequently, the mucins and the nanoparticles were injected at the subphase (1X PBS) as a mixed solution or as individual solutions (Mucins:AuNPs 1:4.5, m/m). Adsorption kinetics and surface pressure isotherms were registered from a DeltaPi4 microtensiometer and a microtrough with compression, respectively (Kibron Inc.). The measurements were obtained at room temperature.

Results: the mucins and the nanoparticles have surface activity; however, the interaction AuNPs-lipids are not favorable showing a Maximum Insertion Pressure (MIP) around 20 mN/m for both lipids. On the other hand, the mucins-lipids interactions are favorable resulting in MIP values higher than 30 mN/m and positive synergies. When combined, the mucins and the nanoparticles change the synergy of the monolayer. By increasing the rate of nanoparticles at the mixture, we observed that the synergy also increases. This behavior could be confirmed through the isotherms with a change in its profile when we have the mixture. An expansion is observed for the presence of mucins, while a condensation is seemed for AuNPs presence. For the mixture, a condensation is also observed, however, as mentioned, it happens with changes on the isotherm's profile (ex. DPPC isotherm losing its plateau), what can be related with rearrangements caused by the penetration of new structures among the lipid molecules. Hysteresis indicate also changes in its cycles of compression-decompression for the mixture, like the presence of domains and a non-homogenous distribution of molecules at the interface.

Conclusion(s): Interactions between AuNPs thiol groups and mucins are behind of the mucoadhesion. The higher synergy observed for the injection of the mixed solution can be related to that. The association of the mucins and the nanoparticles is more favorable and stronger when they are combined before the injection.

Funding: Supported by the Vision Health Research Network and the Fondation Antoine-Turmel

Résumé des présentations orales / *Oral presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

19 - The Long Term Structural and Functional Impact of Retinopathy of Prematurity

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Goal: Retinopathy of prematurity (ROP) is the leading cause of childhood visual impairment worldwide. Emerging evidence shows that ROP carries protracted impact throughout life on one's vision. However, comprehensive data on long-term outcomes of ROP remain scarce. Our goal is to evaluate the functional and structural long-term effects of ROP in school-aged children and young adults.

Method: We performed a cross-sectional study. Recruited participants (aged 8-37) were divided into 3 groups: prematurely-born individuals with a former diagnosis of ROP ("Ex-ROP" ; n = 17), prematurely-born individuals without a former diagnosis of ROP ("Preterm" ; n = 18) and full-term individuals ("Term" ; n = 11). Participants underwent a complete ophthalmological examination including optical coherence tomography (OCT) imaging and flash and multifocal electroretinogram (ERG). Statistical analysis was conducted on SPSS version 28.0.1.0. ANOVA with post-hoc Student's t test and Chi square were used for continuous and categorical variables respectively. Level of significance was 0.05.

Results: Compared to the Preterm and Term groups, the ex-ROP group presented a significantly higher prevalence of myopia and astigmatism. This group's refractive error was also more pronounced with greater spherical equivalent and cylinder values. In the macular OCT, the ex-ROP group showed increased retinal thickness in the fovea and parafovea, as well as decreased retinal thickness superonasally. In the optic nerve OCT, both ex-ROP and Preterm participants displayed decreased retinal nerve fiber layer (RNFL) thicknesses in the temporal and inferotemporal regions. In flash ERG testing, attenuation in retinal function was observed in several parameters for the ex-ROP group, notably in the a-wave and b-wave amplitudes under both photopic and scotopic conditions. On multifocal ERG, the ex-ROP group showed decreased amplitude in the central 3 degrees of visual angle, which represent the fovea and central macula.

Conclusion(s): A history of ROP is linked to increased refractive error, foveolar thickening, RNFL thinning, and diminished retinal function on electrophysiological testing in a group of school-aged children and young adults. These data support the notion that ROP is not a static disease, but a dynamic condition capable of longstanding impact. Therefore, long-term monitoring of visual health is important in patients with a history of ROP.

Funding: Supported by the Fonds de recherche en ophtalmologie de l'Université de Montréal and Fighting Blindness Canada

Résumés des présentations par affiche

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RÉSEAU DE RECHERCHE EN SANTÉ DE LA VISION

VISION HEALTH RESEARCH NETWORK

Résumé des présentations par affiche / *Poster presentations abstracts*
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20 - Banque de renseignements cliniques et de matériel biologique de recherche en ophtalmologie au CUO-Recherche clinique du Centre de recherche du CHU de Québec-Université Laval

Sébastien Méthot[1, 2], Geneviève Dallaire[1, 2], Marcelle Giasson[1, 2], Ali Dirani[1, 2]

[1]CUO-Recherche Clinique, Centre de recherche du CHU de Québec-Université Laval, Hôpital du Saint-Sacrement, Québec, QC, Canada, [2]Département d'ophtalmologie et d'Oto-rhino-laryngologie-chirurgie cervico-faciale, Faculté de médecine, Université Laval, Québec, QC, Canada

Buts : 1) Faciliter l'accès à du matériel biologique issus du vitré et de la rétine des patients opérés pour des pathologies vitréo-rétiniennes; 2) Améliorer la compréhension et la prise en charge des différentes pathologies vitréo-rétiniennes

Description : Les échantillons collectés par la biobanque proviennent de chirurgies oculaires faites pour diverses pathologies rétiniennes et oculaires comme la cataracte, les trous maculaires ou la rétinopathie diabétique. Par exemple, lors de la vitrectomie, le vitré est prélevé et remplacé par une autre solution. Ce type d'opération est aussi utilisé pour effectuer le retrait des membranes épirétiniennes (MER), une membrane cellulaire pathologique qui peut recouvrir la rétine. Dans le cadre de la biobanque, et avec le consentement préalable du patient, une partie du vitré et, si cela s'applique, la MER seront aussi conservées à -80°C. L'humeur aqueuse peut parfois être prélevée lors de la chirurgie et être conservée de la même façon. Ensuite, pour chaque échantillon nous collecterons des données cliniques pertinentes, en lien avec la santé oculaire et générale du patient. Par ailleurs, certains patients nécessitant une vitrectomie présentent des pathologies rétiniennes concomitantes tel que de la DMLA et de la rétinopathie diabétique. Ceci nous permettra d'avoir dans la biobanque des échantillons provenant de patients atteints de différentes maladies affectant l'œil. Dans l'avenir, la biobanque aimerait étendre ses activités aux pathologies du segment antérieur comme la dystrophie endothéliale de Fuchs ou la sécheresse oculaire.

Impact : Les échantillons amassés par la biobanque permettront des avancées dans la recherche biomédicale des pathologies ophtalmologiques. De plus, la biobanque permettra de favoriser la recherche translationnelle des maladies de l'œil. La disponibilité des échantillons et données de la biobanque a déjà contribué à l'obtention d'une prestigieuse bourse du *Fighting Blindness Canada* (FBC) attribuée à la résidente en ophtalmologie Delphine Gobert de l'Université Laval. Cette étude permettra de mieux comprendre le rôle des cellules microgliales dans la rétinopathie diabétique.

Accessibilité : L'infrastructure est disponible aux chercheurs membres du RRSV qui ont reçu une approbation de leur projet par un comité éthique. La banque pourrait favoriser des collaborations entre les membres du Réseau, mais aussi avec des chercheurs externes puisque celle-ci est accessible à ces derniers. Des démarches sont en cours pour l'implantation d'une solution de collecte des données par l'entremise du logiciel REDCap. Cette plateforme permettra aux utilisateurs autorisés de consulter la base de données et sélectionner les échantillons répondant à leurs critères d'intérêt. RedCap est une plateforme sécurisée qui répond aux exigences de la recherche clinique.

Responsable : Ali Dirani, MD, MSc, MPH, **chercheur universitaire clinicien** (**ophtalmologiste et chirurgien de la rétine et du vitrée) de l'Axe Médecine régénératrice, Hôpital Saint-Sacrement, Professeur clinique, Département d'ophtalmologie et d'oto-rhino-laryngologie – chirurgie cervico-faciale, Faculté de médecine, Université Laval**

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Financement : Réseau de recherche en santé de la vision, *Fighting Blindness Canada (FBC)*

Résumé des présentations par affiche / *Poster presentations abstracts*
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21 - COVID-19 Eye Registry (COVER) – Registry of Ophthalmological Manifestations of COVID-19

Mélanie Hébert[1], Soumaya Bouhout[2], Ellen E. Freeman[3], Marie-Josée Aubin[2]

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Background: The novel coronavirus SARS-CoV-2 causes the potentially fatal disease COVID-19 and may involve significant inflammatory and thrombogenic responses. Ocular manifestations related to COVID-19 have been described. However, the difficulty of performing comprehensive eye examinations in intensive care patients, the offloading of outpatient clinics, and the risk of contagion limit the study of ocular complications of COVID-19 and the assessment of the care needed to preserve vision in affected patients.

Methods: The purpose of the COVID-19 Eye Registry (COVER) is to collate de-identified data from across Canada to consolidate cases of ophthalmological manifestations of COVID-19 into a single database. The goals of the registry are to (1) identify cases of patients with COVID-19 infection or vaccination who develop ocular complications and (2) identify cases of patients with pre-existing ocular diseases who develop COVID-19 possibly impacting their visual health. The registry will detail examination findings by portions of the eye affected, as well as the progression of pre-existing eye disease upon infection with COVID-19. This initiative is supported by several Canadian ophthalmological societies and will involve ongoing data sharing to inform ophthalmologists of the pathologies to be investigated in COVID-19 patients.

Results: Three conditions that have been reported a few times in the COVER registry in the context of COVID-19 infection or vaccination are primary ocular toxoplasmosis infection or reactivation, multiple evanescent white dot syndromes (MEWDS), and viral keratouveitis. This has led to local changes in practice whereby clinicians will prescribe prophylactic antibiotics prior to vaccination to prevent toxoplasmosis reactivation in patients with macular-threatening lesions. In patients with MEWDS, COVID-19 infection or vaccination can be inquired upon as a possible contributing factor. In patients with herpes simplex or herpes zoster keratouveitis, reactivation of disease was noted following infection or vaccination, thereby justifying prophylactic antiviral therapy in select patients prior to vaccination.

Conclusions: COVID-19 has a significant impact on the health of patients. However, since the spectrum of ophthalmological manifestations of this disease and possible complications from vaccination are still being explored, there is a need to report and document cases of patients who develop ocular signs. This will be better achieved using a national case registry. It is hoped that it will inform clinicians when assessing patients for possible ophthalmologic manifestations. The COVER registry can also help detect or confirm certain trends and aid our understanding of the pathophysiology of COVID-19.

Infrastructure administrator: Marie-Josée Aubin, MD, MSc, MPH, ophtalmologiste, Hôpital-Maisonneuve-Rosemont – Centre Michel-Mathieu, Université de Montréal, professeure agrégée PTG sous contrat, faculté de médecine, département d'ophtalmologie, Université de Montréal et professeure agrégée, Département de médecine sociale et préventives, École de santé publique, Université de Montréal

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Funding: Vision Health Research Network
Keywords: Coronavirus disease 2019, ocular manifestations, ophthalmology, registry

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form. All authors report that the Vision Health Research Network has provided funding to the institution for the COVER registry as a common infrastructure. There are no other conflicts of interest to declare / ***Ethical Statement***: *The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.*

Résumé des présentations par affiche / *Poster presentations abstracts*
Infrastructures communes / *Common Infrastructures*

22 - Base de données d'images rétiniennes chez les malvoyants: Drusen et dégénérescence maculaire liée à l'âge

Aaron Johnson[1,2,3]

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Des photographies de Fundus et des analyses de la rétine seront prises en utilisant le même modèle d'Optos OCT / SLO situé dans trois sites d'essai (Centre de réadaptation MAB-Mackay, Clinique de l'école d'optométrie de l'Université de Montréal et le *Lighthouse Institute* de New York). Pour chaque entrée individuelle dans la base de données, des informations démographiques et de diagnostic seront disponibles. Toutes les images OCT / SLO sont classées selon la norme de l'étude des maladies des yeux liées à l'âge, en plus du nombre et de la taille du drusen, de la gravité de l'atrophie géographique, de la gravité de la marbrure des pigments et de la présence de néovascularisation choroïdale. La topographie de la rétine et les scintigraphies Raster de l'OCT / SLO fournissent un regard transversal sur les rétines affectées. La stabilité de la fixation est enregistrée à l'aide de la fonction SLO et présente quatre tâches différentes conçues pour reproduire les tâches typiques de la vision quotidienne, chaque tâche pouvant durer 10 secondes. Les tâches sont la fixation croisée, la reconnaissance faciale, la recherche visuelle et la lecture. Ces tâches en plus des scintigraphies de la rétine sont utilisées pour déterminer l'excentricité d'un locus rétinien préféré de la fovéa anatomique et peuvent être utilisées comme mesure de résultat pour les interventions cliniques chez les malvoyants.

Responsable : Aaron Johnson, PhD, Professeur agrégé, Département de psychologie, Université Concordia / Résident de recherche, Centre de réadaptation MAB-Mackay du CIUSSS du Centre-Ouest-de-l'Île-de-Montréal

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Financement : Réseau de recherche en santé de la vision

Résumé des présentations par affiche / *Poster presentations abstracts*
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23 - Plateforme d'analyse computationnelle de cellules individuelles

Gael Cagnone[1], Jean-Sébastien Joyal[1]

[1]Centre de recherche du CHU de Sainte-Justine, Université de Montréal

La Plateforme d'Analyse Computationnelle de Cellules Individuelles (PACCI ou SCAP) est une plateforme bio-informatique qui permet aux chercheurs de générer, analyser et partager des **données génomiques de cellules individuelles** suite à leur l'isolation et au séquençage de leurs transcriptomes.

Cette approche permet d'évaluer l'hétérogénéité cellulaire de la rétine (ou autre organe d'intérêt), à différents stades de développement, tant dans un contexte physiologique que pathologique. **Gestion et Accessibilité :** Notre infrastructure est gérée en mode collaboratif, impliquant le laboratoire du Dr Joyal et les membres étudiants de la *Single-Cell Academy*.

4 types de services sont offerts :

1) Un service de consulting **pour la préparation des échantillons**, de même que leur séquençage grâce à la
2) Plateforme de séquençage supportée par Génome Québec au CHU Sainte-Justine. La technologie de fine pointe supportée par 10X *Genomics* permet l'analyse de différentes modalités "OMICS" tel que la transcriptomiques (scRNAseq) et l'épigénomique (scATACseq), et offre une meilleure flexibilité dans le nombre minimum de cellules requises et le design expérimental ("*cell hashing*"). Nous avons adopté également les nouvelles innovations technologiques tel que le « *spatial transcriptomics* ».
3) L**'analyse bioinformatique et l'interprétation des données**, ainsi que l'intégration complémentaire de données publiques si disponibles (« *single-cell atlas* »).
4) L'**accès aux données de single-cell via une interface web** (genap.ca). Cet outil permet un 'datamining' efficace de ces bases de données communes, mais initialement limité aux membres du Réseau, afin d'offrir un avantage compétitif pour l'élaboration de nouvelles questions de recherche, étoffer un manuscrit en préparation ou une demande de financement.
5) Enfin, la **formation de la nouvelle génération** de bioinformaticien (via la *Single-cell Academy*) s'intéressant aux technologies "*single-cel*l" grâce à un consortium d'experts au centre de recherche Sainte-Justine et ses partenaires.

Responsable : Jean-Sébastien Joyal, MD, FRCPC, PhD, Professeur adjoint, Département de Pédiatrie, Professeur accrédité, Département de pharmacologie, Université de Montréal; Professeur associé, Département de pharmacologie et de thérapeutique, Université McGill, Pédiatre-intensiviste, CHU Sainte-Justine

Personne contact : Gael Cagnone (singlecellacademy@gmail.com)

Financement : Réseau de cherche en santé de la vision

24 - A New Database ("IRD REGISTRY") for Quebec Patients with Inherited Retinal Degenerations (IRD); Bringing Science and the Clinic Closer Together

Glenda Vargas[1], Christine Gannon[1], Ayan Ibrahim[1], Irma Lopez[1], Goreth Leite[1], Shigufa Kahn-Ali[2], Cynthia X. Qian[2], Robert Koenekoop[1]

[1]MUHC, McGill University, Montreal, [2]Faculté de médecine, Département d'ophtalmologie, Université de Montréal

Background: Inherited retinal degenerations (IRDs) cause blindness through photoreceptor death. For over 200 years, IRDs were deemed untreatable. Many Quebecers have IRDs with astronomical impacts on their quality of life. Recently, an exciting array of treatments for IRDs have shown important signals in humans and are now in various stages of development. Importantly, the essential task of genotyping patients and building human subject databases, containing rapidly accessible genetic disease and demographic data have not kept pace with this paradigm shift. This unmet need is the basis of this study.

Methods: Patients are referred to one of two Quebec IRD specialty clinics at the TCC (McGill/Montreal Children's Hospital) and the HMR/STJ at the Université de Montreal. The patients are asked and counselled to consent to undergo genetic testing and to register into the Registry, both processes approved by the respective institutional REBs. Clinical testing is done to assess the disease type, stage, and the phenotypic diagnosis. Genotyping is performed by targeted sequencing using Next Generation Sequencing (NGS) techniques on patient's DNA. Disease and genotype data are then captured by REDCap, a secure web platform for online data bases.

Results: From the (VHRN and FBC) granting period of 2020 to mid 2023, we were able to evaluate, genotype, manage and enter the disease and genotype data into the Registry of 750 Quebec IRD patients. Thanks to the new IRD database, more than 20 Quebec IRD patients subsequently entered into gene therapy, gene editing or natural history clinical trials in Quebec. Many patients showed improvements in visual function endpoints and self-reported outcomes. Data analyses of outcomes are still ongoing.

Conclusions: All 750 IRD patients who were recruited consented to both genotyping and anonymous data entry into the IRD Registry. No-one refused. More than 25 causal retinal genes were found to be mutated. The IRD Registry allowed Quebec IRD patients to enter local clinical trials or into novel standard of care gene therapy treatment. This would not have been possible without the registry. Therapies for IRDs are beginning to show important safety and efficacy signals. There is a great interest and need in the Quebec IRD population to continue to expand this network.

Infrastructure administrator: Robert K. Koenekoop, MD, PhD, Clinician-Scientist, Paediatric Ophthalmologist, Director of Pediatric Ophthalmology and Molecular Biologist of Blindness, McGill University Health Center – Research institute (RI-MUHC), Senior scientist, RI-MUHC, Glen site and professor, Department of Pediatric Surgery, Faculty of Medicine, McGill University

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Data base manager, Glenda Vargas (glenda.vargas@muhc.mcgill.ca)

Funding: Vision Health Research Network (VHRN), Fighting Blindness Canada (FBC), Montreal Children's Hospital Foundation and National Eye Institute (2) to RKK. FRQS grant to CXQ

Keywords: IRD patient data Registry, RP, LCA, gene therapy, gene editing, sub-foveal surgery, Luxturna, RPE65, CEP290, USH2a, USH1c.

Résumé des présentations par affiche / *Poster presentations abstracts*
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25 - Tissus oculaires pour la recherche en vision

Christelle Gross[1], Kelly Coutant[1], Pascale Charpentier[1], Stéphanie Proulx[1]

[1]Centre de recherche du CHU de Québec - Université Laval, axe médecine régénératrice, Québec; Département d'ophtalmologie et d'ORL – chirurgie cervico-faciale, Faculté de médecine, Université Laval, Québec; Centre de recherche en organogénèse expérimentale de l'Université Laval/LOEX, Québec

But : L'infrastructure prélève, reçoit et distribue du matériel biologique cadavérique à différentes équipes de recherche en vision membres du Réseau de Recherche en Santé de la Vision (RRSV).

Description : Les tissus oculaires sont obtenus en collaboration avec Héma-Québec et la Banque d'yeux du CUO de l'Hôpital Saint-Sacrement. Ce sont eux qui appellent les coordonnateurs de cette infrastructure pour les informer de la disponibilité des tissus oculaires pour la recherche. Les coordonnateurs vont ensuite chercher les globes/cornées et procèdent à leur distribution. Les tissus sont anonymisés, puis distribués de manière équitable entre les équipes, un globe oculaire peut servir à plusieurs équipes, par exemple une équipe peut prélever le limbe, une autre l'endothélium cornéen, et une autre la rétine.

Impact : Au cours de l'année 2022-2023, 15 chercheurs, chercheurs cliniciens et collaborateurs (provinciaux et internationaux), soutenus par 23 étudiants, stagiaires et professionnels de recherche, ont utilisé cette infrastructure pour l'avancement de leurs travaux de recherche. En rendant disponibles ainsi des tissus humains, cette infrastructure permet d'effectuer des recherches originales et novatrices. Ultimement, les recherches menées grâce à cette infrastructure permettront l'avancement des connaissances dans le domaine de l'ophtalmologie. Ces connaissances pourront mener au développement de nouveaux traitements pour le soin de patients atteints de maladies de l'œil. Les résultats obtenus à partir des tissus distribués par l'infrastructure permettent de faire rayonner aux niveaux national et international les chercheurs utilisateurs. Depuis octobre 2022, ce sont plus de 54 présentations orales et par affiches (au niveau provincial, national et international) qui ont été effectuées par des utilisateurs de l'infrastructure. Ces fonds ont aussi permis le recrutement et la formation de personnel hautement qualifié. Durant la dernière année, nous avons reçu et distribué 112 cornées et 33 paires de globes oculaires.

Accessibilité : Cette infrastructure est disponible pour tous les chercheurs membres du RRSV.

Responsable : Stéphanie Proulx, PhD, chercheur régulier de l'Axe Médecine régénératrice, Hôpital Saint-Sacrement, Professeur adjoint, Département d'ophtalmologie et d'oto-rhino-laryngologie – chirurgie cervico-faciale, Faculté de médecine, Université Laval

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Financement: Réseau de recherche en santé de la vision

Mots-clés: Tissus oculaires, distribution, infrastructure

26 - Banque québécoise pour la recherche sur le mélanome uvéal

Solange Landreville[1, 2]

[1]Centre de recherche du CHU de Québec-Université Laval, [2]Université Laval

But : Mettre en commun du matériel biologique et des données cliniques de patients souffrant de mélanome uvéal.

Description : Le mélanome uvéal est la tumeur maligne intraoculaire la plus fréquente dans la population adulte. Puisque les cas familiaux de ce cancer sont très rares, il est difficile de le prévenir ou de le dépister. Malgré un traitement efficace de la tumeur de l'œil, plus de 50% des patients développent des métastases incurables, principalement au foie, dans les 15 années qui suivent le diagnostic de la tumeur primaire. Environ 20 prélèvements sont réalisés au Québec chaque année et les biopsies obtenues pour la recherche sont de petite taille. Cette infrastructure provinciale met donc en commun du matériel biologique de donneurs souffrant de mélanome uvéal associé à une banque de données cliniques. Les biopsies de tumeurs ou de métastases prélevées permettent la mise en culture de lignées cellulaires et des études génétiques/de protéomiques/biomécaniques.

Impact : Cette infrastructure joue un rôle de tout premier ordre dans la réalisation de divers programmes de recherche pour une meilleure compréhension des facteurs environnementaux et génétiques impliqués dans le développement du mélanome uvéal, ainsi que sa dissémination métastatique. Elle est utilisée dans le cadre des projets de recherche d'étudiants gradués, de stagiaires et de résidents. Cette banque favorise également les collaborations avec d'autres chercheurs à l'échelle provinciale, nationale et internationale pour faire avancer la recherche fondamentale et clinique sur ce cancer.

Accessibilité : Le matériel biologique et les données cliniques de cette infrastructure sont accessibles sur demande aux membres du RRSV dont le projet de recherche a été approuvé par le Comité d'éthique de leur établissement.

Responsable : Solange Landreville, PhD, Département d'ophtalmologie et oto-rhino-laryngologie – chirurgie cervico-faciale, Université Laval

Personne contact : Solange Landreville (Solange.Landreville@fmed.ulaval.ca)

Financement : Réseau de recherche en santé de la vision, Fonds de recherche du Centre universitaire d'ophtalmologie du CHU de Québec (infirmière de recherche)

Résumé des présentations par affiche / *Poster presentations abstracts*
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27 - ORVIS: Un répertoire d'outils de mesure pour la réadaptation de la vision

Sylvie Cantin[1,2], Catherine Houtekier[3], Walter Wittich[2,4]

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But : L'infrastructure ORVIS vise à faciliter le développement et la mise à disposition d'outils de mesure dont la validité et la fidélité ont été démontrées. Ces outils doivent être disponibles en français, ou en français et en anglais, et être appropriés pour une utilisation auprès de la population ayant une déficience visuelle, par des chercheurs ou par des intervenants. Ils doivent permettre l'évaluation fonctionnelle, perceptuelle, cognitive et psychologique de la population concernée.

Description de l'infrastructure : L'infrastructure ORVIS – Outils pour la Réadaptation de la VISion – répertorie et documente les outils qui correspondent à ces critères, en développe ou en adapte d'autres, puis les fait connaître via une plateforme électronique. La page d'accueil présente le mandat et l'organisation du répertoire puis offre, outre l'accès aux fiches, un glossaire, un lien vers une page consacrée aux balises relatives à l'interprétation des coefficients ainsi que la liste des communications dont ORVIS a fait l'objet. Les outils sont organisés en catégories inspirées de la Classification internationale du fonctionnement (CIF). Le répertoire recense plus de 50 outils dont il présente, à l'aide de fiches descriptives, les caractéristiques, les composantes et les propriétés métriques telles que documentées dans les écrits scientifiques. Il peut aussi décrire succinctement l'outil et renvoyer à une fiche répertoriée dans une source externe fiable. Les fiches d'ORVIS sont disponibles en ligne gratuitement et entièrement accessibles pour les personnes ayant une déficience visuelle. Le répertoire est guidé par un comité consultatif qui veille sur les orientations, les critères de sélection des outils, la forme et le contenu des fiches ainsi que sur le plan de communication.

Impact : Le répertoire ORVIS, spécifique à la clientèle vivant avec une déficience visuelle, augmente l'accessibilité de l'information portant sur des instruments valides pour les chercheurs et les cliniciens actifs dans les domaines de la déficience et de la réadaptation visuelles dans la francophonie. Les outils qu'il répertorie favorisent la réalisation d'études de qualité de même que l'amélioration de la prise en charge des usagers en réadaptation visuelle, ainsi que leur autonomie et leur intégration sociale. Les statistiques compilées à l'aide de *Google Analytics* entre le 1er novembre 2015, date de la mise en ligne du répertoire, et le 30 septembre 2023, attestent de plus de 95 000 pages vues par quelque 60 000 utilisateurs dont près de la moitié se situent en France.

Accessibilité : ORVIS est accessible à l'adresse www.orvis.vision. Ses fiches sont conformes au standard du gouvernement du Québec relatif à l'accessibilité pour toute personne ayant ou non une déficience.

Responsable : **Walter Wittich**, Ph. D., FAAO, CLVT**,** École d'optométrie, Université de Montréal – Chercheur du CRIR – Responsable de sites CRIR : INLB et MAB-Mackay

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Financement : Réseau de recherche en santé de la vision et Institut Nazareth et Louis-Braille du CISSS de la Montérégie-Centre

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28 - Banque de données pour la caractérisation fonctionnelle, anatomo-pathologique et chirurgicale de la cornée

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Cette infrastructure est constituée de données anatomo-fonctionnelles de la cornée, totalisant plus de 36 000 individus. On y retrouve par ailleurs des données d'optique physiologique, des données psychométriques, des données protéomiques et des données cliniques (antécédents médicaux, paramètres chirurgicaux, acuité, etc.) pour diverses conditions pathologiques ainsi que pour des sujets normaux. En particulier, cette infrastructure comprend les données cliniques d'une des plus grandes cohortes de patients implantés avec la kératoprothèse de Boston. Des outils d'analyse topographique ont été intégrés au fil des années permettant l'analyse de cartes individuelles, l'analyse de cartes moyennes de populations, la modélisation et la visualisation 3D. On compte aussi des outils de dépistage (LASIK, PRK, RK, kératocône) sur les cornées vivantes et de banque et des outils d'échange sécurisé de données entre les collaborateurs.

Accessibilité: Les données de cette banque sont **accessibles à tous les membres du RRSV** sur demande, dans un contexte de respect des règles d'éthique et de la propriété intellectuelle.

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Résumé des présentations par affiche / *Poster presentations abstracts*
Cornée et segment antérieur / *Cornea and anterior segment*

34 - Efficacy and Safety of Kahook Dual Blade Goniotomy and Trabecular Micro-bypass Stent (iStent Inject) in Combination with Cataract Extraction: A Retrospective Study

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Goal: Controversy exists regarding the efficacy and safety of Kahook Blade Dual (KDB) goniotomy to that of a second-generation trabecular micro-bypass stent (iStent inject) in combination with cataract extraction. This study aims to bridge existing research limitations, which have either focused solely on first-generation iStent or limited their scope to mild-to-moderate primary open-angle glaucoma patients, with small samples and outside North America.

Method: We performed a retrospective, single-center, observational, longitudinal case series to compare the efficacy and safety of these two types of microinvasive glaucoma surgery (MIGS). The intervention was combined with elective cataract extraction. Data collection included IOP, IOP-lowering medications and best-correct visual acuity (BCVA) preoperatively and at 1 day, 2 weeks, 1 month, 6 months and 12 months postoperatively. In addition, intraoperative and postoperative adverse events were also be examined. The primary efficacy outcome was the proportion of patients in each group attaining 20% reduction of IOP. Subgroup analysis were conducted for different types of glaucoma.

Results: A total of 38 patients (66 eyes) were included in the iStent inject group and 19 patients (25 eyes) in the KDB group. Mean follow-ups were 12 months for both groups. Pre- and post-operative IOPs were 23,68 ± 6,06 mmHg and 12,8 ± 2,4 mmHg (P <0.0001) in the Phaco-KDB group as well as 21,51 ± 4,99 mmHg and 15 ± 1,91 mmHg (P <0.0001) in the Phaco-iStent inject group. Both the iStent inject and KDB had similar success rates in achieving a 20% reduction in IOP (67% and 60% respectively) with no significant statistical difference (p=0.55). No major complications occurred. Changes in IOP and medications were not significantly different between groups (P>0.05).

Conclusion(s): As North America's first comprehensive study comparing KDB and iStent inject with a larger sample size, this research validates both procedures' safety and efficacy in IOP reduction. Conducted following a standardized protocol across a range of glaucoma types and severities, the study enriches the clinical utility of these procedures. It emphasizes the need for tailored procedure selection based on surgeon expertise and patient factors. Importantly, the findings serve as a stepping stone for future multicentered, prospective studies focusing on cost-effectiveness and sub-group analysis, thereby enabling clinicians to make more targeted MIGS choices.

Funding: Department of Ophthalmology - Université de Sherbrooke

Résumé des présentations par affiche / *Poster presentations abstracts*
Cornée et segment antérieur / *Cornea and anterior segment*

35 - Interdisciplinary Quality Improvement in Oculoplastic Surgery: Transforming Biopsy Follow-Up through PDSA Cycles

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Goal: To evaluate and improve the quality of periocular biopsy follow-up by determining the absolute compliance rate (percentage of cases that successfully met all quality parameters), examining delays between stages, and identifying obstacles to high-quality follow-up, offering recommendations for improvement.

Method: Phase 1: A retrospective, observational, and descriptive study was conducted using chart reviews of adult patients who underwent periocular biopsies at CHUS from January 2019 to December 2022. Phase 2: Three simultaneous Plan-Do-Study-Act (PDSA) cycles were implemented, focusing on enhancing communication channels between clinicians and pathologists, introducing a priority system for urgent cases, and establishing an automatic reminder system for pathologists. Results were collected and compared to the pre-PDSA (phase 1) results.

Results: Phase 1: Among the 103 patients analyzed, 29 had malignant lesions while 74 had non-malignant lesions. The absolute compliance rate was 37.9% for malignant lesions, representing a significant difference compared to the targeted absolute compliance rate of 100%. All these non-compliances were due to excessive turnaround time to issue the pathology report. The percentage of cases that had adequate pathology turnaround time (TT ≤ 7 days) were 37.9% for malignant lesions, much lower than the Quebec Ministry of Health's target (80% at ≤ 7 days). Phase 2: The implemented PDSA cycles led to significant increases in absolute compliance rates and pathology TT compliance rates for malignant lesions, aligning with the Quebec Ministry of Health's target rate. Primary outcomes showed that the absolute compliance rate increased to 93.3% for malignant lesions. These improvements were statistically significant compared to previous results. Secondary outcomes indicated that the pathology TT compliance rate for malignant lesions reached 93.3%, with no statistical difference from the target compliance rate recommended by the Quebec Ministry of Health (80%). Furthermore, no biopsy slides were left unanalyzed for more than three months, and the maximum delay was reduced from 120 days to only 39 days.

Conclusion(s): Delayed pathology reporting was identified as the primary cause of suboptimal follow-up. The successful implementation of targeted PDSA cycles improved communication, prioritization, and reminder systems, resulting in considerable improvements in primary and secondary outcomes. This study highlights the importance of root-cause analysis, interdisciplinary communication, and workflow mapping in enhancing follow-up quality in periocular biopsy cases.

Funding: Department of Ophthalmology - Université de Sherbrooke

Résumé des présentations par affiche / *Poster presentations abstracts*
Cornée et segment antérieur / *Cornea and anterior segment*

38 - Identification automatique des différentes couches de la cornée sur les images de microscopie confocale par apprentissage profond

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But : L'étude de la cornée est essentielle pour diagnostiquer et suivre les maladies oculaires. La microscopie confocale permet une analyse approfondie, rapide, sécurisée et sans douleur en capturant des images haute résolution des différentes couches de la cornée. Lors de l'acquisition, le clinicien explore la surface cornéenne à différentes profondeurs en vue d'une analyse ultérieure. Le tri manuel des images par région et couche peut être fastidieux. Cette recherche vise à automatiser cette procédure en utilisant un réseau de neurones à convolution couramment employé dans l'apprentissage profond.

Méthode : Un réseau de neurones à convolution est entraîné pour identifier 4 couches principales observées en microscopie confocale de la cornée : épithélium, endothélium, stroma et plexus sub-basal. Un ensemble d'images originales est utilisé puis augmenté par des rotations et flips pour la phase d'entraînement (total de 924 images). Un nombre similaire est ensuite utilisé pour tester l'algorithme (684 images). Les images sont ramenées à une dimension de 112 x 112 pixels.

Résultats : L'exactitude de la classification atteint 87.6% pour les quatre couches. L'endothélium et le stroma sont les plus faciles à identifier par le réseau. Toutefois, l'épithélium est parfois confondu avec l'endothélium ou le plexus alors que le plexus est parfois identifié incorrectement comme épithélium ou endothélium. Ceci peut être dû à la présente de deux couches simultanément sur certaines images (obliques). Notons qu'à titre de comparaison, un simple réseau de neurones ne peut faire mieux que 29.2% et qu'un tirage aléatoire donnerait 25% d'exactitude. Ces résultats préliminaires d'un algorithme d'apprentissage machine profond sont donc prometteurs.

Conclusion(s): La microscopie confocale cornéenne est une technique d'imagerie rapide et efficace pour l'analyse de la cornée. L'identification automatique de quatre couches principales de la cornée a été obtenue avec succès par un réseau de neurones profond élémentaire ce qui laisse entrevoir des améliorations futures avec des réseaux plus complexe pour l'identification d'autres couches et l'amélioration de la précision.

Financement : Cette recherche a été supportée par le Réseau de Recherche en Santé de la Vision (RRSV) et la Chaire Suzanne Véronneau-Troutman en ophtalmologie de l'Université de Montréal, ainsi qu'une bourse de l'Université de Montréal pour les étudiants internationaux.

Résumé des présentations par affiche / *Poster presentations abstracts*
Cornée et segment antérieur / *Cornea and anterior segment*

40 - Étude des mécanismes moléculaires et cellulaires modulant l'expression du gène de la Clusterine durant la guérison des plaies cornéennes

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But : La cornée constitue une structure particulièrement vulnérable aux divers traumatismes pouvant mener à des déficiences visuelles importantes allant jusqu'à la perte de la vue. Dans les cas les plus graves, une greffe est nécessaire. Cependant, le nombre de donneurs de cornées est limité. Ainsi, la compréhension des mécanismes cellulaires et moléculaires de guérison après une atteinte de la cornée est de première importance. Certains travaux réalisés dans le laboratoire ont permis d'observer une importante réduction dans l'expression du gène codant pour la *Clusterine* (CLU) durant la guérison des plaies en utilisant notre cornée humaine reconstruite par génie tissulaire (hTEC) comme modèle d'étude. Nous pensons que certains éléments de la matrice extracellulaire (MEC), comme la Fibronectine (FN) et le Collagène IV (Coll IV), peuvent influencer l'expression du gène CLU. L'objectif de ce projet consistait à étudier la régulation de l'expression de CLU dans les hCECs cultivées en monocouches sur différents composants de la MEC (FN et Coll IV), avec ou sans lésion.

Méthode : L'expression protéique de CLU a été suivie par buvardage Western sur des hTECs et des cellules épithéliales de cornée humaine (CECHs) contrôles ou lésées. Les séquences régulatrices du gène ont été identifiées grâce à la création de vecteurs recombinants contenant différents segments du promoteur CLU couplés au gène rapporteur CAT et transfectés dans des CECHs cultivées en présence ou non des composants de la MEC. L'expression génique des facteurs de transcription (FTs) a été suivie par profilage génique sur biopuces à ADN et des essais de retard sur gels (EMSA) ont ensuite été réalisées pour suivre la fixation de FTs au promoteur CLU. L'expression de ces FTs a aussi été analysée par Western.

Résultats : Les analyses Western ont permis d'observer une forte diminution de l'expression du gène CLU chez les hTECs lésées, réduction néanmoins plus modérée chez les cellules cultivées en monocouches (hCECs). La transfection des plasmides portant les différents segments du promoteur CLU dans les CECHs a mis en évidence 2 régions régulatrices importantes: un élément activateur proximal (positions -82 et -203) et un élément répresseur distal (-1424 à -2000). La transfection des délétants -82 et -203 du promoteur a, quant à elle, permis de positionner les éléments de réponse à la FN et au Coll IV en aval du site d'initiation de la transcription du gène CLU. Une étude bioinformatique a permis de démontrer que la région en question porte des sites reconnus par les FTs Ets1, MZF1, NFkB et Essrb. Une analyse génique a ensuite permis de restreindre notre recherche à NFkB et MZF1 puisque ce sont les seuls dont l'expression est régulée par la présence de MEC. Les analyses EMSA sont en cours pour confirmer la liaison de ces FTs à la région basale du promoteur CLU.

Conclusion(s) : Les résultats de cette étude permettent de mieux comprendre les mécanismes qui contrôlent l'expression du gène CLU durant la guérison des plaies cornéenne en exploitant les hTECs, un modèle d'étude in vitro novateur.

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41 - Sélection et criblage de gènes candidats comme modificateurs de l'âge d'apparition du glaucome primaire à angle ouvert au locus MOG2 sur le chromosome 20p12

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But : Le glaucome primaire à angle ouvert (GPAO) est une maladie génétique complexe où environ 90 % des cas sont causés par des interactions gène-gène. Dans l'autre 10%, le GPAO ségrègue selon un mode autosomal dominant (AD) présentant souvent d'importantes variabilités phénotypiques. Notre hypothèse est que cette variabilité serait causée par des gènes modificateurs qui interagissent avec le gène responsable du GPAO AD. Le but général de nos recherches est de caractériser ces gènes modificateurs. En effet, ceux-ci pourraient être impliqués dans les interactions gène-gène de la forme complexe du GPAO. Notre but actuel est de sélectionner et de mettre au point le criblage des gènes candidats au locus Modifier-Of-Glaucoma 2 (MOG2) sur le chromosome 20p12. *MOG2* couvre une région de 10 à 15 millions de nucléotides pauvre en gènes. Quatre candidats y furent identifiés, *BMP2* à l'intérieur du sous-locus *GLC1K* associé au glaucome juvénile, *LAMP5*, *SNAP25* et *JAG1*. Pour cette étude, nous avons sélectionné *JAG1* car la protéine qu'il encode, jagged1, fait partie du sentier de signalisation moléculaire NOTCH.

Méthode : Le laboratoire étudie une famille canadienne-française chez qui la mutation K423E du gène *myociline* (*MYOC*^{K423E}) cause du GPAO autosomal dominant. Dans cette famille, l'âge de début du GPAO chez les porteurs hétérozygotes *MYOC*^{K423E} varie de 7 à 60 ans. Grâce au pedigree, deux loci furent cartographiés pour cette grande variabilité d'âges de début, *MOG1* à 20q13 et *MOG2*. Pour notre étude, l'ADN de 12 membres d'une seconde famille canadienne-française fut utilisé pour mettre au point le séquençage de *JAG1*. Le séquençage fut effectué par la méthode Sanger.

Résultats: De nombreux Single Nucleotide Polymorphisms (SNPs) furent découverts dans des régions non-codantes du gène *JAG1*. Aucun de ceux-ci ne fut détecté dans la région codante de *JAG1*. Ce type de mutation ADN entraînerait alors un changement de la séquence des acides aminés de jagged1 causant le syndrôme d'Alagille. Aucun des individus étudiés ou séquencés ne présentait de symptômes associés à Alagille. Plusieurs SNPs présentaient toutefois une fréquence élevée de l'allèle mineur avec une valeur d'environ 25 % chez les personnes séquencées, alors que la valeur attendue était de 5 % (allèles majeur + mineur = 100%), ce qui indique une bonne répartition des SNPs chez les individus séquencés. De façon intéressante, trois des SNPs, rs910118, rs910019 et rs8119088, se retrouvaient dans la région promotrice.

Conclusion(s) : Nous avons mis au point et optimisé le séquençage de *JAG1*. Les SNPs dont l'allèle mineur présentait une fréquence élevée faciliteront la découverte d'haplotypes associés à la grande variabilité des âges de début du GPAO dans notre grande famille *MYOC*^{K423E}. Les SNPs trouvés dans le promoteur pourraient changer le taux d'expression de la protéine jagged1 altérant ainsi le mécanisme de transition épithélio-mésenchymateuse potentiellement induit par les mutations *MYOC* au niveau du trabéculum de l'œil.

Financement : Réseau de Recherche en santé de la vision du FRQS, Instituts de recherche en santé du Canada, Fondation des maladies de l'oeil, The Glaucoma Foundation, Glaucoma Research Fondation (USA).

42 - One-year Comparison of a 45 µm Lumen and 63 µm Lumen Gel Microstent Implantation

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Goal: The XEN-45 and XEN-63 are micro-drainage implants for glaucoma creating a filtering bleb in order to decrease intraocular pressure. This study aims to compare clinical outcomes of the XEN-45 and XEN-63 implants.

Method: Retrospective study of eyes diagnosed with glaucoma and having undergone XEN-45 or XEN-63 implantation surgery. Eyes were classified into the XEN-45 or XEN-63 groups. Primary outcome is surgical success which was achieved if postoperative IOP ranged between 6-21 mmHg with or without glaucoma medications, further classified as qualified or complete success respectively. Analyzes were stratified by surgical technique (closed, open) and type of surgery (alone or combined with cataract surgery). Postoperative complications were also recorded.

Results: 93 eyes were included in the study, with 82 eyes and 11 eyes in the XEN-45 and XEN-63 groups respectively. At 12 months, 67 eyes in the XEN-45 group and 3 eyes in the XEN-63 group had their follow-up. In the first group, mean IOP decreased from 21.1 ± 5.8 mmHg on 3.7 ± 1.0 glaucoma medications to an IOP of 14.5 ± 4.6 mmHg ($p < 0.001$) on 0.9 ± 1.3 medications ($p < 0.001$) at 12 months postoperatively. In the XEN-63 group, mean IOP decreased by 23.5 ± 4.7 mmHg on 3.3 ± 1.1 glaucoma medications to an IOP of 11.3 ± 1.1 mmHg ($p = 0.029$) on 0.7 ± 1.2 medications ($p = 0.35$) at 12 months postoperatively. Stratified analyzes also demonstrated statistically significant differences for the two groups.

20 eyes in the XEN-45 group and 3 eyes in the XEN-63 group required postoperative needling. 9 patients in the XEN-45 group had an implant revision or a second glaucoma surgery. Among the complications, 7 patients in the first group and 3 in the second had clinically significant transient hypotony. Only 1 patient in the XEN-63 group required intraocular injections.

Conclusion(s): In patients with uncontrolled glaucoma, XEN-45 and XEN-63 implants appear to offer a significant reduction in the number of glaucoma medications and IOP.

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43 - Optimisation de la culture de cellules endothéliales cornéennes sur substrat à rigidité physiologique pour l'étude des jonctions intercellulaires

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But : La rigidité du tissu influence les cellules. Dans l'œil, les cellules endothéliales cornéennes (CECs) reposent sur une membrane qui a une rigidité physiologique de 20 à 80kPa. Nous avons émis l'hypothèse que cette rigidité était importante pour le maintien de l'intégrité de l'endothélium cornéen. Le but de ce projet est d'optimiser les conditions de culture permettant une adhésion et une maturation des CECs sur substrat à rigidité physiologique afin de pouvoir étudier la formation des jonctions intercellulaires.

Méthode : Des CECs (30 000 cellules/cm^2) ont été ensemencées sur des substrats de 32kPa (CytoSoft; Advanced Biomatrix) ou sur des lamelles de verre (>GPa) avec différents recouvrements de protéines matricielles (collagène IV, laminine 511 ou FNC coating mix). Des photos ont été prises 1h, 3h et 24h après l'ensemencement. La quantité de cellules adhérées (aplaties et sombres) et non adhérées (rondes et brillantes) ont été comptées à l'aide du logiciel ImageJ. Des immunofluorescences ont aussi été effectuées contre les protéines collagène IV, laminine α5 et fibronectine bovine avant et après la culture cellulaire pour s'assurer du recouvrement homogène des protéines. Afin d'optimiser la vitesse de maturation des jonctions intercellulaires, 30 000 cellules/cm^2 ont été ensemencées sur lamelle de verre et gardé en culture 7 jours post-confluence avec ou sans TGF-β2 et avec une quantité variable de sérum de veau fœtal (SVF, 1, 2, 3, 5 ou 8%). L'analyse de leur morphologie (indice de circularité) et de leur densité a été effectuée à l'aide du logiciel ImageJ. Elles ont par la suite été immunomarquées contre les protéines de jonctions intercellulaires ZO-1 et N-Cadhérine.

Résultats : Le nombre de CECs adhéré est semblable pour les revêtements de collagène IV et laminine 511 sur substrat 32kPa et >GPa après 1, 3 et 24 heures, mais l'adhésion est plus homogène sur collagène IV. Les cellules avec revêtement de FNC ont une adhésion plus faible sur 32kPa et sur >GPa après 1 et 3 heures. Après 24h, on retrouve des cellules adhérées sur >GPa, mais pas sur 32kPa. Les immunomarquages démontrent une répartition homogène des protéines de recouvrement avant la culture et un arrangement filamentaire après la culture. On observe une augmentation non significative de la circularité des cellules et une diminution de la densité cellulaire lors de l'ajout de TGF-β2, peu importe la quantité de SVF. Les immunofluorescences démontrent la présence de N-Cadhérine seulement en présence de TGF-β2, peu importe la quantité de SVF. Plus la quantité de SVF est élevée, plus ZO-1 est présent. L'ajout de TGF-β2 augmente la quantité de ZO-1 et celui-ci a une meilleure localisation membranaire avec 5%SVF.

Conclusion(s) : La culture de CECs sur substrat à rigidité physiologique est optimale pour l'étude des jonctions intercellulaires en utilisant un revêtement de collagène IV et en ajoutant TGF-β2 et 5%SVF à post-confluence.

Financement : CRSNG

44 - Right eye orbital schwannoma with histopathological features of benignity adjacent to hypercellular areas

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Goal: Schwannomas are tumors that develop from Schwann cells of peripheral nerve sheaths[1]. Usually benign, these tumors progress slowly and present themselves with non-specific symptoms, including painless proptosis of the eye[1]. Orbital schwannomas are rare and represent 1% of all orbital tumors combined[2]. Considering the structural complexity of the orbit, it is challenging to identify the origin of these tumors. Sensory nerves are usually at cause, more specifically the supraorbital and supratrochlear nerves[1]. The incidence is highest between the ages of 30 and 60 and is found equally amongst men and women[3]. Owing to their encapsulated form, it is possible to achieve complete excision of the tumor which is highly recommended[4]. Incomplete excision is a risk factor for recurrence as well as tumor progression and extension to other regions[2]. Key histological features found in schwannomas are the following two types of cell morphology: Antoni types A, characterized by the presence of numerous spindle cells, and Antoni types B, which are hypocellular areas[3]. Malignant transformation is more probable with highly cellular tumors, which also have a greater tendency to recur[2].

Results: (CASE PRESENTATION): We report the case of a right eye orbital schwannoma found in a 34-year-old female who presented to the emergency department with symptoms of headache and red teary eyes. Clinical examination showed right eye papilledema and, on imaging, a multilobulated and well-defined mass was found in the superior aspect of the right orbit. Histopathological examination in our case revealed an unusual presentation of benign features adjacent to hypercellular areas. The clinical features, radiological findings, histological features, and treatment options of orbital schwannomas are discussed in this case report.

Conclusion(s): Our patient presented with signs of compression of the right optic nerve with reduced visual acuity and papilledema of the right eye. Although CT-scan revealed a hypodense mass, it lacks specificity in identifying its nature. Histological characteristics found in this tumor confirm the diagnosis of orbital schwannoma with its typical alternating regions of Antoni types A and Antoni types B. However, in addition to benign features, our case presents hypercellular areas which makes it more prone to further recurrences. Following total excision, a close follow-up is essential in these cases to ensure complete remission.

Funding: No funding

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Cornée et segment antérieur / *Cornea and anterior segment*

45 - One-year clinical outcomes of Hydrus Microstent implantation

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Goal: To determine the 12-month performance and safety of Hydrus Microstent standalone or combined with phacoemulsification compared by visual field severity.

Method: Retrospective, single center, single surgeon, comparative study. All patients with intraocular pressure (IOP) above target who received either Hydrus Microstent standalone or combined with phacoemulsification between 2020 and 2023 were included. Patients were evaluated at baseline and 1 day, 1 week and 1,3,6,12 months postoperatively. For each outcome, results were obtained for all patients combined, followed by an analysis by visual field severity (VFS). Primary outcomes were intraocular pressure and number of glaucoma medications variations from baseline to 12 months postoperatively per glaucoma severity. The secondary outcomes were complete (no medications) followed by qualified (with medications) success of surgery at 1 year for IOP thresholds of 6 to 21 mmHg included and 6 to 18 mmHg included. Risk factors for failure, surgical complications and need for additional glaucoma surgery were also evaluated.

Results: 163 glaucomatous eyes were included in the study, among which 70.7% with primary open angle glaucoma. Eyes with mild visual field severity represented 70.5 % of all cases, followed by 14.1 % and 15.4% for moderate and severe visual field severity respectively. Preoperative mean IOP (SD) was 16.9 (3.8) mmHg on 2.2 (1.1) medications for all cases combined, and 17.5 (4.0) mmHg on 2.1 (1.1) medications, 15.9 (2.9) mmHg on 2.5 (0.9) medications and 15.2 (3.4) mmHg on 2.6 (1.3) medications for mild, moderate, and severe VSF respectively. Postoperative mean IOP was 14.6 (2.5) mmHg on 0.8 (1.1) medications for all patients combined, and 15.1 (2.5) mmHg on 0.6 (1.1) medications, 14.4 (1.4) mmHg on 1.5 (1.2) medications, and 13.3 (2.6) mmHg on 1.2 (1.0) medications for mild, moderate, and severe VSF respectively.

For all patients combined, complete and qualified success rates with IOP 6-21 mmHg and 6-18 mmHg went from 53.4 % and 37.6% to 88.9% and 78.9%. For mild VFS, success rates with IOP 6-21 mmHg and 6-18 mmHg went from 51.5 % and 33.7 % to 86.55 % and 79.83%. For moderate VFS, success rates with IOP 6-21 mmHg and 6-18 mmHg went from 56.6% and 51.7% to 100 % and 59.2 %. For severe VFS, success rates with IOP 6-21 mmHg and 6-18 mmHg went from 63.8% and 49.4 % to 89.0 % and 86.3 %. For all patients combined, 43.1 % achieved ≥ 20% IOP reduction from baseline during follow-up for at least two consecutive visits. 67.5% were drop-free after 1 year of follow-up.

Complications were mostly cases of steroid response (31.3%) and IOP spikes (8.0%), followed by inflammation (6%) and hyphema (4%). There were 3 patients in total who required additional surgery for IOP control.

Conclusion(s): Hydrus Microstent leads to significant reduction of IOP and use of medications for all patients combined, including patients with mild, moderate, and severe visual field severity.

Funding: No funding

46 - Pre-clinical study of an injectable biocompolyer-based hydrogel as a promising treatment for alkali burnt cornea blindness

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Goal: Corneal perforations are emergency situations that are currently treated by sealing with cyanoacrylate or Super-Glue. This treatment is sub-optimal and often requires a follow-on corneal transplantation to restore vision. Our goal is development of a one-step injectable sealant-filler that promotes regeneration to circumvent the need for corneal transplantation.

Method: Liquid hydrogels were prepared by conjugation of self-assembling collagen-like peptides (CLP) to a novel polymer made from anti-inflammatory 2-Methacryloyloxyethyl phosphorylcholine (MPC). Live/Dead Viability/Cytotoxicity Assay was used to determine the biocompatibility of the hydrogels. The hydrogels also were tested ex vivo on excised pig corneas with surgical perforations to examine its efficacy to seal large perforations. The hydrogels were tested *in vivo* on alkali burnt BALB/c mouse corneas to investigate their biocompatibility and efficacy. A pre-clinical study was then started in mini-pigs.

Results: Chemical characterization confirmed the successful synthesis of CLP-MPC. Hydrogels supported the growth of human corneal epithelial cells. Bursting pressure tests showed that the hydrogel tolerated pressures up to almost 50 mm Hg when it was applied as a self-gelling sealant. *In vivo* testing in mouse corneas showed no sign of inflammation or angiogenesis in cornea. Early results in alkali burned mini-pig corneas with large surgical perforations (6 mm diameter at the epithelial surface tapering to 1 mm, and then scalpel wounds at the endothelium) showed that all 8 of 8 corneas tested were sealed. Six of 8 corneas epithelialized from 30 to 100% after 1 week, dependent on the smoothness of the in situ gelled surface. At 2-3 months post-operation, all corneas were epithelialized, and in-growth of stromal cells was starting.

Conclusion(s): Liquid Corneas made from CLP-MPC delivered in a single syringe spontaneously gelled in perforations in mini-pig corneas. The hydrogel supported corneal regeneration in mouse corneas. Early results in pre-clinical mini-pig corneas showed that the Liquid Cornea promotes regeneration.

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Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

47 - Ikzf2 regulates amacrine cell diversification in the developing mouse retina

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Goal: During Central Nervous System development, neural progenitors generate different cell types in a strict chronological order, and any perturbance in this birth order impairs the development of functional circuits. But how exactly cell birth order is regulated at the molecular level remains poorly understood.

Method / Results: The vertebrate retina is a good model system to address that question, as multipotent retinal progenitor cells (RPCs) give rise to retinal cell types in a precise chronological order that is conserved between different vertebrate species. Previous work in our lab identified the zinc finger transcription factor (TF) Ikaros1 (I*kzf1*) as a key regulator of temporal identity progression in the retina, but partial phenotypes in loss of function experiments suggest that other factors are also involved. Here, we investigated the role of the TF *Ikzf2* during retinogenesis. We report that misexpression of Ikzf2 in late-stage RPCs promotes the heterochronic generation of GABAergic amacrine cells (AC), an early-born cell type. Conversely, inactivation of Ikzf2 in the retina *in vivo* leads to a reduction in the number of GABAergic and glycinergic AC observed at mature stages. Finally, we observed that amacrine cell generation might rely in a cross-talk between *Ikzf1* and *Ikzf2*.

Conclusions: These results suggest that Ikzf2 regulates a gene regulatory network in RPC leading to the timely production of specific subtypes of ACs. This work may allow the development of new protocols to stimulate neurogenesis from different sources, potentially contributing to retinal repair and neuronal replacement strategies.

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Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

48 - Targeting mast cell alleviates subretinal inflammation and photoreceptor loss in a model of retinal degeneration

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Introduction: Age-related macular degeneration (AMD) is a leading cause of blindness in the elderly worldwide. Dry AMD is characterized by retinal pigment epithelium (RPE) degeneration, subretinal inflammation and photoreceptor cell death. Interestingly, accumulation of mast cells was reported at areas of RPE atrophy in patients with geographic atrophy, the advanced stage of dry AMD. However, the role of mast cells in the pathogenesis of geographic atrophy is unclear.

Goal: To investigate the implication of mast cells in RPE degeneration and photoreceptor death in an oxidative stress-induced mouse model of AMD.

Method: Oxidative stress was induced by sodium iodate administration. Wild type (WT) mice and mast cell-deficient mice (*Kit*$^{wsh/wsh}$) were treated with a mast cell stabilizer, ketotifen fumarate (KF), or vehicle. RPE damage was visualized by phalloidin staining. Mononuclear phagocyte (MP) infiltration was evaluated by Iba1 immunofluorescence. Photoreceptor cell death was assessed by TUNEL assay. Retinal function was evaluated by electroretinography.

Results: Sodium iodate administration caused structural disorganization of the RPE and massive recruitment of MPs in the subretinal space associated with photoreceptor death. Importantly, retinal damage was associated with mast cell degranulation. KF reduced the area of RPE atrophy on WT mice but not on *Kit*$^{wsh/wsh}$. *Kit*$^{wsh/wsh}$ and KF-treated mice had less recruitment and activation of MPs in the subretinal space, and less photoreceptor death.

Conclusion(s): These results show that targeting mast cells confers a protective effect on RPE and photoreceptors in a mouse model of retinal degeneration.

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Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

49 - Dysfunctional microglial heme metabolism prevents retinal vascular remodeling and impairs vision in proliferative retinopathy

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Goal: Retinopathy of prematurity (ROP), the leading eye disease of immature newborns, is characterized by an initial vaso-obliteration (VO) and retinal ischemia followed by pathological neovascularization (NV). During VO, the injured avascular retina accumulates heme from trapped red blood cells and degraded mitochondria. Microglia are resident phagocytes that scavenge cellular debris and degrade heme through heme-oxygenase 1 (HMOX1). HMOX1 recycles heme-bound iron to prevent oxidative damage and promotes vascular repair, but its role in ROP has not been explored. Here, we show that disrupting heme metabolism within microglia prevents retinal remodelling and impairs vision.

Method: ROP was studied using the well-characterized oxygen-induced retinopathy (OIR) mouse model. Briefly, mouse pups are exposed to 75% O_2 from postnatal days 7 (P7) to P12 to produce vaso-obliteration, followed by a 5-day exposure to room air causing retinal hypoxia and subsequent pathological neovascularization (P17). Retinas were then analyzed via single-cell RNAseq to elucidate the gene expression in various retinal cells. Myeloid-deficient *Hmox1* mice (LysM-Cre) were exposed to the OIR model and retinal VO and NV were quantified. Retinal microglial distribution and morphology was assessed using the IMARIS software. Iron was quantified in retinal tissue and vitreous humor using a colorimetric assay. Electroretinogram (ERG) was performed to assess the functional integrity of the retina.

Results / Conclusion(s): Ferroptosis and iron metabolism were the predominant upregulated pathways in pathological neovessels and retinal microglia by single-cell RNAseq of OIR retinas. *Hmox1* expression was markedly increased in microglia during OIR. Depletion of *Hmox1* in myeloid cells (LysM-Cre) of mice exposed to OIR led to greater VO at P17 and P19, and delayed revascularization of the deeper vascular plexus (P21), indicating slower retinal revascularization compared to the controls. Further, tuft regression was slower in mutant mice (P19), reflecting impaired microglial functionality. Indeed, we observed an accumulation of activated microglia in mutant retinas, exhibiting more rounded and less ramified morphologies. Elevated iron levels were measured in the retina and vitreous of these mice at P12. Delayed revascularization, iron accumulation and microglial changes correlated with vision impairment; reduced a-wave amplitudes were observed in scotopic ERG of conditional myeloid *Hmox1*-deficient mice at P21.

50 - Deciphering the role of mTOR pathway in differentiated pericytes in proliferative retinopathies

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Goal: Pericytes are perivascular cells that surround capillaries and control angiogenesis and capillary barrier function. In proliferative retinopathies, pericytes start to differentiate and cover angiogenic sprouts and pathological neovascular tufts (NVTs). While pericytes are known to express SMA and are needed to form the NVTs, the mechanism regulating their differentiation remain poorly understood. Therefore, the objective is to identify new molecular mechanisms regulating pericyte differentiation and dysfunction in the mouse model of oxygen-induced retinopathy (OIR).

Method / Results: First, we isolated retina from OIR and control mice and identified the perivascular cells using scRNAseq. After bioinformatics analysis, we found new pericyte clusters present in OIR retina. We identified new markers and uncovered an increase of the mTOR pathway in those new pathological pericytes, suggesting that mTOR activation might promote pericyte differentiation and/or dysfunction.

Secondly, we generated 2 new transgenic mouse line to increase (TSC1 l/l) or decrease (Rptor l/l) mTOR pathway signalisation specifically in the pericytes using the Pdgfrb Cre ERT2. Surprisingly, we were not able to increase the activation of the mTOR pathway in pericytes following TSC1 inhbition in vivo. However, deleting Rptor and thus inhibiting the mTOR pathway in pericyte during the development impairs both the outgrowth and the density of the retina vascularization. These results where correlated with a defect of both proliferation and migration of human pericytes in vitro.

Thirdly, using the well-known inhibitor of mTOR, rapamycin, we showed that inhibiting the mTOR pathway decrease the number of tufts formation thus improving the phenotype.

Conclusion(s): We will now investigate the role of the pericyte mTOR signaling pathway in OIR context using this new transgenic mouse line. We expect that inhibiting mTOR pathway would prevent pericyte differentiation and dysfunction and thus improve revascularization in OIR.

Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

51 - L'absence du récepteur GPR55 accélère le déclin des fonctions visuelles chez la souris

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But : Les observations sur l'impact du cannabis sur différents paramètres de la vision ont suscité un vif intérêt pour l'étude du système endocannabinoïde dans la modulation de ce sens. GPR55 est un récepteur cannabinoïde non classique impliqué dans la croissance axonale et le guidage des cellules ganglionnaires rétiniennes pendant le développement du système visuel. L'absence du récepteur chez les souris ralentit aussi la maturation de l'acuité visuelle et diminue la sensibilité au contraste à l'âge adulte. L'objectif de cette étude était d'investiguer si la suppression du gène *Gpr55* affecte également le vieillissement des fonctions visuelles.

Méthode : Les fonctions rétiniennes et le comportement visuel de souris *knockout* pour le gène *Gpr55* (*Gpr55*$^{-/-}$) ont été évalués en comparaison avec des souris de souche sauvage (*Gpr55*$^{+/+}$) chez de jeunes animaux adultes et de vieux animaux. La méthode du réflexe optomoteur a été utilisée pour évaluer les conséquences de la suppression de *Gpr55* sur l'acuité visuelle. L'électrorétinographie (ERG) scotopique et photopique à champ complet a été utilisée pour évaluer la baisse de fonction des cellules rétiniennes avec l'âge en fonction de la présence du récepteur GPR55.

Résultats : L'absence de GPR55 n'affecte pas l'acuité visuelle atteinte à l'âge adulte, mais une diminution est observée chez les souris *Gpr55*$^{-/-}$ âgées, alors que les souris sauvages du même âge conservent la même acuité visuelle. Les enregistrements obtenus à partir de souris *Gpr55*$^{-/-}$ adultes révèlent aussi une diminution de l'amplitude et un retardement de la latence de plusieurs composantes de l'ERG scotopique et photopique. Ces défauts dans la réponse à la lumière deviennent plus importants chez les vieilles souris *Gpr55*$^{-/-}$ avec une accentuation des différences déjà observées chez les souris adultes et l'apparition de différences significatives dans de nouvelles composantes.

Conclusion(s) : Ces résultats mettent en évidence un rôle de GPR55 dans le développement et le maintien de la fonction visuelle, puisque son absence retarde le développement des fonctions visuelles et accélère leur déclin. Cette étude souligne également l'influence complexe des récepteurs cannabinoïdes sur la vision et amène à se questionner sur l'innocuité de la consommation de cannabis sur la préservation d'une bonne santé oculaire.

Financement : Supporté par le Conseil de recherches en sciences naturelles et en génie du Canada, l'École d'optométrie, les Études supérieures et postdoctorales de l'Université de Montréal, le Réseau de recherche en santé de la vision et la Fondation J.A. DeSève.

Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

52 - Transfer learning for choroid segmentation

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Goal: The accurate segmentation of the choroid layer of the eye is a key component of an ongoing investigation involving spaceflight associated neuro-ocular syndrome (SANS). SANS designates a group of ocular findings which represent a risk to extended microgravity exposure. Some astronauts present with thicker than average choroids which can be challenging to segment using convolutional neural networks (CNNs) trained on an independent dataset. The present experiment aims to determine the feasibility of leveraging transfer learning to accurately segment thicker than average choroids.

Method: Macular optical coherence tomography (OCT) movies were gathered from both eyes of astronauts before and after long duration spaceflight. Manual segmentations were performed on the first 10 frames of each astronaut OCT movie and a criteria was devised to allow identifying inaccurately segmented movies. Choroid segmentation was performed with 11 CNNs trained on an independent dataset and astronaut movies which met the criteria were identified. The combination of a ResNet-101 encoder and a DeepLabV3+ decoder, both pre-trained on the ImageNet image database, was retrained using a fraction of labelled B-scans from OCT movies which met the criteria for inaccurate segmentation. Segmentations of the resulting model were evaluated for similarity against manual segmentations.

Results: Segmentation results from the repurposed model outperform models trained on an independent dataset on similarity measures with respect to manual segmentations. Unlike the other models, the retrained model produces accurate segmentations according to the established criteria. The retraining strategy is more efficient, exceeding performance of the previous approach on the target task while using two orders of magnitude less labelled samples (tens of thousands vs several hundreds of B-scans).

Conclusion(s): Results suggest that some astronaut choroids lay outside the distribution of choroids in an independent OCT images dataset, preventing CNNs trained on the dataset from generalizing well to new examples. Transfer learning by retraining a CNN pretrained on the ImageNet database is an effective means of achieving adequate choroid segmentation performance on challenging OCT images.

Funding: This work was supported by the Canadian Space Agency (Reference No. 19NASAHER3)

Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

53- The impact of fetal alcohol exposure on retinal response in vervet monkeys

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Goal: The aim of this study is to assess the impacts of fetal alcohol exposure on retinal response in vervet monkeys. This will allow a better understanding of the functional differences observed with controls. The 6 different electroretinography (ERG) parameters allow to measure the activity of specific cell types within the retina and infer potential structural changes that may explain these differences.

Method: ERG was performed in 58 vervet monkeys at the Behavioral Science Foundation in St-Kitts. 25 of them had previously been exposed to various ethanol amounts during the third trimester of pregnancy by voluntary consumption. Ethanol was available during 4 hours per day, 4 days per week and stopped at the end of pregnancy. Electroretinography was performed with the LKC RET*evet* portable device following different ISCEV protocols. 1 set of acquisitions in flash ERG and 1 set of acquisitions in flicker ERG were performed in photopic condition and 4 sets of acquisition were performed at different flash intensities and frequencies in scotopic condition.

Results: The ERG results did not show any significant difference between fetal alcohol exposed individuals and controls.

Conclusion(s): Even though significant differences in fetal alcohol exposed vervet monkeys had previously been observed under different ERG conditions, no significant changes were observed in electroretinography in this study. However, this could be due to the lower sensitivity of our portable device compared to other ERG devices, which makes it more difficult to observe significant differences since the gap is smaller between subjects.

Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

54 - Enhancing autophagy rescues pathological angiogenesis and improves vision in neovascular age-related macular degeneration

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Goal: Nowadays, a high-fat diet favors the development of many age-related eye diseases. Retinal angiomatous proliferation (RAP) accounts for 12-15% of neovascular age-related macular degeneration (NV-AMD) and is a major cause of blindness. In NV-AMD, it is suggested that dysregulated glucose and lipid metabolism in photoreceptors leads to a shortage of fuel, which attracts pathological neovessels to restore energy homeostasis. Photoreceptors can undergo autophagy, a process by which they recycle intracellular nutrients to fuel mitochondria, and excess circulating lipids could disrupt autophagy, leading to a metabolic syndrome phenotype. We hypothesize that restoring autophagy might reduce neovascularization and improve visual functions by alleviating the energy shortage of photoreceptors in NV-AMD.

Method: Pathological retinal neovascularization in a mice model of RAP, which lacks the Very low-density lipoprotein receptor (*Vldlr*$^{-/-}$) was assessed with lectin staining on postnatal day 12 (P12) to P16. Autophagy flux was measured by incorporating a CAG-RFP-EGFP-LC3 reporter construct into our mouse model of RAP. Expression of TFEB, a master regulator of autophagy, was measured by western blot. The role of lipid excess on autophagy in *Vldlr*$^{-/-}$was assessed by deleting *Ffar1* (*Ffar1*$^{-/-}$), a Free Fatty Acid Receptor sensitive to changes in circulating free fatty acids. Rescue of NV-AMD using an autophagy agonist (HPβCD) was assessed by quantification of RAP-like vascular lesions at P16 and electroretinography at P30 in *Vldlr*$^{-/-}$, *Vldlr*$^{-/-}$*Ffar1*$^{-/-}$ and WT mouse. Scotopic and photopic recordings were performed under increasing light intensities.

Results: Pathologic vessels in *Vldlr*$^{-/-}$ retinas originated from the deep vascular plexus and breached the outer plexiform layer at P12, extending towards photoreceptor outer segments at P16. Compared with control retinas, autophagy flux was reduced by more than 60% in *Vldlr*$^{-/-}$ retinas, and TFEB expression was significantly suppressed ($p<0.05$). TFEB levels were rescued by deleting *Ffar1* in *Vldlr*$^{-/-}$ mice and the number of pathological RAP-like vascular lesions were reduced compared to *Vldlr*$^{-/-}$ retina (57%; $p<0.01$). Treatment with autophagy robustly decreased pathological retinal neovascularization and significantly improved vision in *Vldlr*$^{-/-}$ mice (33% increase a-wave; $p<0.01$).

Conclusion(s): Under excessive circulating lipid conditions, down-regulation of autophagy contributes to the onset of AMD-like lesions by preventing fuel supply to mitochondria. Means of restoring autophagy may offer a novel therapeutic strategy to alleviate neovascular AMD and improve vision.

Funding: CIHR

Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

55 - Rôle neuroprotecteur des corps cétoniques dérivés de l'endothélium dans les rétinopathies prolifératives

Charlotte Betus[1], José Carlos Rivera[2, 3], Candace Yang[4], Gaël Cagnone[2], Emilie Heckel[2], Tapan Agnihotri[4], Nahid Tamanna[1], Anli Ren[4, 5], Grant Mitchell[6], Jean-Sébastien Joyal[1, 2, 3, 4, 6]

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Goal: Proliferative retinopathy (PR) is a leading cause of blindness in premature infants and diabetic adults. PR is characterized by the initial loss of retinal blood vessels, leading to retinal ischemia. Surprisingly, few hypoxic neurons die in the process and their survival mechanism is unknown. We hypothesize that pathological neovessels that invade the vitreous in PR secrete local neuroprotective signals essential for the survival of adjacent ischemic neurons. Ketone bodies (KB, mainly β-hydroxybutyrate) derived from fatty acid oxidation, have proliferative actions on endothelial cells (EC), neuroprotective in the brain, and is epigenetic signal directly by inhibiting HDAC activity and modifying acetylation profiles of histones. Here we show that KB in pathological neovessels can be produced locally and have neuroprotective effects on the ischemic retina.

Method: To investigate the impact of KB production in PR, we depleted a critical enzyme of ketogenesis, HMG CoA lyase (Hmgcl), in EC (Tek-Cre; $Hmgcl^{fl/fl}$) and hepatocytes (Alb-Cre; $Hmgcl^{fl/fl}$). We used the oxygen-induced retinopathy (OIR) model of PR. Briefly, mice pups were exposed to 75% O_2 from postnatal days 7 (P7) to P12, causing vaso-obliteration (VO). Mice were then returned to room air for 5 days, resulting in relative hypoxia and subsequent neovascularization (NV). Single-cell transcriptomic retinas were performed in mice exposed to PR and normoxic controls. We localized the expression of Hmgcl in vessels (lectin) by immunofluorescence of retinal flat-mounts at P17. Measurement of ketones levels in the vitreous and retinas were assessed by mass spectrometry (LC/MS/MS) in humans and OIR mice. Blood ketones levels were tested with strips in OIR exposed-mice. *Ex vivo* aortic ring sprouting assays were performed in aortas from Hmgcl-depleted ECs and wild-type (WT) control. The retinal function of mutant and WT mice was assessed by electroretinogram (ERG) and photopic negative response (PhNR) at P21. To investigate the epigenetic signals of ketones, we measured H3K9 acetylation expression in OIR P17 retinas by Western blot.

Results: Single-cell transcriptomics and immunofluorescence localized the expression of the ketogenic enzyme *Hmgcl* to pathological tufts in PR. Metabolomics analysis confirmed precursors of KB accumulation in PR patients, and targeted metabolomics analysis of ketones also showed an accumulation in mice exposed to OIR. Interestingly, conditional deletion of *Hmgcl* in EC, but not in the liver, significantly reduced pathological neovascular tufts in mice exposed to OIR. Endothelial *Hmgcl*-depletion also showed decreased vitreous B-HB levels and microvascular sprouting in the aortic ring angiogenesis assay. As expected, decreased negative photopic response signals in the electroretinogram of TekCre-Cre; $Hmgcl^{fl/f}$ mice corroborated the compromised neuronal function of bipolar and retinal ganglion cells (RGCs). Finally, to explore ketolysis as a neuroprotective mechanism, mRNA levels of Oxct1 were overexpressed in RGCs from mice in OIR conditions compared to normoxic, and H3K9 acetylation was increased in OIR retinas.

Conclusion(s): Ketone bodies (KB) derived from pathological neovessels in PR might have neuroprotective effects, by providing fuel and possibly through epigenetic signaling in retinal ganglion cells.

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Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

56 - Impact of kinin B1 receptor antagonism on visual function and choroidal neovascularization and inflammation in a mouse model of age-related macular degeneration

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Goal: Neovascular age-related macular degeneration (AMD), a retinal degenerative disease is devastating in terms of vision loss. Current treatments try to counteract neovascularization processes, but inflammation during AMD still maintain the degenerative cascade. The pro-inflammatory kallikrein-kinin system (KKS) contribution to vascular inflammation and neovascularization particularly via the kinin B_1 receptor (B_1R) is distinctly known. The aim of the present study is to determine the protective effects of the topical administration of the metabolically stable and selective antagonist B_1R (R-954) on inflammation, neovascularization, and retinal dysfunction in a murine model of neovascular AMD.

Method: The choroidal neovascularization (CNV) lesion was developed in C57Bl6 mice by creating a five 100 µm laser burns on the Bruch's membrane around the optic nerve using an argon laser. A treatment with ocular drops of R-954 (100 µg/ 15 µl, twice daily in both eyes), or vehicle, was started immediately after laser induction and continued twice every day for 7, 14 or 21 days in three different experimental groups. Changes in the visual functions were evaluated by measuring amplitude and peak latency at day 0, 2 and 7 after CNV by scotopic electroretinography (ERG). The distribution and expression of B_1R during CNV development was studied using selective markers and imaged using confocal microscopy. CNV regression was monitored by measuring the area and volume of CNV lesions using ImageJ.

Results: CNV, invasive microglia and B_1R immunoreactive glial cells, as well as electroretinography alterations, were observed within retina and choroid of the CNV group but not in the control group. The staining of B_1R was abolished by R-954 treatment as well as the proliferation of microglia. R-954 treatment prevented the CNV development (volume: 20 ± 2 vs 152 ± 5 x $10^4 \mu m^3$ in R-954 vs saline treatment). R-954 also significantly decreased photoreceptor and bipolar cell dysfunction (a-wave amplitude: -47 ± 20 vs -34 ± 14 µV and b-wave amplitude: 101 ± 27 vs 64 ± 17 µV in R-954 vs saline treatment, day 7) as well as angiogenesis tufts in retina.

Conclusions: The study provides the evidence of involvement of B_1R in reducing retinal function as well as increased retinal and choroidal inflammation and neovascularization in the laser induced AMD mouse model. However, treatment with R954 restore the photoreceptor and bipolar cell function in addition of protection of retinal and choroidal integrity and function by inhibition of B_1R-enhanced inflammation and neovascularization. Hence, the non-invasive, self-administration of R-954 by eye-drop treatment could be a promising therapy in AMD to preserve retinal health and vision.

Funding: CIHR

Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

57 - SGOL1 REGULATES ANGIOGENESIS AND ENDOTHELIAL SENESCENCE IN THE RETINA

Mathilde Bizou[1, 2], Damien Maggiorani[1, 3], Joséphine Lenfant[1], Emilie Heckel[1], Gregor Andelfinger[1, 4], Jean-Sébastien Joyal[1, 4, 5, 6, 7], Alexandre Dubrac[1, 2, 3]

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Goal: Shugoshin-1 (SGOL1) is a protein of cohesin complex implicated in cell cycle regulation. Dysregulation of SGOL1 is implicated in Chronic Atrial and Intestinal Dysrhythmia (CAID) syndrome. These patients with recessive SGOL1 mutation (SGOL1 K23E mutation, where the lysine is replaced at position 23 by glutamic acid) develop dysrhythmia in pace-making tissues, the heart and the intestine. More recently, studies have shown that these patients also develop brain hemorrhages, suggesting a potential role for sgol1 in vascular biology where his functions remain unknown. Here, we aim to identify the functions of endothelial SGOL1 in vascular biology using the postnatal retinal angiogenesis mouse model.

Method: We developed conditional postnatal mice in which *Sgol1* is specifically deleted in endothelial cells (ECs). To study SGOL1 mutation found in human pathology, we also developed a mouse model in which *Sgol1 K23E* mutation is exclusively expressed in ECs.

Results: Our preliminary results show that postnatal endothelial deletion of Sgol1 (*Sgol1iEKO*) leads to important vascular defects as soon as postnatal day 5 (P5). *Sgol1iEKO* mice show a delay in retinal vascular outgrowth and an angiogenic sprouting inhibition. Mechanistically, we found that SGOL1 deletion induces cell cycle arrest and spontaneous senescence in ECs *in vitro*. Furthermore, electroretinograms revealed that loss of endothelial SGOL1 has adverse effects on neuronal functions in the retina. Moreover, endothelial expression of *Sgol1 K23E* mutation recapitulates *Sgol1iEKO* retinal vascular phenotype to some extent.

Conclusion(s): Our findings suggest that endothelial SGOL1 plays a central role in retinal angiogenesis and neuronal homeostasis. These findings raise the possibility that vascular defects in SGOL1 may have broader implications in other tissues affected by CAID syndrome such as the brain, gut, and heart. To date, there are no available treatments for this chronic disease and further research into the endothelial function of SGOL1 could potentially lead to therapeutic strategies for patients. In addition, our results highlighted the impact that EC senescence could have on neuronal function and vision loss. Understanding the role of SGOL1 in EC biology may offer new insights into the comprehension of pathological development of age-related pathologies leading to vision loss.

Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

58 - K2000 deletion mitigates pathological angiogenesis in mouse model of ischemic retinopathy

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Goal: In a quest to elucidate pathways involved in pathological angiogenesis, we identified a gene highly regulated in a mouse model of oxygen-induced retinopathy (OIR) we named *K2000. K2000* is highly evolutionary conserved and with human homolog. Currently, its function is unknown and its reported expression in broad tissue expression screens suggests restricted to testes and tumor environment. We therefore genetically engineered a mouse with *K2000* deletion (*K2000*$^{-/-}$) and studied its potential role in pathological retinal angiogenesis.

Method: Bulk RNA sequencing analysis (RNAseq) was performed on retinas from P14, P17 and P30 OIR (OIR model: P7-P12 75% O_2; P12-P17 21% O_2) or normoxic C57BL/6J mice. CRISPR/Cas9 engineering was used to produce *K2000*$^{-/-}$ in a C57BL/6J genetic background. In OIR, retinal avascular areas were assessed at P12 and P17 and neovascularization was assessed at P17. Choroidal neovascularization (CNV) was induced in 8-week-old males by rupturing Bruch's membrane by argon laser. Fourteen days after induction of CNV, mice were perfused with fluorescein isocyanate-dextran (FITC). Fixed choroids were labeled with Isolectin-B4 (IB4). In accordance with data sets collected, statistical analyses were performed using the exact Fisher's test, the unpaired t-test with Welch's correction, or the Mann-Whitney test. Correlations were assessed using the Pearson r test, after screening for potential outliers using the Root method (Q=5%).

Results: RNAseq revealed downregulation of *K2000* expression (log2 FC=-3.4, p=0.02) in OIR wild type C57BL/6J (WT) mice at P30. Engineered *K2000*$^{-/-}$ were fully viable. When *K2000*$^{-/-}$ mice were bred, the number of pups per litter was reduced (Q_1=4.0, M=6.0, Q_3=7.5, n=136 pups) compared to WT mice (Q_1=5.0, M=7.0, Q_3=8.0, n=630 pups; p<0.01). In contrast, the female-to-male ratio did not significantly change between K2000$^{-/-}$ (47.52% females [95% CI 43.5 to 51.5], n=604 mice) and WT (50.29% females [95% CI 48.0 to 52.5], n=1907; p=0.24). In OIR at P12, *K2000*$^{-/-}$ did not have similar magnitudes of avascular areas (38.0%, SEM±0.8, n=15 pups) compared to WT (38.4%, SEM±0.7, n=18 pups; p=0.72). At P17, *K2000*$^{-/-}$ showed reduction in both avascular areas (15.4%, SEM±0.7, n=23 mice) compared to WT mice (17,4% SEM±0.6, n=21 mice; p<0.01) and neovascular area (5.30%, SEM±0.22, n=23 mice) compared to WT (6.65%, SEM±0.36; p<0.01). Additionally, at P17, we found that in contrast to WT (r=0.61 [95% CI 0.23 to 0.83], n=20; p<0.01), neovascular area in K2000$^{-/-}$ mice did not correlate with avascular area (r=0.23 [95% CI -0.20 to 0.58], n=23; p=0.30). Conversely, there were no significant differences in CNV model with respect to neovascular area (FITC, Log 2 FC=-0.02, p=0.96), burn scarring area (IB4, log 2 FC=-0.13, p=0.40) or the FITC/IB4 ratio (log 2 FC=0.11, p=0.64) between WT and *K2000*$^{-/-}$ (n=43 burns [7 mice]) vs WT (n=94 burns [17 mice]).

Conclusion(s): K2000 may contribute to the angiogenic response to hypoxia. Structural and functional analyses of the K2000 gene product are ongoing.

Funding: FROUM

Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

59 - Uncovering the role of Podocalyxin-like Protein (Podxl) in photoreceptor polarity and function

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Background: Cell polarity is defined as the asymmetric distribution of cellular components and is essential for proper functioning of the nervous system. In the retina, rod and cone photoreceptor cells are highly polarized. The apical domain of photoreceptors consists of the inner and outer segment, whereas the basal domain contains the cell body and synaptic contacts with second-order retinal interneurons. While the maintenance of these distinct functional compartments is critical to photoreceptor function and survival, it remains unclear how this is achieved. The Podocalyxin-like protein (Podxl) poses as an interesting candidate to play a role in this process. Initially identified in kidney podocytes as an anti-adhesion protein due to its negatively charged extracellular domain, Podxl has since been implicated in many polarized processes, such as epithelial cell maturation, cell migration, microvilli formation, neural development, and synaptogenesis.

Goal: Considering that Podxl is thought to exclude certain proteins from the apical domain in other cells, we hypothesize that Podxl plays a critical role in the maintenance of photoreceptor polarity and protein localization to support light-sensitivity. Accordingly, this project aims to elucidate whether Podxl is required for the maintenance of photoreceptor polarity and if Podxl absence in the retina affects vision.

Methods / Results: Using immunostaining on adult mouse retinas, we found that Podxl localizes to the inner segments of both rod and cone photoreceptors, and to the outer plexiform layer. To study the distinct roles of Podxl in each photoreceptor cell type, we developed cone- and rod-specific conditional *Podxl* knockout (cKO) mouse lines. In the cone-specific *Podxl* cKO mouse line, we found a reduction in the amplitudes of both a- and b-wave electroretinogram (ERG) recordings evoked by high intensity light flashes in photopic conditions. Preliminary data in the rod-specific *Podxl* cKO line suggest a similar decrease of ERG response in scotopic conditions. While we did not observe any neurodegeneration phenotypes upon Podxl ablation, our ERG results suggest a role for Podxl in light-induced photoreceptor activity and/or signal transmission to interneurons via a role in synapse formation and/or maintenance. To understand how Podxl functions in photoreceptors, we performed an unbiased proteomic screen in the adult mouse retina, identifying novel Podxl interacting partners through *in vivo* immunoprecipitation and mass spectrometry. Using this approach, we identified several candidates that could potentially interact with Podxl to regulate photoreceptor function, including ion channels involved in photoreceptor light-response and proteins constitutive of the photoreceptor-specific ribbon synapse.

Conclusion(s): Taken together, these results suggest an important role for Podxl in photoreceptor mediated light-response and/or signal transmission. This project will make a substantial contribution to the field of retinal and cellular neurobiology, as the role of Podxl has never been investigated in the retina. Considering Podxl is expressed in a subset of neurons and is involved in synaptogenesis in the brain, we anticipate that uncovering the role of Podxl in photoreceptor biology may also lead to a better understanding of the principles involved in neuronal maturation in the central nervous system, which may provide ways to reconstruct neural circuits in disease.

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60 - Cell division orientation regulates tissue size in the developing retina and neocortex

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Goal: The accurate regulation of cell number and identity during development is critical for the formation of a fully functional nervous system, but the mechanisms coordinating cell proliferation with differentiation remain ill defined. In the developing neocortex, the regulation of neuronal cell number involves different subtypes of progenitors undergoing mitosis at various apico-basal locations, whereas retinogenesis is achieved by a single type of equipotent progenitor undergoing mitosis at the apical surface. Interestingly, the cortical expansion observed in humans is thought to be achieved by basally-dividing progenitors called outer Radial Glial Cells (oRGC), which are produced by radial glia dividing with their mitotic spindle aligned 'vertically' along the apico-basal axis. Whether vertical divisions are sufficient to generate basal progenitors in other CNS regions like the retina remains unknown.

Method: Recently, we showed that the G-protein signaling modulator GPSM2 and the adaptor protein SAPCD2 regulate cell division orientation and asymmetric neurogenic divisions at late stages of retinal development, but their role in proliferative divisions remain unknown. To explore this question, we generated *Gpsm2/Sapcd2* double knock-out mice (dKO) and studied retinal and cortical development at different stages.

Results: We found a drastic switch from horizontal to vertical divisions in both the retina and cortex, which was accompanied by an overproduction of basally-dividing progenitors and hyperplasia in both tissues, including the generation of an extra neuronal layer. Using single-cell RNA sequencing, we found that progenitors generated in the dKO cortex present oRGC features while the identity of retinal basal progenitor remains more elusive. However, it seems that in both cases deregulation of the Hippo pathway is involved.

Conclusion(s): These findings show that vertical divisions are sufficient to the production of basal progenitors in the retina and neocortex and identify a common mechanism regulating tissue size through mitotic spindle orientation.

Funding: CIHR

Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

61 - Optimizing LNP Composition to co-delivery miRNAs and chemotherapy agents

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Goal: Treatment of Rb with current remedies is risk-adapted, inefficient, and may lead to complicated cytotoxic side effects. Alternative treatments that maximize specificity and localization and decrease cytotoxic side effects are urgently needed. The present study aims to screen and select the best cationic lipid to compose a lipid nanoparticle (LNPs), for the future co-delivery of miRNA (non-coding RNAs that affect cell proliferation, differentiation, and migration) and chemotherapeutic drugs for the treatment of seeded retinoblastoma.

Method: A retinoblastoma cell line (Y-79, HTB-18, ATCC) was seeded with different concentrations of vincristine and docetaxel. At 72h post-treatment, the viability of Rb cells in vitro was analysed using 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (Prestoblue) and fluorometric changes were quantified using a spectrofluorometer. The physical-chemical characterization of the LNPs was made through the dynamic light scattering (DLS) used to measure the hydrodynamic diameter of the resulting LNPs containing four different cationic lipids (MC3, DODMA, CSL3 and ALC 0315) with or without miRNA GAPDH (housekeeping gene). All the measurements were done at 20 °C using a Malvern Zetasizer Nano ZS. Size measurements are reported using the *Z*-Average value. ζ-potential measurements were realized at 20 °C using the Smoluchowski model. For both DLS and ζ-potential measurements, nanoparticles were diluted fourteen times in water (final volume 0,75 mL). The encapsulation efficiency of miRNA GAPDH was quantified indirectly by fluorescence displacement assay using SYBR® Gold. The delivery efficiency of the four LNPs was evaluated through gene silencing by real-time quantitative RT-qPCR.

Results: The 50% inhibitory concentration (IC_{50} value) for Y79 cells were 0.11 and 118 nM for vincristine and docetaxel respectively. In the present study, the LNP containing ALC0315 as a cationic lipid showed the smallest size (120±1 nm) and the CSL3 as the biggest (157±1 nm). As expected, all the LNPs presented a positive charge with the highest value for MC3 (29±1) and the lowest DODMA (11±1). Among the LNPs-optimized, those containing MC3 and DODMA showed a high-efficiency encapsulation profile (85,82% and 85,12%) and the best behavior delivering miRNA.

Conclusion(s): Our results suggest that vincristine is the best candidate to be co-loaded with miRNA into LNP-optimized containing MC3 or DODMA valeted in the present study.

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62 - Calcium clearance deficits linked to endoplasmic reticulum stress are signature features of early retinal ganglion cell damage in glaucoma

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Goal: The mechanisms underlying retinal ganglion cell (RGC) vulnerability in glaucoma are poorly understood. We tested the hypothesis that retinal ganglion cell (RGC) calcium (Ca^{2+}) dynamics are affected in the early stages of ocular hypertension (OHT) and probed the mechanisms underlying this response.

Method: Two-photon laser scanning microscopy (TPLSM) was used to record light-evoked single-RGC Ca^{2+} dynamics in transgenic mice carrying the Ca^{2+} sensor GCaMP6f. OHT was induced by intracameral injection of magnetic microbeads, and Ca^{2+} signals were recorded two weeks later, prior to RGC loss. TPLSM imaging was performed in living anesthetized mice by longitudinal trans-scleral imaging as well as ex vivo in retinal explants. Ca^{2+} signals were extracted, and the parameters computed included rise time (Ca^{2+} influx), decay time (Ca^{2+} clearance), and amplitude. A set of approaches was used to examine RGC-specific pathways, including single-cell (sc)-RNAseq, qRTPCR, FACS, flow cytometry, and immunohistochemistry.

Results: Live trans-scleral and ex vivo imaging showed consistent defects in Ca^{2+} clearance across all RGC types (N=5-8 mice/group, n>1,200 RGCs, $p<0.01$). For example, ON-RGCs subjected to OHT displayed an increase in Ca^{2+} decay time relative to sham controls (sham: 1.1 ± 0.08 sec, OHT: 2.8 ± 0.5 sec, N=7-8 mice/group, n=62 cells/group, $p<0.01$). Analysis of molecular pathways revealed an RGC-specific reduction in gene and protein expression of the endoplasmic reticulum (ER) Ca^{2+} ATPase 2 (SERCA2), which is responsible for pumping Ca^{2+} from the cytoplasm to the ER. Loss of SERCA2 was accompanied by upregulation of the ER stress markers pPERK, pEIF-2a, ATF4, and CHOP. TPLSM recordings in naïve mice treated with a pharmacological inhibitor of SERCA2 showed Ca^{2+} clearance impairment in RGCs, recapitulating the effect of OHT. In contrast, glaucomatous eyes treated with a SERCA2-specific activator restored the ability of RGCs to effectively reduce cytoplasmic Ca^{2+} to physiological levels.

Conclusions: Our study reveals defective Ca^{2+} clearance as a signature feature of early RGC damage, a trait conserved across RGC subtypes, and suggests that loss of SERCA2 has a profoundly detrimental effect on the ability of these neurons to regulate cytoplasmic Ca^{2+}.

Funding: This work was funded by a grant to ADP from the Canadian Institutes of Health Research (CIHR). AGRO is supported by a PhD fellowship from the Fonds de recherche du Québec (FRQS), and AK holds a Canada Research Chair (Tier 2). YS is supported by a postdoctoral fellowship from the FRQS and CIHR, and ADP holds a Canada Research Chair (Tier 1).

Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

63 - Age-related choroidal involution is associated with a local reduction of endothelial progenitor cells in vascular bed through the acquisition of senescence phenotype: impact in ischemic retinopathies

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Goal: Choroidal involution that in turn, are associated with retinal photoreceptors lost are a common featuring in age-related maculopathies (AMD). It is now well recognized that bone-marrow derived endothelial progenitor cells-CD34+ (EPCs) are essential for vascular repair process and maintains ocular vascular integrity. However, the contribution of EPCs and the associated mechanism related to senescence-acquisition involved in age-related vascular degeneration, particularly in the choroid remains to be investigated. In this study, we compared in vivo, the physiological activity of EPCs in young rat choroid (6 week) vs aging-choroid (16-18 month) and analyzed the expression of senescence markers in EPC.

Method: We isolated the retina of young (6 week) and old rats (16-18 month) to assessed by immunostaining of retinal cryosections, the choroidal thickness (lectin staining), photoreceptor number (DAPI) and the number of EPCs (CD34/CD133 staining) co-localized in choroidal vessels. In addition, we performed next generation sequencing (NGS) to compare the gene expression profile of young vs old rat choroid including for senescent and EPC markers.

Results: Old rats display a significant decrease in choroidal thickness associated with fewer photoreceptors compared to retinas of young rats. These changes are associated with a reduced number of EPCs in choroid. In addition, an increased expression of senescence marker p53 combined with a reduced level of Lamin-B1 (Lamin-B1 is downregulated in senescence) is observed in EPCs. To better understand processes associated with age-related choroidal involution, we next analyzed the mRNA and miRNA expression profile of old and young rat choroids using NGS. First, we found in whole genome 802 significantly modulated genes that correspond to ~2% of total genes expressed. Among the 802 genes, we identified a global downregulation of EPC markers (CXCR4, CD34, CD117, CD133 and CD136) in choroid of old rats, associated with an upregulation of senescence markers p53, p21, p16 (involved in cell cycle arrest) and a downregulation of Lamin-B1. Moreover, 13 miRNAs were significantly modulated in choroid of old rats. Bioinformatic predictors suggested that these miRNAs are in inflammatory processes, p53 signaling and regulation of cell cycle arrest.

Conclusion(s): Our results suggest that age-related choroidal involution is associated with reduced numbers of EPCs colocalized with choroidal vessels and associated with senescence-like phenotype. We propose that bioengineering of EPCs with senolytic agents could potentially provide a new strategy to preserve vascular integrity particularly of the aged choroid, which may predispose to maculopathies.

Funding: MITAC and IRSC

Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

64 - The effect of the adipose tissue-eye axis on choroidal neovascularization via PRDM16

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Goal: Age-related macular degeneration (AMD) is a neovascular eye disease characterized by proliferation of pathological neovessels known as choroidal neovascularization (CNV) that lead to loss of central vision. Obesity represents a risk factor for AMD, it is linked to adipose tissue (AT) expansion, impacts brown adipose tissue thermogenesis, and reduces the browning process (conversion of white adipocytes to beige) in AT. The role of browning in the progression of distal diseases including AMD is unknown. The objective of this research is to determine whether AT browning is involved in CNV formation.

Method: CNV was induced by argon laser in male *C57BL/6J, AQ: Prdm16$^{+/+}$ or AQ: Prdm16$^{-/-}$* mice. AT browning and inflammation were assessed by qPCR and Western blots in white (WAT), beige (BgAT), and brown (BAT) adipose tissue during CNV. PRDM16 implication was assessed using an AT-specific PRDM16 KO model in the which AT browning was inhibited by tamoxifen treatment of *AQ: Prdm16$^{-/-}$* mice. Impact of AT browning reintroduction on CNV was determined by adipose tissue transplant (ATT) of BgAT into browning deficient mice (*AQ: Prdm16$^{-/-}$* mice). CNV size was assessed in RPE-choroid-sclera flatmounts.

Results: Three days after laser CNV, a significant induction of browning markers (UCP1 and PGC1α) was observed solely in BgAT. However, 14 days after laser, UCP1 protein levels were significantly decreased in BgAT. qPCR analysis demonstrated a significant increase in pro-inflammatory markers in BgAT. Inhibition of AT browning in AQ: Prdm16$^{-/-}$ mice significantly decreased CNV size, while reintroduction of BgAT via ATT significantly increased CNV size 14 days after laser.

Conclusions: Our data demonstrates that laser CNV can trigger expression of browning markers and induce inflammation in AT. Inhibition of AT browning reduces CNV, whereas AT browning exacerbates CNV formation. These results suggest a potential role for deregulation AT browning in nAMD.

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Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

65 - PAR6 role in retinal blood vessel development

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Goal: The vascular system in the retina plays a pivotal role in maintaining the health and functionality of the eye. Retinal vasculature is essential for delivering oxygen and nutrients to the neuroretina, ensuring its proper function and preserving vision. Neovascular intraocular diseases are the leading cause of vision loss in the industrial world, affecting millions of people worldwide. They include retinopathy of prematurity (ROP) and diabetic retinopathy (PDR), characterized by retinal vaso-obliteration and retinal ischemia, leading to pathological angiogenesis. While current therapeutic strategies focus on inhibiting pathological angiogenesis, there is no treatment to improve retinal revascularization. Previous work in the laboratory shows that Transforming Growth Factor β (TGFβ) is essential for retinal revascularization in angiogenesis in the oxygen-induced retinopathy (OIR) mouse model, through a non-canonical ALK5 receptor pathway. Among non-canonical pathways, ALK5 recruits the PAR6 protein to regulate the polarity and migration of epithelial cells and neurons. In the endothelium, it is only known that PAR6 is essential for EC polarity in response to hemodynamic forces induced by blood flow, but knowledge is still limited. **Therefore, the aim of my project is to identify the role of endothelial PAR6 in retinal vascularization.**

Method: To determine the PAR6 expression profile we used single-cell data from retinal endothelial cells previously generated in the lab. Next, we have developed new transgenic mice for inducible *Pard6* genes deletion specifically in the endothelium. To induce postnatal deletion, we inject tamoxifen (50µg) into P1, P2, and P3 and we analyze the vascular phenotype at P6.

Results: There are three different PAR6 genes, *Pard6a*, *Pard6b* and *Pard6g*. First, our single-cell data show that only *Pard6a* and *Pard6g* are expressed in the endothelium. While *Pard6a* deletion induced a modest vascular phenotype, *Pard6g*iECKO mice exhibited a strong decrease in retinal vascular areas, radial migration, sprouting, and less branching. Moreover, there is a decrease in the venous diameter. Our single-cell data identified a venous zonation of *Pard6g* expression, with an absence of arterial expression. Arteries are high-flow regions, while veins are low-flow regions, suggesting that flow-induced shear stress could regulate *Pard6g* expression. We found that arterial-like shear stress strongly inhibited *Pard6g* expression in endothelial cells *in vitro*, which is consistent with its expression profile.

Conclusion(s): Our preliminary results show that PAR6, especially PAR6G, is important for the development of blood vessels in the mouse retina. Furthermore, *Pard6g* is enriched in venous proliferative endothelial cells. Then, we want to determine its role in cell proliferation and test whether inhibiting *Pard6g* expression can inhibit pathological proliferative angiogenesis in the OIR model. This work could ultimately lead to the identification of new therapeutic strategies for the treatment of retinopathies.

66 - Langerhans islets transplantation in the eye to promote neuronal regeneration during glaucoma

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Goal: Glaucoma is the main cause of irreversible blindness in the world. It is a neurodegenerative disease caused by the death of the retinal ganglion cells (RGCs), long projecting neurons that convey visual information from the retina to the brain. We previously showed that insulin daily eye drops administration to glaucomatous mice promoted RGC dendrite and synapse regeneration, restored RGC function, and improved vision. However, the modality of insulin application as eye drops can be limiting for insulin to reach the retina in humans because of different eye anatomy.

Method: For this, we transplanted Langerhans islets (LI), containing the specialized insulin-secreting beta-cells, in the eye to produce insulin locally. LI were isolated from mice pancreas using enzymatic digestion with collagenase. Around 50 islets were transplanted per eye using a 27G needle. The islets were transplanted directly on the iris without touching the lens nor blocking the iridocorneal angle. One month after transplantation, the iris was imaged and insulin level in the anterior and posterior chamber was majored using radioimmunology.

Results: Insulin expression was significantly increased in the posterior and anterior chambers in transplanted eyes compared to sham-operated eyes. Iris imaging using micron IV showed that Langerhans islets were stable and vascularised from the iris.

Conclusion(s): Our finding suggests a potential role of LI transplantation in the eye to deliver insulin directly to the retina to promote neuronal regeneration during glaucoma. We will test whether LI transplantation improves RGC function and vision during glaucoma. Other potential molecules can be secreted by cells of LI to promote retinal neuron regeneration during glaucoma. We will explore further this possibility.

Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

67 - L'impact de la pandémie COVID-19 sur l'accès aux soins en glaucome au CHUM

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But : La pandémie de COVID-19 a eu un impact considérable sur la prise en charge des patients en ophtalmologie dont l'étendue n'est toujours pas élucidée. Dans cette étude rétrospective, notre objectif est d'évaluer l'adaptation des services de soins en glaucome face à ce contexte, au fil des années 2019 à 2022.

Méthode : Les données cliniques des patients nouvellement référés au service de glaucome du CHUM entre mars et juin, avant et après la pandémie (2019 à 2022) ont été comparées. Des entrevues téléphoniques sont menées auprès des patients consentants pour recueillir leurs informations socioéconomiques et pour mieux évaluer leur appréhension face à la COVID-19, en utilisant un questionnaire validé à ce sujet, « *Fear of COVID-19 Scale* ». Les issues primaires à l'étude sont : le délai d'attente initial, le pourcentage d'urgences glaucomateuses[i], la sévérité de la maladie, et les approches thérapeutiques adoptées par les spécialistes en glaucome.

Résultats : 590 nouvelles consultations étaient éligibles pour les périodes à l'étude. Les patients, d'un âge médian de 63 ans, partageaient des caractéristiques démographiques et des antécédents oculaires comparables.

Concernant l'accès aux soins, le délai d'attente pour une première consultation a significativement augmenté entre 2019 et 2022 (7.3 ± 0.5 semaines à 13.3 ± 1.5 semaines, respectivement), à l'instar du pourcentage de retard dans le respect des délais initialement prévus qui atteint 55.6% en 2022 comparativement à 8.5% avant la pandémie. En relation à 2019, le nombre de nouvelles consultations a quant à lui diminué de 44% en 2020 et de 20.4% en 2022. Le pourcentage de tests essentiels (CV et OCT) effectués, le nombre de consultations annulées et les sources de références sont demeurées stables, avec une majorité des cas référés par des ophtalmologistes à 72,3% en 2022.

Concernant la prise en charge, le degré de sévérité initial de la maladie a augmenté de manière non-significative après la pandémie[ii]. Le pourcentage d'urgences glaucomateuses a significativement diminué, passant de 31.6% en 2019 à 16.4% en 2022 ($p < 0.01$). Pour ces consultations, la proportion d'interventions chirurgicales a diminué (14.1% en 2019 par rapport à 12.6% en 2022). Après la pandémie, le pourcentage de patients n'ayant reçu aucun traitement a connu une augmentation significative ($p < 0.01$), tout comme le pourcentage n'ayant eu aucun suivi ($p < 0.01$).

Le niveau d'appréhension face à la COVID-19 est demeuré stable au fil des ans et ne semble pas corréler avec l'absentéisme aux rendez-vous ni avec les délais de retard.

Conclusion(s) : La pandémie de COVID-19 a eu un impact négatif sur l'accès aux soins pour les patients nouvellement référés au service de glaucome du CHUM, spécifiquement en termes de délais d'attentes pour une première consultation. Le niveau d'appréhension face à la COVID-19 ne semble pas expliquer ces constations. D'autres entretiens téléphoniques sont en cours pour valider cette observation.

[i] Urgences glaucomateuses : définies comme la nécessité de subir une intervention chirurgicale ou par laser au courant du premier mois suivant la consultation initiale

[ii] 28.2% de glaucomes suspects, 29.8% légers, 10.7% modérés et 28.2% sévères, en 2022 selon les critères établis par la Société canadienne d'Ophtalmologie

68 - Deciphering the role of endothelial and pericytes mTOR in retina angiogenesis

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Goal: Mammalian target of rapamycin (mTOR) pathway regulates critical cellular functions including growth and proliferation. Thus, mTOR dysregulation have been shown in various diseases like metabolic disorders and cancer as well as ocular degenerative diseases like age-related macular degeneration or diabetic retinopathy. While rapamycin treatment, inhibiting mTOR pathway, has been shown to regulate physiological and pathological angiogenesis, the role of mTOR specifically in the endothelial cells and the pericytes in still unexplored.

Therefore, the first objective of this project is to understand the specific role of endothelial and pericyte mTOR in the retina vascularization during development.

Method / Results: We generated 4 new transgenic mouse lines to increase (TSC1 l/l) or decrease (Rptor l/l) mTOR activation specifically in the pericytes (Pdgfrb Cre ERT2) or the endothelial cells (Cdh5 Cre ERT2). While the specific deletion of TSC1 in the pericytes does not impact the vascularization, in endothelial mutant mice, TSC1 deletion induces a hyper-proliferation and an abnormal vascularization with impaired outgrowth. Rptor deletion, whether it is restricted to pericytes or endothelial cells, impaires outgrowth and branching induces retinal vascular defects correlated with a decrease of the proliferation and migration in vitro.

Furthermore, and despite their physiological and pathological importance, pericyte-endothelial cells interactions are still largely unknown. Thus, we will investigate how the deletion of Rptor in endothelial cells impacts the pericytes and vice versa.

Conclusion(s): Overall, this project should help understand the complexity of the mTOR pathway and its regulation in physiological context to pave the way to further studies in pathological context and thus improve patient health care.

Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

69 - Investigating the role of p21CIP1/WAF1 in retinal vascular disease

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Goal: Among vision-threatening pathologies, retinal vascular disease is the leading cause of blindness in Western countries. We previously identified that pathological neovascularization during oxygen-induced retinopathy (OIR) engage programs of cellular senescence. Cellular senescence is associated with the expression of genes involved in cell cycle arrest, such as $p16^{INK4A}$ and $p21^{CIP1/WAF1}$. Although we demonstrated that ablation of $p16^{INK4A}$-expressing cells can halt pathological angiogenesis, the role of $p21^{CIP1/WAF1}$ is yet to be studied.

Method: Experimental pathological angiogenesis was achieved using oxygen-induced retinopathy (OIR; 75% O_2 from P7 to P12) and laser-induced choroidal neovascularization (CNV) with mice deficient in $p21^{CIP1/WAF1}$ (p21KO) and control C57Bl6/J (wildtype) mice. In OIR, the vasculature was analyzed at P14 and P17 with retina whole-mount preparations (immunohistochemistry) and the inflammatory profile of the retina was investigated by whole-retina qPCR. Laser-induced CNV was performed on 7-8-week-old males by rupturing the Bruch's membrane using an argon laser. 14 days after CNV induction, mice were perfused with fluorescein isocyanate-dextran (FITC-dextran). Additionally, fixed choroids were labelled with Isolectin-B4 (IB4). 3 days after CNV induction, RPE-choroid-sclera complexes were collected for qPCR to investigate the inflammatory response.

Results: P21KO mice are less likely to survive the OIR-related oxygen challenge. However, surviving pups had reduced pathological neovascularization at P17 OIR. No changes were observed regarding vascular regeneration of the retina at P14 or P17 OIR. We observed a similar trend of several retinopathy marker genes, including *Vegfa*, *Serpine1*, *Il6*, *Il1b*, and *Tnf*, at P14 and P17 OIR in the p21KO mice. In the laser-induced CNV model, we found decreased CNV area (FITC-dextran) and a decreased burn area (IB4) in p21KO mice at D14. We also found a decrease of *Il1b* expression in P21KO mice RPE-choroid-sclera complexes at D3, though no changes were observed in *Vegfa* or *Il6* expression between p21KO and controls.

Conclusion(s): Systemically, expression of $p21^{CIP1/WAF1}$ may play a crucial role in controlling homeostasis regulation after hypoxic insult. In retinal and choroidal tissues, pathological neovascularization appears to be supported by $p21^{CIP1/WAF1}$, though investigations into its specific function are ongoing.

70 - Light instructs planar cell polarity in mammalian cone photoreceptors

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Goal: The coordinated spatial arrangement of organelles within the plane of a tissue, generally referred to as Planar Cell Polarity (PCP), is critical for various processes ranging from organogenesis to sensory detection. Decades of work showed that the establishment of PCP depends on gradients of morphogens and their receptors, but whether non-molecular cues, akin to phototropism in plants, might play a part in setting up PCP in animals remains unknown.

Method / Results: Here we used 3D reconstructions of the mouse retina to show that the basal body of newborn photoreceptor cells is centrally positioned, but then moves laterally around the first post-natal week. During the second postnatal week, when eyes open, the position of basal bodies of cone photoreceptor cilia, but not rods, becomes coordinated across the tissue plane to face the center of the retina. We further show that light is required during a critical window to instruct cone PCP.

Conclusion(s): Mechanistically, we report that light triggers a non-canonical cascade leading to cone transducin interaction with the G-protein signaling modulator protein 2 (GPSM2), which in turn is required to instruct cone PCP. This work uncovers a non-canonical PCP pathway initiated by light.

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Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

71 - Modulation de la voie BMP/TGF-β pour la prévention de la néovascularisation choroïdienne

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But : La dégénérescence maculaire liée à l'âge (DMLA) est la cause la plus fréquente de cécité dans les pays développés, en particulier chez les personnes de plus de 50 ans. La caractéristique pathologique prédominante de la forme humide de la DMLA est la néovascularisation choroïdienne (CNV), qui correspond à la formation de nouvelles branches à partir de vaisseaux choroïdiens préexistants qui pénètrent la membrane de Bruch et se développent sous l'épithélium pigmentaire rétinien et/ou dans l'espace sous-rétinien. Le VEGF est devenu la cible de choix pour le traitement de l'angiogenèse oculaire pathologique à l'aide d'anticorps anti-VEGF. Malgré l'efficacité de ces molécules dans l'amélioration de l'acuité visuelle, des injections intravitréennes répétées d'anti-VEGF peuvent entraîner des complications oculaires à long terme étant donné le rôle important du VEGF dans le maintien de l'intégrité vasculaire et la survie des cellules neuronales. La signalisation BMP9 via le récepteur endothélial Alk1 sérine-thréonine kinase module la réponse des cellules endothéliales au VEGF et favorise la quiescence et la maturation des vaisseaux au cours du développement. De plus, l'activation de la signalisation Alk1 dans la rétinopathie induite par l'oxygène a inhibé la néovascularisation et réduit le volume des lésions vasculaires.

Méthode / Résultats : Six jours après la CNV induite par laser, des s souris C57BL/6J ont été traitées par injection intravitréenne de complexe pro-propeptide BMP9 ou d'anticorps anti-VEGF. Au jour 7, nous avons mesuré les effets des traitements sur la régression des lésions CNV, l'intégrité de la barrière hémato-rétinienne e et l'expression génique des médiateurs inflammatoires et des facteurs angiogéniques dans la rétine et l'EPR/choroïde. Les modifications structurelles de la rétine ont été identifiées à l'aide de la tomographie par cohérence optique. L'activation de la signalisation Alk1 dans la CNV régule la néovascularisation et réduit l'hyperperméabilité vasculaire rétinienne chez les souris ayant subis des CNV au laser. De plus, la mesure du liquide sous-rétinien a révélé que l'exsudation diminuait de manière significative chez les souris CNV traitées avec le complexe BMP9.

Conclusion(s): Dans l'ensemble, les résultats montrent que le ciblage de BMP9/Alk1 empêche efficacement la croissance des néovaisseaux dans les modèles AMD.

Financement : Fondation des maladies de l'œil

72 - Photoreceptor Reprogramming to Prevent Retinal Degeneration

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Goal: Retinitis Pigmentosa (RP) is a neurodegenerative disease where rod photoreceptor cells degenerate, leading to the secondary loss of cone photoreceptors and irreversible blindness. Previous work has shown that knocking down Nrl, a rod-determining transcription factor, is sufficient to reprogram degenerating rods into healthy cone-like cells, thereby preventing vision loss by preserving endogenous cone photoreceptors (Montana et al. 2013, Yu et al. 2017). While these results are exciting and open a new therapeutic avenue for RP, gene knockdown approaches are less amenable to clinical applications due to potential side effects. Recently, our lab has identified the transcription factor Pou2f2 as a negative regulator of Nrl (Javed et al. 2020). Additionally, we showed that the transcription factors (TFs) Ikzf1 and Ikzf4 can reprogram adult mouse fibroblast and glial cells into cone-like cells comparable to those seen in the Nrl knockdown experiments (Boudreau-Pinsonneault et al. 2021). In the mature photoreceptor, chromatin is highly compacted which is a property that is thought to help maintain cell identity and function. This established rigidity in cell identity naturally poses a barrier for reprogramming. Thus, we hypothesize that expression of Pou2f2, in combination with chromatin remodeler Ikzf1 and/or Ikzf4 in adult rods will reduce expression of Nrl and reprogram them into cone-like cells, preventing total blindness in mouse models of RP.

Method: To test this, I generated and validated individual and bicistronic Adeno-Associated Viral vectors (AAV) expressing Pou2f2, Ikzf1, and Ikzf4. I now conduct subretinal injections of these respective viruses to deliver the AAVs to the photoreceptors of wild-type mice. Following different time points (11 weeks) post injection, I carry out functional experiments and collect the eyes for analysis by immunohistochemistry (IHC) or biochemical experiments. My project has three stages: validating the vectors, characterizing an effective combination of transcription factors for reprogramming, and finally, investigating AAV-mediated reprogramming in mouse models of RP.

Results: The viruses required for my project have been successfully validated (*in vitro, ex vivo*, and *in vivo*) and the infection efficiency has been determined. After overexpressing individual transcription factors (Pou2f2, Ikzf1, and Ikzf4) in the adult retina, no changes were observed in Nrl repression or in rod/cone identity factors. However, co-expression of Ikzf1 and Pou2f2 has shown to reduce protein Nrl levels as observed by immunohistochemistry. Further analyses on cone-specific markers, morphological changes, and functional analyses on diseased animals remains to be studied.

Conclusion(s): The low expression levels of Nrl in co-infected adult mouse rods indicates a potential reprogramming ability of mature cells with the over-expression of a chromatin remodelling transcription factor (ikzf1) and a targeted gene regulator (Pou2f2). Further investigation is required to uncover molecular mechanisms and properties of these cells.

Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

73 - Identification of proteins secreted by choroidal melanocytes under normal and oxidative stress conditions

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Goal: Age-related macular degeneration (AMD) is a leading cause of blindness in the elderly population. It impacts the retina, and particularly the retinal pigment epithelium (RPE). Oxidative stress-induced cell death is a contributor to AMD. How oxidative stress influences other cell types in the back of the eye, such as choroidal melanocytes (CMs), is currently unknown. This study aimed to investigate proteins secreted by choroidal melanocytes in normal and oxidative stress conditions.

Method: RPE cells, choroidal fibroblasts (CFBs), and choroidal melanocytes (CMs) were isolated from native human RPE/choroidal tissues and expanded. RNA was isolated from CMs, CFBs, and RPE cells and processed for gene profiling analysis, and the expression of candidate proteins was confirmed by ELISA assay. In parallel, the medium conditioned by these three cell types was collected in stressed (10mM NaIO3, 24h) and unstressed (NaIO3-) conditions, and secretome analysis was performed to identify cytokines secreted majorly by CMs. Unconditioned media was used as blank control. Cytokine levels were normalized to the total number of cells.

Results: Gene profiling data identified 1,120 mRNA transcripts with more than 2-fold increased expression in CMs compared to the other 2 cell types. Among them, 17 genes encoded for secreted proteins, including *SERPINF1* (pigment epithelium-derived factor (PEDF) protein). ELISA assay revealed that PEDF was expressed 3.8- and 6.7-fold higher by CMs in comparison with RPE cells and CFBs, respectively. The secretome analysis of the unstressed media condition showed that 20 proteins were majorly secreted by CMs. Higher expression level of osteopontin (OPN) (4.3- and 5.5- fold), GM-CSF (2.6- and 1.7- fold), GDF-15 (3.1- and 1.7- fold), and DKK-1 (2.7- and 1.6- fold) was observed in CMs compared to the RPE cells and CFBs, respectively. Comparing stressed and unstressed condition media, secretome analysis demonstrated a 2-fold increased expression of OPN, GM-CSF, GDF-15, and DKK-1 by CMs in response to oxidative stress compared to the other two cell types.

Conclusion(s): In this study, we have identified proteins that are abundantly transcribed and secreted by CMs *in vitro* as well as cytokines that are upregulated by CMs in the presence of oxidative stress. A better understanding on CMs' participation in choroidal homeostasis in healthy and oxidative stress conditions may shed light on their role in eye diseases such as AMD.

Funding: FRQS AMD program, VHRN 'Ocular tissue' infrastructure

74 - Evaluation of MRI methods' capacity for imaging the anterior visual pathway

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Goal: Diffusion-weighted MRI faces challenges in imaging the optic nerve due to its small diameter and susceptibility changes near the bony canal. We aimed to conduct a comparative analysis of six diffusion MRI protocols to determine the most effective protocol for analyzing the anterior visual pathway (AVP). We compared track overlaps generated by each protocol with anatomical ground truth. Additionally, we aim to compare the encoding directions (AP vs. PA) and the number of readout segments (5 vs. 7) for the rs-EPI (RESOLVE) sequence.

Method: Data were collected from 13 participants. The study includes two HCP-like diffusion MRI sequences (b-values of 1000 and 1500), a high-resolution gSlider sequence, and three readout segmented EPI sequences (1.0 mm, 1.2 mm, 1.4 mm voxel sizes), collectively called RESOLVE. Alongside the six tested dMRI protocols, each participant underwent a structural T1-weighted scan. We employed probabilistic tractography and manually placed ROIs at five AVP locations using the structural T1 scan. These locations comprise two at the optic nerves' starting tips, one at the optic chiasm, and two at the optic tracts' ends. To assess the diffusion sequences, we compared generated AVP tracks with anatomical data, serving as ground truth. We manually delineated anatomical masks outlining the optic nerve and optic tract on the structural T1 MRI. Using the Dice score, a pixel-based similarity metric (0 to 1), we quantified the extent of overlap between dMRI-generated tracks and structural MRI masks. This analysis identifies the dMRI protocol best at reconstructing the AVP.

Results: We divided the AVP into optic nerves and optic tracts segments and analyzed each individually, using MRtrix's iFOD2 algorithm with a 20-degree angle cut-off and different seeding directions. Track densities were compared with corresponding anatomical segments to calculate Dice scores for each diffusion protocol. On average, the three RESOLVE sequences performed well, with high Dice scores ($> 0.7 \pm 0.1$), indicating substantial track density overlap with anatomical segments. In contrast, the HCP ($< 0.04 \pm 0.02$) and gSlider protocols ($< 0.07 \pm 0.03$) yielded low Dice scores, failing to generate the expected tracks. Further analysis of RESOLVE scans compared encoding direction and readout segments. Data from five subjects revealed that the AP direction (0.72 ± 0.12) outperformed the PA direction (0.66 ± 0.12) and having seven readout segments (0.73 ± 0.11) surpassed five readout segments (0.64 ± 0.13). Among the three RESOLVE sequences, 1.4 mm voxels achieved the highest mean Dice score (0.8 ± 0.11), followed by 1.2 mm voxels (0.68 ± 0.1), and 1.0 mm voxels (0.66 ± 0.12) voxel sizes.

Conclusion(s): We conclude that the RESOLVE sequence with 1.4 mm isotropic voxels is the most effective acquisition method among those we compared for diffusion MRI of the AVP. Acquiring RESOLVE sequences in the AP direction with seven readout segments provides the best track overlap with anatomy, making it the most suitable choice for reconstructing the anterior visual pathway. In future studies, we plan to use RESOLVE to compare diffusion parameters in the AVP between patients with optic neuropathy and healthy controls.

Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

75 - The Impact of Choroideremia on Female Carriers - A Global Survey

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Goal: Choroideremia (CHM) is an X-linked inherited retinal disease with most affected patients being males. As with other inherited retinal disorders, it was recently shown that female carriers of the *CHM* mutation may develop degenerative visual disability with advancing age. The literature regarding the impact of *CHM* mutation on the psychosocial sphere and activities of daily living (ADLs) of female carriers is significantly lacking. Therefore, our objective was to determine the psychosocial burden of *CHM* mutation in female carriers.

Method: A total of 55 female responders with a positive carrier status for *CHM* mutation (mean age = 47 ± 14 years) filled the online survey through not-for-profit stakeholder organizations and social media platforms. The online survey encompassed questions regarding demographics, self-described visual assessment, genetic testing, use of aid, fields of challenges and disease impact on activity of daily living, emotional burden, and social sphere. Participant recruitment was conducted through Choroideremia Research Foundation and Fighting Blindness Canada's database from April to December 2022. Survey questions were also disseminated through social media platforms.

Results: Most female carriers (76%) reported a change in their visual acuity past 50 years old. When assessing the impact of carrier status on ADLs, Pearson's correlation coefficient showed a negative correlation between both driving (p=0.046) and mobility capabilities (0.046) with the respondent's age. Furthermore, more than half of women reported being afraid, anxious, and stressed, with younger females reporting a statistically significantly higher level of feeling of distress and hopelessness (p=0.003), anxiety (p=0.00007), issues with relaxing (p=0.025) and negative personal thoughts (p=0.042).

Conclusion(s): Overall, this survey outlines both the physical and psychological burden of being a carrier of the *CHM* mutation in females. Given the limited clinical research in female carriers, this patient-centered survey is a crucial advocacy tool for these carriers.

Funding: The current research was funded by the Randy-Wheelock Award from the Choroideremia Research Foundation as well as the Fonds de recherche en ophtalmologie de l'Université de Montréal (FROUM).

76 - Modélisation et caractérisation des mécanismes impliqués dans une dégénérescence rétinienne héréditaire associée à BCOR

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But : Les dégénérescences rétiniennes héréditaires (DRH) représentent un ensemble de maladies caractérisées par la mort progressive des photorécepteurs pouvant mener à la cécité. Au-delà de 260 gènes ont été identifiés comme pouvant être responsables d'une DRH, mais l'origine génétique demeure inconnue dans 30 à 50% des cas. Une récente étude du laboratoire Cayouette a identifié différentes nouvelles mutations associées à une DRH à début précoce chez l'humain et localisées dans le gène BCOR, qui code pour un cofacteur de la régulation transcriptionnelle. Toutefois, l'impact fonctionnel de ces mutations reste mal compris.

Méthode : Nous visons à générer et à caractériser quatre modèles de souris génétiquement modifiées, porteuses des mutations identifiées dans BCOR (BCORmut), en utilisant la technologie CRISPR/Cas9. L'étude de la rétine de ces souris, notamment par histologie, immunohistochimie et analyse transcriptionnelle scRNAseq, ainsi que l'évaluation de leur capacité visuelle (électrorétinogramme, réflexe opto-moteur) viseront à confirmer l'impact de la mutation sur la survie des photorécepteurs et son implication dans l'étiologie de la DRH d'intérêt. Le gène BCOR étant localisé sur le chromosome X, nous voulons déterminer l'impact de chaque mutation chez les mâles porteurs, ainsi que les femelles homozygotes ou hétérozygotes.

Résultats : Il fut jusqu'à présent possible de générer au moins une souris portant chacune des mutations de BCOR d'intérêt, ce qui fut confirmer par Sanger sequencing. Comme ces mutations ont été générées chez des souris CD1, qui peuvent présenter des problèmes de vision, nous avons débuté un rétrocroisement avec des souris C57BL/6J (B6J). L'analyse de l'impact de certaines mutations dans des souris de background mixte CD1/B6J ont débutées. L'analyse préliminaire de l'acuité visuelle, déterminée via le réflexe opto-moteur, et de l'activité électrique rétinienne (électrorétinogramme) suggèrent un défaut de la fonction des photorécepteurs dès l'âge d'un mois chez les souris mâles porteuses de la mutation. L'analyse par immunomarquage et western blot des rétines des souris BCORmut suggère également des anomalies de l'intégrité rétinienne.

Conclusion(s) : L'étude rendra possible de confirmer l'identification de BCOR comme étant un locus à l'origine de DRH. De plus, le projet devrait permettre de générer un modèle représentant fidèlement une DRH à début précoce, d'en étudier les mécanismes et, éventuellement, d'investiguer des cibles thérapeutiques potentielles.

Financement : Supporté par le Réseau de Recherche en Santé de la Vision (RRSV), la Faculté de Médecine de l'Université de Montréal et la Fondation IRCM

Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

77 - Le diagnostic de la DMLA humide: avec ou sans OCT-A

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But: L'objectif de cette étude est de déterminer si l'ajout de l'OCT-A, un nouvel appareil permettant d'imager à la fois les vaisseaux rétiniens et choroïdiens de façon non invasive a un impact sur le diagnostic de la dégénérescence maculaire liée à l'âge (DMLA) humide et sur la décision d'initier un traitement. La mesure de l'accord entre les observateurs est aussi mesurée.

Méthode : 50 yeux atteints de DMLA humide sous traitement ont été imagés par la tomographie par cohérence optique (OCT) et par la tomographie par cohérence optique-angiographie (OCT-A). Un optométriste et deux ophtalmologistes (rétinologue) ont analysé les imageries et ont indiqué la présence ou non de signes de DMLA humide nécessitant un traitement. Le Kappa de Cohen est calculé pour voir l'accord entre les deux techniques d'examen ainsi que les 3 observateurs.

Résultats: En ce qui concerne le diagnostic de DMLA humide nécessitant un traitement, les Kappa de Cohen entre l'optométriste et l'ophtalmologiste 1 et 2 ainsi qu'entre l'ophtalmologiste 1 et 2 sont respectivement de 0,682, 0,598, 0,564 pour l'OCT et de 0,324, 0,322 et 0,190 respectivement pour l'OCT-A. Sur 50 analyses, l'ophtalmologiste 1, l'ophtalmologiste 2 et l'optométriste ont détecté des signes d'activité pour 5 (10%), 2 (4%) et 7 (14%) patients sur l'OCT-A respectivement sans la détecter sur l'OCT.

Conclusion(s) : Bien que l'accord entre les différents observateurs pour le diagnostic de la DMLA humide avec l'OCT-A est faible, nous constatons que l'appareil permet de diagnostiquer la maladie chez des patients qui ne l'auraient pas été si seulement l'OCT avait été utilisé. Il est effectivement possible que certains patients présentent des membranes néovasculaires choroïdiennes mais que ces dernières ne se manifestent pas au niveau rétinien. Cependant, bien les ophtalmologistes étaient des spécialistes de la rétine, le faible accord pourrait être expliqué par le manque d'expérience avec cette technologie puisque cette dernière reste relativement nouvelle. Cette étude démontre donc que l'utilisation de l'OCT-A en plus de l'OCT pourrait permettre de diagnostiquer plus de patients atteints de DMLA nécessitant un traitement. Des études prospectives sur ces patients seraient pertinentes afin de connaître l'évolution de la maladie avec le temps.

Financement : aucun

78 - The effect of calcium on the membrane interaction of S100A16 protein and its potential localisation in the photoreceptor cells

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Goal: People with diabetes are more likely to develop diabetic retinopathy, which is defined as an eye disease that affects the retina of the eye and causes reduced visual acuity. In an advanced diabetic retinopathy disease model, Akimba mice, it was observed that the proteins S100A1, S100A6, S100A10, S100A11 and S100A16 were upregulated in the retina and especially in the rod photoreceptors. The S100A16 protein was recently discovered for which no protein or membrane interaction has yet been identified. The S100A16 protein belongs to the S100 family, composed of 27 members. Several S100 proteins interact with the transmembrane receptor for advanced glycation endproducts (RAGE), for which a dysfunction has been observed during the development of diabetic retinopathy. It is therefore probable that the S100A16 protein can interact with RAGE and that its membrane binding influences its behavior. Moreover, S100 are known to complex with proteic family of annexins. The Annexin A4 is also upregulated in diabetic retinopathy and could eventually interact with S100A16. In addition, S100A16 undergoes a conformational change in the presence of calcium ions, probably involved in its membrane binding. The main objective consists of studying the membrane interactions of S100A16 protein to better understand its role to the membrane and its eventual role in diabetic retinopathy. Specific objectives are: i) to gather information on its membrane interactions, ii) to study the influence of calcium on these interactions, and iii) to study the protein-protein interaction.

Method: The S100A16 protein was obtained by a cleavage followed by a purification on a His-Trap column. Membrane interactions were studied with the Langmuir monolayer model. After measurement of the saturating concentration, the protein binding parameters, i.e., the maximum insertion pressure and the synergy, were determined in the presence of several phospholipids' representative of physiological membranes. Moreover, biomolecular modelisation are used as complementary for the simulation of the protein interaction with bilayer membrane. The protein-protein interaction was determined by surface plasmon resonance.

Results: The S100A16 protein was obtained with a purity greater than 99%, and its saturating concentration was 0.5 µM. Biophysical study with different phospholipids in monolayer is currently in progress but preliminary results suggest that S100A16 has a preferential binding for saturated short chain phospholipids with a zwitterionic polar headgroup in the presence of calcium. Preliminary results suggest a stronger affinity for saturated lipids in the absence of calcium. In addition, the biomolecular modelisation suggest a better interaction for the bilayer in presence of cholesterol. The protein-protein interaction with Annexin A4 and RAGE are ongoing.

Conclusion(s): Obtaining the S100A16 protein with a high purity allowed carrying out the biophysical study of the membrane binding of S100A16. This project will provide a better understanding of the membrane behavior of S100A16, as well as its role at the membrane and in diabetic retinopathy.

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Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

79 - Electrostatic interactions play a key role in the membrane binding of the C-terminal segment of G-protein coupled receptor kinase 4

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Goal: The human proteome includes ~20 000 proteins, from which 10 to 20 % could be acylated. Very little information is available on the importance of acylation on the membrane binding of proteins. The ~950 G-protein coupled receptors (GPCR) are acylated proteins which play a key role in signal transduction and therefore have their function tightly regulated. Their inactivation involves G-protein coupled receptor kinases (GRK), a protein family of seven members, which all interact with membranes via their C-terminal segment. Four GRKs are acylated at their C-terminus: GRK1 is farnesylated, GRK7 is geranylgeranylated whereas GRK4 and GRK6 are palmitoylated. We have previously shown that the presence of a farnesyl is mandatory to the membrane binding of the C-terminal segment of GRK1 (Cter-GRK1) and that its binding is highly favored by polyunsaturated phospholipids. Therefore, the objective of this research work was to compare the membrane binding properties of the palmitoylated C-terminal segment of GRK4 (Cter-GRK4) with that of Cter-GRK1.

Method: The secondary structure of the peptide segments was determined by circular dichroism measurements. Fluorescence measurements of different variants of Cter-GRK4 allowed to determine the importance of different parts of Cter-GRK4 in its binding to zwitterionic as well as anionic phospholipid vesicles. The mean fluorescence lifetime values obtained as function of the accessible lipid concentration allowed to retrieve partition coefficients Kp, which provide information on the affinity of the peptide for specific phospholipids.

Results: While Cter-GRK1 adopts a fully random coil structure, a portion of Cter-GRK4 includes an alpha helical segment. Previous measurements with different phospholipid monolayers suggested that the palmitoyl group of Cter-GRK4 was not the sole driving force promoting its membrane binding. Fluorescence measurements were performed with three variants of Cter-GRK4: Long-Palm, Long-NPalm and Short-helix. A shift in the center-of-mass as well as in the mean fluorescence lifetime of all three variants is observed with vesicles of various compositions, which shows that the region where the tryptophan is located is involved in their membrane binding. The addition of anionic phospholipids to the vesicles does not significantly modify the binding of Long-Palm. There is however a much stronger binding of both Long-NPalm and Short-helix to vesicles containing 15 % and 30 % anionic phospholipids compared to Long-Palm. The Kp values confirm the affinity of Long-NPalm and Short-helix to anionic phospholipids. It is also worth noting that the center-of-mass, as well as the fitted fluorescence lifetime values all converge to similar values, which suggests that the tryptophan is in a similar environment for all variants assayed.

Conclusion(s): The results show that electrostatic interactions are involved in the membrane binding of Cter-GRK4 but play a lesser role than the palmitoyl group. This is in contrast with Cter-GRK1 which did not bind membranes in the absence of its farnesyl group. Overall, the membrane binding of palmitoylated Cter-GRK4 is much stronger than that of farnesylated Cter-GRK1.

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80 - Glia-derived lipid metabolites drive pathological angiogenesis in proliferative retinopathy

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Goal: Proliferative retinopathy (PR) is a prominent microvascular complication of premature infants and diabetic adults and is a leading cause of blindness. Long-chain polyunsaturated fatty acids (LCPUFA) protect (ω−3) or exacerbate (ω−6) PR but the precise mechanisms remain ill-defined. Cytochrome P450 oxidase 2J (CYP2J) is an epoxygenase that metabolizes ω−3 and ω−6 LCPUFA into bioactive lipid mediators with pro-angiogenic effects. Mice with vessel-specific CYP2J overexpression, when fed ω-6 and ω-3 LCPUFA, produced more lipid mediators, such as 19,20-EDP, promoting increased choroidal neovascularization. Pharmacological Inhibition of CYP2J2 reduced plasma levels of pro-angiogenic metabolites and choroidal neovascularization. In our PR model, we show that CYP2J is primarily expressed in retinal glial cells rather than vessels and its lipid metabolites indirectly signal for neovascular disease.

Method: In this study, we used the oxygen induced retinopathy (OIR) model of PR. Briefly, we exposed mouse pups to 75% O_2 from postnatal days 7 (P7) to P12 causing vaso-obliteration, followed by a 5-day exposure to room air to prompt retinal hypoxia and subsequent excessive neovascularization. We then performed a comprehensive single-cell transcriptomic analysis of human and mouse retinas with PR to delineate the expression profile of retinal CYP2J and its alterations in PR. The impact of retinal proangiogenic CYP2J inhibition using flunarizine, a potent and selective CYP2J2 inhibitor, was evaluated in mice fed or not with diets containing either ω−3 or ω−6 LCPUFA subjected to OIR. Cellular localization of CYP2J was explored by immunohistochemistry in the retinas of OIR mice. Single-cell transcriptomics analysis was used to generate hypotheses for the proangiogenic effects of CYP2J-derived metabolites.

Results: Single-cell transcriptomic analysis revealed that CYP2J in RP was predominantly expressed in astrocytes and Müller glia in both human and mouse retinas. In addition, we observed increased RNA expression levels of CYP2J6 and CYP2J9, two primary CYP2J subtypes in OIR mice. Importantly, inhibition of CYP2J activity with flunarizine resulted in a significant reduction ($p<0.001$) of pathological neovascularization by 35% and 25% in mice with ω−6 and ω−3 LCPUFA diets, respectively. CYP2J protein was localized in astrocytes by immunofluorescence. Finally, lipid metabolites derived from CYP2J were shown to activate peroxisome proliferator-activated receptors (PPARs). In OIR, PPAR-delta was the major subtype of PPARs in retina and markedly enriched in retinal pathological neovessels, suggesting a possible paracrine signaling role of glia-derived lipid metabolites on pathological neovessels.

Conclusion(s): This study reveals the expression patterns and retinal localization of CYP2J subtypes, as well as their significant role in pathological retinal neovascularization. Pharmacologic modulation of CYP2J may be a promising alternative to mitigate pathologic neovascularization in PR and other vascular diseases.

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Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

81 - Studying the role of homocysteine metabolism in the aging retina

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Background: Homocysteine is an amino acid not present in food that our body synthetizes mainly from methionine. In excess, it can cause damage to blood vessels, including those of the retina. The levels of homocysteine increase naturally with age and have been linked to different sight-threatening vascular pathologies including age-related macular degeneration (AMD). While hyperhomocysteinemia has been considered a risk factor to AMD, not much is known about the underlying mechanisms leading to disease. Recently, high levels of homocysteine were found elevated in the retina and vitreous of patients with vascular disease, suggesting that there might exist an ocular local metabolism of homocysteine that fails in disease.

Goal: This project aims at elucidating which retina cell types are responsible of the recycling of homocysteine, and whether the process of aging incapacitates the metabolism of homocysteine and predisposes the retina to suffer vascular complications.

Method: Gene expression was assessed using single-cell RNA sequencing data of the human retina. Protein expression was studied in the aging retina of foveate non-human primates using immunohistochemistry. Müller glia were studied in vitro and subjected to H2O2- and CuSO4-driven oxidative stress. Protein content was analyzed by Western blot.

Results: The expression of genes involved in the recycling of homocysteine is heterogeneous and varies among retina cell types. Key genes *CBS* and *FOLR1* were highly associated to glial cells, and the preliminary histological validation confirmed the expression of these targets in the inner retina. When subjected to aging-like oxidative stress in vitro, expression of folate receptors in Müller glia significantly decreased.

Funding : Réseau de recherche en santé de la vision; Banting Research Foundation

82 - Purification of lecithin retinol acyltransferase and characterization of its membrane and substrate binding

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Goal: Lecithin retinol acyltransferase (LRAT) is a membrane protein of the visual cycle that transforms retinol into retinyl ester. LRAT mutations lead to vision loss. We have previously determined that truncated LRAT (tLRAT; LRAT 30-196) is insoluble without detergent but has high activity when purified with sodium dodecyl sulfate (SDS), whereas its mutations lead to important activity loss. However, our data show that tLRAT is not properly structured in presence of high concentrations of SDS. Structural information of LRAT must be obtained to better understand the mechanism of its enzymatic activity. In addition, one study proposed that a unique segment at LRAT (residues 76-105) is involved in the membrane binding of this enzyme, potentially explaining the difficulty in solubilizing tLRAT. The objectives are therefore to 1) purify an active and stable form of LRAT in sufficient quantity to determine its structure by NMR, 2) compare the binding of retinol by tLRAT and its mutants, and 3) characterize the membrane binding of the unique segment of LRAT.

Method: To obtain an active and stable form of LRAT or tLRAT, either tLRAT was purified by affinity chromatography with different detergents or different constructs of LRAT and tLRAT were produced. The binding of retinol by tLRAT and its mutants was studied using fluorescence measurements. The unique segment of LRAT was synthesized commercially and its membrane binding was studied using Langmuir monolayers.

Results: The activity of tLRAT is highest in the presence of lyso-myristoyl-phosphoglycerol, which is comparable to that with SDS. Our results show that the addition of lysines or protein tags produces more soluble forms of tLRAT. The lack of acyltransferase activity of LRAT mutants could be explained by a deficiency in their binding of retinol. However, fluorescence measurements allowed to determine that the dissociation constant of retinol with wild-type tLRAT is similar to that of most tLRAT mutants. In contrast, kinetic measurements demonstrate that enzyme activity is faster for wild-type tLRAT than for its mutants. The Langmuir monolayer measurements of the unique segment of LRAT show its strong binding to phospholipid monolayers since the maximum insertion pressure values obtained in the presence of most phospholipids studied are higher than the estimated value of the membrane lateral pressure.

Conclusion(s): These results allow to better understand the mechanism of enzymatic activity of LRAT and the effect of its mutations on its activity.

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Résumé des présentations par affiche / *Poster presentations abstracts*
Rétine et segment postérieur / *Retina and postérieur segment*

83 - Denoising OCT videos based on temporal redundancy

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Goal: Identifying oculopathies and their progression relies on a clear visualization of the ocular anatomy and on different metrics extracted from OCT B-scans. In the case of glaucoma pathophysiology, current research aims to find new prognostic biomarkers based on mechanical properties of the eye. Analyzing tissue movement driven by blood pulsation and using external forces to manipulate intraocular pressure both require fast dynamic imaging. However, speckle noise hinders the quality of rapid OCT imaging, hampering the extraction and reliability of anatomical biomarkers. We present here a simple method to denoise dynamic OCT scans based on the temporal redundancy in movies of multiple heart cycles.

Method: By synchronizing the acquisition of OCT images with the pulse measurement, we transform a low-quality OCT video into a clear one by phase-wrapping each frame to the subject's heart pulsation and averaging frames that correspond to the same instant in the cardiac cycle. The workflow is based on clear physiological assumptions to obtain high quality information from the B-scans. Recent studies have focused on different OCT denoising strategies using new and improved deep learning architectures. Nevertheless, while they allow fast inference, it is unclear that these approaches are reliable at the scale required to measure physiological ocular changes. We compare the performance of our one-cycle denoising strategy with a deep-learning architecture, Noise2Noise, as well as a supervised implementation of Noise2Noise, called Noise2Clean. We systematically analyze different image quality descriptors as well as region-specific metrics to assess the denoising performance based on the anatomy of the retina and optic nerve head.

Results: In our experiments, the methods based on convolutional neural networks, particularly when trained in a supervised way, demonstrate a blurring effect. In essence, they achieve high denoising performance in terms of contrast-to-noise ratio (CNR) and Mattes Mutual Information (MMI) at the cost of losing details needed to analyze ocular structures. In comparison, our one-cycle method achieves the highest denoising performance, increases image quality and preserves the high-resolution structures within the eye tissues.

Conclusion(s): The proposed workflow is very simple, achieves good denoising performance and can be readily implemented in a clinical setting.

Funding: This work was supported by the Institut de valorisation des données (IVADO) and the OPSIDIAN scholarship program of Polytechnique Montréal.

Résumé des présentations par affiche / *Poster presentations abstracts*
Déficience visuelle et réadaptation / *Visual impairment and rehabilitation*

84 - Effect of laser-induced choroidal neovascularization on visual function in mice

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Goal: Choroidal neovascularization (CNV), a pathological feature of age-related macular degeneration, induces vision impairment due to abnormal blood vessel growth and leakage beneath the retina. The laser induced CNV in mice is an established model of this disease, although it is used merely for determining the efficacy of pharmaceuticals to prevent retinal degeneration. Here, we investigated the behavioral, retinal, and cortical function changes following 21-day laser-induced CNV by mesoscale calcium imaging in head-fixed mice to evaluate the visual deficit induced.

Method: A chronic optical chamber was implanted in Thy1-GCaMP6s mice (n = 9). Five laser burns of the Bruchs membrane were created unilaterally, at 1-2 mm around the optic nerve or within the same quadrant, using an ophthalmic argon laser. Cortical dynamics during resting state and visual stimulation (drifting sinusoidal gratings) were measured by mesoscale calcium imaging before and at 2, 7, 14, and 21 days after CNV induction. Visual acuity for each eye was evaluated by optokinetic reflex and the visual cliff behavioral tests before and after CNV.

Results: IsolectinGS_IB4^{+} CNVs were observed in whole-mounted choroids, showing popcorn-like neovascular tufts. Microcirculation alteration and microglial invasion were observed in the retina, as well as impaired scotopic ERG. CNV reduced visual acuity (0.25 ± 0.16 vs 0.39 ± 0.03cpd in controls), only when the CNVs were concentrated in the same quadrant, not if they were scattered around the optic nerve (0.43 ± 0.16 vs 0.48 ± 0.14cpd in controls). However, avoidance of visual cliff was preserved in both cases, indicating that spatial perception remained relatively unaffected by the CNVs. CNVs in the same quadrant elicited a reduction in calcium signals evoked by visual stimulation (-21 to -53 % variation from pre-CNV) in the primary visual and secondary areas in the projection hemisphere, indicating a decrease in neuronal activity and visual perception. Scattered CNV did not necessarily induce a detectable change in the calcium signals (-2.5 to -10 % variation from pre-CNV). However, resting state activity between the different visual cortical areas was altered in the CNV projection hemisphere in both cases.

Conclusion(s): These results demonstrate that the laser-induced CNV model is suitable to evaluate the visual deficit and its possible prevention by ocular pharmacological treatment, only if the lesions are concentrated in the same area of the choroid.

Funding: The project is financed by the Canadian Institutes of Health Research (grant PJT-175061)

Résumé des présentations par affiche / *Poster presentations abstracts*
Cerveau et perception / *Brain and perception*

85 - Recourir à la neurophotonique pour concevoir un modèle de cécité corticale chez la souris

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But : Les accidents vasculaires cérébraux ischémiques (AVCi) revendiquent un haut taux d'invalidité, car un AVCi provoque des pertes fonctionnelles liées aux aires corticales touchées en bloquant leur apport sanguin. Une réorganisation fonctionnelle spontanée, mais limitée survient généralement après un AVCi. Majoritairement étudiée dans le cortex moteur de la souris, elle implique des mécanismes qui modifient la connectivité et les propriétés fonctionnelles des aires avoisinantes. Sont-ils aussi présents dans le cortex visuel? Le but est de développer un modèle de cécité corticale en induisant un AVCi dans le cortex visuel de la souris afin d'étudier la réorganisation fonctionnelle longitudinale avec l'imagerie calcique.

Méthode : L'implantation d'une fenêtre crânienne chez des souris transgéniques a permis l'enregistrement des variations de fluorescence associées à l'activité calcique neuronale pendant plusieurs semaines. Après 3 semaines d'enregistrement d'une ligne de base, un AVCi localisé dans le cortex visuel a été induit par photothrombose. La connectivité entre les aires corticales, la cartographie des aires visuelles et leur sélectivité fonctionnelle pour le contraste ont ensuite été mesurées jusqu'à 4 semaines après l'induction d'un AVCi.

Résultats : L'activité calcique au repos des aires visuelles et rétrospléniales bilatérales est fortement corrélée. Lors des stimulations visuelles, la réponse calcique dans le cortex visuel augmentait graduellement en fonction du contraste. Une semaine après l'induction de l'AVCi, une perte de la corrélation, de la réponse calcique et une diminution de la sélectivité ont été observées dans les aires visuelles lésées.

Conclusion(s) : L'induction d'un AVCi dans le cortex visuel droit de souris perturbe initialement la connectivité et la sélectivité des aires visuelles. Ce projet fournira un modèle animal approprié pour étudier les mécanismes de plasticité dans le cortex visuel de souris. Dans le futur, il sera utilisé pour définir la contribution du système des endocannabinoïdes, en particulier des récepteurs aux cannabinoïdes CB2, dans la réorganisation fonctionnelle après un AVCi.

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86 - Modeling perception across eye movements, and an open-source gaze tracker

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Background: A static visual stimulus falls on different parts of the retina before and after a saccade. It has been shown that neurons in many visual and oculomotor "priority-map" brain areas respond to stimuli appearing before the saccade at the spatial location that their receptive field will occupy after the saccade. In a separate line of work, psychophysical studies have shown that stimuli flashed around the time of a saccade are systematically mislocalized in various characteristic patterns. The anticipatory remapping along the saccade direction and the mislocalization along the saccade direction have been suspected to be linked, but there has been no explicit model of how they might be linked and some studies have called this connection into question. We show that anticipatory remapping along the saccade direction predicts biphasic mislocalization of brief perisaccadic flashes similar to that seen in empirical data. Additionally, we present a status update on our ongoing efforts to create an open-source phone-based eye-tracker.

Method: We introduce a conceptual model incorporating receptive field (RF) remapping, as well as an explicit rate model. In the explicit model, the firing rate of each neuron is modeled by a two-variable dynamical system, with a slow variable representing delay-period activity, and a fast variable driven by visual input and tracking the slow variable. Remapping only occurs at the level of the slow variable. We avoid the spatial response blurring that multi-hop (transitive) remapping would incur by considering two distinct subpopulations of neurons: one solely receiving feedforward input from upstream visual areas, and one also receiving lateral input from the former to support remapping. Parameters are tuned using Bayesian optimization. For our eye tracker, we reproduce the closed-source lightweight Convolutional Neural Network (CNN) proposed by Valliappan et al. (2020, Nature Communications) using PyTorch, which we train on the open GazeCapture dataset. We use Support Vector Regression on the penultimate layer's activations for participant-specific personalization.

Results: We show that mislocalization, rather than being an artifact of remapping, is a result of incomplete remapping right before the saccade and residual remapping after the saccade. Our conceptual/explicit models are consistent with one another, and with the known physiology of RF remapping and trans-saccadic information transfer. They make clear predictions regarding the dynamics of RF remapping and trans-saccadic response updating for task-relevant stimuli. Our gaze tracking model achieves an error of 1.9-2.1 cm at 25-40 cm viewing distance in the un-calibrated setting, and 1.15 cm (± 0.015cm) in the calibrated setting using GazeCapture data. We expect to reach an error of 0.4-0.5 cm by collecting our own calibration dataset (ongoing).

Conclusion(s): Forward RF remapping can indeed predict a biphasic mislocalization pattern for perisaccadic flashes, as has been shown empirically. Our open-source gaze-tracker shows promising performance and will facilitate research on eye movements and visual attention. In the future, we plan to make the model readily accessible through a self-contained Android application.

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87 - The processing of spatial frequencies through time in visual word recognition

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Goal: The range of spatial frequencies optimal for the recognition of written words is well established. However, studies of other classes of stimuli (objects, faces, scenes, etc.) demonstrate a rapid temporal evolution of the spatial frequencies most useful for visual recognition. The present study aims to assess the time course of spatial frequency processing in the specific context of a visual word recognition task.

Method: Word images were filtered according to four SF conditions using a bandpass Butterworth filter with center frequencies of 1.2, 2.4, 4.8, and 9.6 cycles per degree (cpd). Exposure duration was of 200 ms with variyng signal-to-noise ratio (SNR; signal = target image; noise = white noise field) according to a random sampling function made by the integration of sine waves with frequencies ranging between 5 and 55 Hz in steps of 5 Hz with random amplitudes and phases. Thus, the visibility of the target word varied randomly throughout its exposure duration. New, independent SNR functions and white noise fields were generated on each trial. Classification images (CI) of processing efficiency as a function of time were then calculated to illustrate how the processing of each spatial frequency band evolves through time.

Results: Response accuracy was very close to 50% correct for all conditions, which did not differ from one another ($F(3, 45) < 1$). The contrast level of targets leading to these accuracies however, differed across conditions ($F(3, 45) = 17.6$; $p < .001$). Thus, the lowest and highest SF conditions required a higher target contrast than the two intermediate conditions, which comprise the optimal SFs for reading.

Published data would have predicted a coarse-to-fine SF processing order. Our time-domain CIs however, show the greatest initial efficiency for the highest SF condition, followed by the second highest, and then the lowest SF range. Further analyses indicate that the time-domain CIs fail to capture the full story. Thus, time-frequency CIs show that processing efficiency is also affected by the frequency content of the SNR oscillations in a complex interaction with SF condition and time. Congruently, the classification performance of a support vector machine (SVM; with leave-one-out cross validation) in mapping the Fourier transforms of individual CIs to SF condition is much greater if the task rests on time-frequency (90.6% correct with 8.0% of the features available) than time-domain CIs (42.2% correct with 100% of the features available).

Conclusion(s): Previous tests of the coarse-to-fine theory of visual recognition (Bar, 2003, JCogNeurosci) have focused on SF usage through time and their findings using object, scene, or face recognition have supported it. The present findings, however, fail to support the notion of coarse-to-fine processing for word recognition, showing instead a fine-to-coarse SF processing order. Moreover, at least in the context of a word recognition task, the frequency content of target visibility oscillations through time is a crucial factor to take into account for a complete understanding of the phenomenon.

Funding: Supported by grants from the Fonds de Recherche Québec—Nature et Technologie and the Natural Sciences and Engineering Research Council of Canada (NSERC) to Martin Arguin and a summer research scholarship to Clémence Bertrand Pilon from the Conseil de recherches en sciences naturelles et en génie du Canada (CRSNG).

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88 - Longitudinal monitoring of the spontaneous activity of the dorsal cortex during late blindness in mice using calcium imaging

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Goal: The loss of visual inputs has major anatomical and functional effects on brain organization. In humans, the cross-modal plasticity that follows vision loss has been well characterized. However, the difficulty to recruit blind participants along with the heterogeneity of groups makes it difficult to study the development of cross-modal plasticity over time and in terms of the sensory experience of the individuals. Moreover, while most of the studies on blindness focus on early vision loss, few studies investigate the effect of vision loss at the adult stage on the brain, which represent the clinical situation of most blind people in the world.

The mouse is a popular model in neuroscience that has been used to study the effect of vision loss on the brain mostly using anatomical investigations. It has been found that it takes around 7 weeks after monocular enucleation to observe an activation of the monocular zone after stimulation of the whiskers. However, it is now relatively easy to express fluorescent calcium indicators to measure the neuronal activity of specific neuronal populations in awake mice over several weeks/months.

The brain expresses rich and dynamic activity patterns when the animal is not engaged in any specific task and in the absence of any external sensory stimuli. This “resting state” has been used to characterize the functional connectivity between brain regions. In the present study, we seek to explore how binocular enucleation in the adult mouse affects the spontaneous activity pattern of the dorsal cortex over time using calcium imaging.

Method: We have implanted a chronic imaging window on 12 thy1-jrGECO1a mice to perform widefield calcium imaging on the dorsal cortex. Mice were group housed to maximize the multisensory experience and ultimately the cross-modal plasticity. They were habituated to be head-fixed on a running wheel under the imaging system. To capture the red fluorescence from jrGECO1a, the dorsal cortex was illuminated with a green LED (565/12nm), and the fluorescence, filtered at 618/50nm, was captured by a camera (CMOS). Retinotopic mapping with moving checkerboard bars on a monitor was performed to get the retinotopic maps and determine the position of visual areas of all mice. After 3 baseline sessions of spontaneous activity (10min), 6 mice were bilaterally enucleated while the 6 others remain sighted as a control. Imaging sessions were then conducted weekly.

Results: In progress at the time of submission.

Conclusion(s): Compared to previous investigations focusing on early blind mice, this study exploits the benefit of longitudinal monitoring to map the changes in connections induced by the loss of vision after the period of development.

Funding: FRQS - 312876; NSERC; Quebec bio-imaging network; CIRCA

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89 - Developing a novel dichoptic reading application to treat amblyopia

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Goal: Amblyopia, or lazy eye, is a neurodevelopmental disorder of the visual cortex in which the brain cannot process visual input from one eye. Currently, research on treatments for amblyopia have shifted focus from the routine patching treatment, which is ineffective across age groups and has low compliance rates, towards the use of entertaining binocular tasks. The purpose of this study was to determine if amblyopes can read binocularly on a dichoptic electronic-book application & if equating visual input to both eyes could improve their reading ability.

Method: A prototype of the application was programmed and uploaded onto tablets used to assess participants. These individuals read e-books in a binocular presentation using anaglyph red/green/black glasses which allowed for separate alterations to monocular and binocular contrast. The researchers questioned controls and amblyopes on application use comfortability and measured their reading speed in various viewing conditions.

Results: The data revealed that amblyopes read much slower that controls in dichoptically presented viewing conditions. Amblyopes also read significantly slower in dichoptic conditions compared to black-text control conditions. This demonstrates that their visual systems were forced to integrate information from both eyes to read all the text on screen. Furthermore, when the contrast of text seen by the fellow eye was reduced, reading speed increased in agreement with current research on other binocular training platforms.

Conclusion(s): Overall, this research provides evidence that amblyopes can read binocularly using the e-book application platform indicating it could be an effective tool to treat amblyopia. Future steps in this research will aim to train amblyopes to read in this application to improve their binocular vision.

Funding: This project was funded by an IGNITE grant from Healthy Brains Healthy Lives and an NSERC CGS-M scholarship provided to Nicole Dranitsaris

90 - How does the temporal spectrum of noise impact its masking effect on contrast detection?

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Goal: Experiments that use the noise masking paradigm measure thresholds for detecting a target as a function of external noise. The equivalent input noise approach finds the magnitude of external noise that is required to overcome the effect of the internal noise in the visual system. Measuring performance in noise allows the efficiency with which that noisy signal is processed to be determined. These methods reveal changes in perceptual limits across developmental states. The goal of the study is to determine how noise with different temporal properties impacts the noise-masking measurements.

Method / Results: Experiment 1A (5 participants). Gratings were detected in 1D pink spatial noise. This noise was presented with 3 temporal spectra (constant, pink, white) and at 3 levels (both without noise, and with noise +12dB, and +18dB above the threshold for detecting the noise itself). The duration of the presentation was 0.25 seconds. A two-interval forced-choice task was used. Equivalent internal noise and efficiency were obtained by fitting the Linear Amplifier Model (LAM). Experiment 1B (3 participants). Like 1A but investigating the effect of varying stimulus duration (0.05, 0.1, 0.2, and 0.5 seconds). In Experiment 1C (9 participants), we were interested in whether the impact of stimulus temporal properties was different for two different tasks. Our targets were circular patches of 1D pink noise that were either constant or varied over time (white or pink spectrum). We compared results from identification and detection two-interval forced-choice tasks. In the detection task, the participant detected either a left oblique or right oblique target that appeared in either the first or second temporal interval (with the other blank). In the identification task, both intervals contained a stimulus. One was left oblique, and the other right oblique. The goal was to select the interval containing the left oblique target.

Experiment 1A. The masking effect of temporally white noise was significantly weaker than that of noise that was constant over time. Experiment 1B. Like 1A, we found temporally white noise to have a reduced masking effect. Longer stimulus durations reduced detection thresholds without noise but did not impact thresholds for detection in noise. This resulted in reduced equivalent input noise for longer stimulus durations. Experiment 1C. We analyzed the slope of the threshold-vs.-duration functions for the two tasks. They significantly varied based on temporal noise type but not between the two tasks. Slopes were steepest in white noise.

Conclusion(s): We find that noise which is white over time has a masking effect which is distinct from that of constant and temporally pink noise. The masking effect is reduced, and more strongly affected by stimulus duration. Our temporally pink noise is similar to the white noise in that both are dynamic, however the slower rate with which the pink noise changes appears to lead to behaviour similar to constant noise. This is advantageous in task designs where dynamic noise is preferable. The results presented here are from young adults. These findings will inform the design of planned studies to compare results between younger and older adults.

Funding: VHRN, FRQS, Fiera Capital Awards, NSERC

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91 - The role of vision perception in the phonological deficit observed in dyslexics

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Goal: Dyslexia is a cognitive learning disability that impacts the recognition and decoding of words, leading to phonological deficits, poor spelling and reading abilities throughout their lifespan. Recently, researchers have investigated the role of visual perception in dyslexia, with inefficient eye movements while reading (Franzen et al. 2022), and reversals of letters (e.g., d/b).

Method: The York-Adult Assessment Battery-Revised is designed to assess cognitive and vision functioning in adults using tests of reading, spelling, writing and phonological measures (Warmington et al., 2013). The phonological component is measured using spoonerisms (i.e., words or phrases in which letters or syllables get swapped), and digit and object recognition using a rapid automatized naming (RAN) task. Here we aim to investigate whether the spoonerisms and RAN tasks could act as screening tools for dyslexia. We hypothesized that a performance difference in both tasks will exist between individuals with dyslexia and non-dyslexics.

Results: We found a performance difference in both the spoonerisms and RAN digit, with dyslexics performing worse in both tasks. We also hypothesized a sex difference between and across groups for each task. We observed a sex difference for the spoonerisms task, with males performing better than females, but not for the RAN task.

Conclusion(s): Therefore, spoonerisms may be an adequate tool for discerning between adults with and without dyslexia, allowing it to be used as a screener for dyslexia. However, further research is needed for the RAN task.

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92- The real-time effects of selective attention on sensory eye dominance

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Goal: To investigate the role of selective attention on ocular dominance in real-time using dichoptic phase-scrambled movie.

Method: 16 adults with normal vision participated in our study. Fourier phase spectrum scrambled movie images were displayed on one eye (unattended eye), and natural movie images were presented to the other eye (attended eye) in dichoptic conditions. Same mixed movie images (phase-scrambled image mixed with natural image) were presented to both eyes as control conditions (binocular conditions). Movies were displayed under binocular with sound, binocular without sound, dichoptic with sound and dichoptic without sound conditions. The perceptions (more natural or more phase-scrambled image) of participants were measured during the movie watching.

Results: The proportion of more-scrambled perception (i.e., the dominance of the unattended eye) increased progressively over the 10-minute of dichoptic movie watching. Delayed key response was observed when the movies were played with sound, suggesting higher attentional load. Slightly smaller changes in sensory eye dominance were found under dichoptic without sound condition than dichoptic with sound condition.

Conclusion(s): We demonstrate that, initially, the dominance of attended eye slightly increased after correcting judgement bias. But dichoptic phase-scrmabled movie biased the sensory eye dominance progressively in favor of unattended during the 10-minute of viewing, reversing the initial changes. Audio enhanced the attentional load and further slightly increased the sensory eye dominance shift. The present study helps us to better understand the dynamic time course of changes in sensory eye dominance that induced by top-down attention.

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93 - Investigating the temporal dynamics of binocular combination

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Goal: In the standard model of binocular combination, the inputs from the two eyes not only sum together but also suppress each other. Interocular suppression can be characterised through dichoptic masking, a phenomenon in which the ability to detect a target presented to one eye is reduced by a noise mask presented to the other eye. Summation can be characterized using a slightly modified masking paradigm in which the mask is replaced by another identical target. Currently, the temporal dynamics of binocular combination are not fully understood. In particular, the functional consequences of desynchronizing the ocular inputs in both interocular suppression and binocular summation are not known. Our aim was to investigate the functional consequences in both these processes using psychophysics.

Method: To assess the effect of asynchronous ocular inputs on interocular suppression, we employed a dichoptic suppression paradigm using a two-alternative-force-choice task. Stimuli were displayed on a passive 3D screen. Participants indicated the orientation of a target grating presented to one eye while a pink noise mask was presented to the other eye at the same spatial location but at a different time. The contrast of the target was adjusted using a 2-up 1-down staircase. Thirteen inter-stimulus intervals (-100, -66, -42, -24, -16, -8, 0, 8, 17, 24, 42, 66, and 100 milliseconds) between the mask and the target were tested. To assess the effect of desynchronization on binocular summation, we made two modifications to the suppression paradigm: we replaced the mask with another target, ensuring both targets always shared all stimulus properties, and we removed all negative inter-stimulus intervals from testing.

Results: Our results revealed concrete consequences of interocular desynchronization in both experiments. In the suppression experiment, the smallest masking effect was observed for simultaneous presentation of stimuli which indicates that increased interocular desynchronization results in increased interocular suppression. In the summation experiment, increasing ISI resulted in increased contrast detection thresholds indicating that interocular desynchronization results in worsened binocular summation.

Conclusion(s): These findings provide novel insight into the functional consequences of asynchronous ocular inputs, particularly in revealing that increasing interocular desynchronization both increases interocular suppression and decreases binocular summation. Our findings may have implications in the general understanding of the binocular visual deficits in amblyopic and in the development of novel treatments for amblyopia.

94 - Evaluation of high-resolution gSlider-SMS diffusion MRI in detecting occipital lobe structural connectivity

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Goal: The structural connections between human lower visual areas haven't been studied with diffusion MRI (dMRI). To investigate the pattern of these connections, a dMRI is required to operate at both high-resolution and high signal-to-noise ratio (SNR). gSldier-SMS (Setsompop et al., 2015) overcomes the difficulty of low SNR at high resolution commonly observed for common dMRI sequences. We aim to evaluate gSlider's capability in modelling the white matter connections between lower visual areas.

Methods: Using a Siemens 3 T Prisma scanner equipped with a 64-channel head coil, data were acquired by applying three variations of gSlider dMRI, HCP-like dMRI, and structural MRI from 10 subjects. The dMRI and structural MRI processing pipelines are based on the Tractoflow pipeline (Theaud et al., 2020) and the HCP preprocessing pipeline. We used Benson's atlas (Benson et al., 2014) to generate the retinotopic eccentricity and polar angle maps. We focused on eccentricities from 1° to 15° to study the retinotopically organized structural connectivity.

Results: The connectivity results are shown in a 60 by 60 symmetric matrix separately for each of the 4 protocols. Figure 1 presents the average structural connectivity tract count between V1-V2, V2-V3, and V1-V3. Despite having a higher angular resolution — more directions — in the acquisition, the HCP sequence generates fewer tracts than the gSlider protocols.
To further compare the 4 protocols, we computed a measure called C-sensitivity. C-sensitivity measures the proportion of expected connections that show higher connectivity measures than the 95th percentile of unexpected connections. gSlider sequences achieved higher mean and median C-sensitivity than the HCP sequence. We found that for each pair of connections between V1, V2, and V3, the central visual field regions are more densely connected than the regions in the periphery. In addition, we evaluated the divergence of connections from an eccentricity range in one visual area corresponding to a second visual area. The divergence is presented by the blue curve to which we fitted a Gaussian presented by the orange curve. The divergence pattern can be seen in all pairs of connections and protocols. We can also observe differences in the divergence: the connection between V1 and V2 shows a narrower divergence than the connections between V1 and V3, and V2 and V3. The high R-squared value suggests that the Gaussian model accurately captures the nature of the spread of the connections.

Conclusion(s): We evaluated gSlider's capacity in examining the fine-scaled structural connectivity between the human lower visual areas. We show that within the same acquisition time, gSlider is better at detecting the connectivity than the HCP dMRI sequence. This means that spatial resolution is more important than angular resolution when it comes to regions that are densely connected. We also found denser connections between central visual field regions than peripheral regions. This conforms with the higher central vision acuity. The divergence of connectivity agrees with previous tracer injection studies (Salin and Bullier, 1995).

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95 - Visual precision processing in a higher-order visual area

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Goal: Our visual environment is composed of distributions of variable orientation precisions. Here we focused on understanding how the precision of visual stimuli affects the processing of orientation in higher hierarchical areas.

Methods: Specifically, we examined cortical area 21a in cats, often considered the equivalent of primate area V4 within the hierarchical organization of visual processing. Using pseudo-natural visual stimuli called "MotionClouds," (MC) we investigated the impact of orientation precision on the responses of neurons in area 21a. Four parameters control the MC precision: the orientation, the spatial frequency (SF), B_θ and B_{sf}. The latter two regulate the bandwidth of the orientation and SF, respectively. We recorded and analyzed responses of 21a neurons to determine variations in orientation precision.

Results: Preliminary data reveal that neurons in area 21a exhibit mainly two types of responses to MC. The first type is a binary response, where neurons show strong activation to high-precision stimuli (B_θ low) but do not respond to low-precision stimuli (B_θ high). The second type of response demonstrates a gradual decrease in neural activity as precision decreases. Interestingly, both responses maximize their activity to different SFs to those used to maximize the response to sinusoidal drifting gratings. When comparing this second type of response to that observed in V1, we notice that neurons in area 21a exhibit a higher degree of fitting, as their orientation tuning curves are narrower compared to those in V1.

Conclusion(s): This data suggest the involvement of the cortical ventral stream in precision processing. However, a key question remains: how does the cortex utilize this precision information to shape visual perception?

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96 - La reconstruction des images mentales grâce à Bubbles et à l'électroencéphalographie

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But : L'imagerie mentale visuelle joue un rôle significatif dans le quotidien de la majorité des gens puisqu'elle complémente plusieurs fonctions cognitives comme la mémoire de travail visuelle et la mémoire épisodique. Toutefois, la nature des caractéristiques visuelles en conscience lors de l'imagerie est difficile à étudier empiriquement. Les quelques reconstructions des images mentales existantes sont de mauvaise qualité en raison d'une faible couverture de « l'espace de la scène ». L'objectif de cette étude exploratoire est de reconstruire des images mentales de meilleure qualité en augmentant la résolution d'échantillonnage des caractéristiques visuelles grâce à la méthode *Bubbles* et à l'électroencéphalographie (EEG).

Méthode : Jusqu'à présent, six participants ont effectué six séances d'une heure alternant deux tâches différentes durant lesquelles leur activité cérébrale était enregistrée par EEG. Durant la tâche de perception, les images étaient présentées successivement, occluses par un masque aléatoire (1000 essais). Cette « méthode des bulles » a permis d'échantillonner l'espace pour identifier les propriétés imaginées. Durant la tâche d'imagerie, les images étaient suivies d'un indice référant à l'une d'elles, que les participants devaient imaginer et en indiquer la vividité (300 essais). Les analyses ont ensuite été réalisées par électrode, pour chaque participant et chaque image. L'activité cérébrale de chaque essai d'imagerie a été corrélée avec celle de tous les essais de perception des images masquées. Les valeurs de corrélation ont été utilisées comme poids dans une somme pondérée des masques de bulles afin de produire une pseudo-image de classification pour chaque essai d'imagerie. Toutes les pseudo-images de classification ont été moyennées, produisant une image de classification. Les tests de Pixel et de Cluster ont ensuite été appliqués pour identifier les régions les plus significatives.

Résultats : Pour chaque participant et pour chaque image, les tests statistiques ont identifié les régions les plus significatives des images de classification, révélant ainsi les régions les plus imaginées durant l'imagerie mentale visuelle.

Conclusion(s) : Les résultats obtenus suggèrent que la méthode employée permet effectivement la reconstruction des images mentales. Il s'agit donc d'une avancée importante dans l'étude empirique du contenu de l'imagerie mentale et, de manière plus générale, des processus cognitifs sous-tendant l'expérience subjective.

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97 - Influence of aging on visual attention and peripheral perception

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Goal: When searching for an item among distractors, we distribute our attention to a certain extent around each fixation. It has been suggested that in aging, there is a reduced attentional distribution, leading to visual and attentional declines.

Method: To investigate attentional distribution, 27 younger and 16 older adults performed a pop-out visual search task. With gaze-contingent methods, we presented different visible window sizes around participants' fixation during the task. We extracted the size of each participant's attentional window based on their search times for the different visible window sizes. To test whether performance in the visual search task was related to peripheral visual function, participants performed a contrast detection task and two motion detection tasks (local and global motion perception). In these tasks, stimuli were presented at two different peripheral eccentricities (5° and 10° distant from fixation point).

Results: Overall, we observed that older adults took longer to report the target's presence compared to younger adults, t (41) = 6.31, p<.001. Compared to younger participants, they also had a significantly smaller attentional window, t (41) =2.16, p=.036. In addition, older adults had higher contrast detection thresholds, F (1, 41) = 23.23, p < .001, and higher thresholds in local, F (1,41) = 4.53, p=.039, and global motion perception, F (1,41) = 27.58, p<.001, contrary to the idea that motion perception is preserved with aging.

Conclusion(s): Overall, we observed a reduced attentional distribution as well as lowered contrast thresholds and lowered motion perception in aging. Strategies that aim to improve spatial attention and enhance the processing of peripheral visual information may be beneficial for improving visual perception and attention in older adults.

Financement : Fonds de recherche du Québec en santé, Centre interdisciplinaire de recherche sur le cerveau et l'apprentissage

Résumé des présentations par affiche / *Poster presentations abstracts*
Cerveau et perception / *Brain and perception*

98 - L'échantillonnage temporel comme prédicteur du TDAH

Pénélope Pelland-Goulet[1], Martin Arguin[1], Hélène Brisebois[2], Nathalie Gosselin[1]

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But : Le trouble du déficit de l'attention avec/sans hyperactivité (TDAH) est un trouble neurodéveloppemental ayant pour symptômes l'inattention et l'hyperactivité/impulsivité. Chez les adultes ayant un TDAH, les oscillations neuronales présentent des particularités au repos et lors de tâches cognitives, notamment les oscillations alpha (8-12 Hz) et beta (12-35 Hz). Cette étude s'intéresse aux caractéristiques temporelles du traitement perceptif des adultes ayant un TDAH en tant qu'indice de ces différences oscillatoires.

Méthode / Résultats : La technique d'échantillonnage temporel a été appliquée chez 50 participants (17-30 ans); 25 TDAH et 25 neurotypiques afin d'investiguer les oscillations du traitement visuel, qui refléteraient hypothétiquement les oscillations cérébrales associées au traitement visuel. Les participants doivent reconnaître des stimuli (mots), auxquels sont superposés du bruit blanc. Le ratio signal et bruit (RSB) oscille selon une fonction aléatoire durant chaque essai. Des images de classification reposant sur l'exactitude des réponses sont calculées afin d'examiner l'efficacité du traitement perceptif selon les caractéristiques temporelles de la stimulation.

Un algorithme d'apprentissage automatique de type Support Vector Machine (validation « leave-one-out ») est ensuite utilisé pour classifier les participants selon qu'ils présentent ou non un TDAH à partir de leur image de classification. L'algorithme a obtenu un taux de prédiction correcte de 94% en utilisant seulement 0,3% des données disponibles.

Conclusion(s): Les fluctuations d'efficacité de traitement dans les bandes de fréquence de 10, 30 et 55 Hz pour des fréquences d'oscillations du RSB à 55 Hz offrent la meilleure discrimination entre les groupes. Il semble que les oscillations gamma devraient être investiguées comme possiblement impliquées dans les altérations électrophysiologiques présentes dans les TDAH.

Financement : FRQSC

Résumé des présentations par affiche / *Poster presentations abstracts*
Cerveau et perception / *Brain and perception*

99 - Exploring the surround suppression mechanisms in amblyopia: a psychophysical study

Rinku Sarkar[1], Frederick. A.A. Kingdom[1], Alexandre Reynaud[1]

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Goal: Amblyopia, a brain-based vision disorder, is characterized by enduring spatial deficits in the amblyopic eye resulting from an aberrant and disproportionate interocular suppression exerted by the good fellow eye. This study aimed to determine if presenting a dichoptic surround mask to the amblyopic eye can selectively eliminate abnormal suppression from the fellow eye to the amblyopic eye, subsequently improve contrast sensitivity in the amblyopic eye, or if it only suppresses the stimulus in the fellow eye.

Method: Using a dichoptic center-surround masking paradigm, normal healthy individuals and individuals with amblyopia participated in a psychophysical task involving the detection of a central target in a two-interval forced-choice procedure. The stimuli consisted of horizontally oriented gratings with a spatial frequency of 0.5 cycles per degree (cpd), with the central test stimulus measuring 2 degrees in diameter and the surround mask measuring 6.5 degrees in diameter. The experimental setup included two interleaved targets and three distinct surround mask conditions.

Results: The findings revealed that contrast thresholds in the fellow eye were significantly elevated when the mask was presented in the fellow eye, indicating the presence of monocular suppression which contrasts with the control group. Also, amblyopic eye contrast thresholds were raised in both fellow and amblyopic eye masking conditions, with a more pronounced effect observed in the fellow eye masking condition, indicative of dichoptic suppression.

Conclusion(s): The results from this study suggest that individuals with amblyopia exhibit greater dichoptic suppression in the amblyopic eye when presented with fellow eye masks compared to the suppression observed in the fellow eye when presented with amblyopic eye masks. Furthermore, the vulnerability to suppression appears to be a consistent characteristic of amblyopia, regardless of whether the suppression originates from the amblyopic eye or the fellow eye. These findings shed light on the complex interplay of interocular suppression mechanisms in amblyopia and have implications for the development of targeted interventions to address this vision disorder.

Funding: This research is funded by the start-up funds from RI-MUHC to AR.

100 - Visually-evoked release of acetylcholine: spatial and temporal mapping in the mouse cortex

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Goal: Acetylcholine (ACh) modulates visual cortex processing during attentional and learning mechanisms. However, dynamics of ACh release during visual experience remains to be defined. To this aim, spatial and temporal ACh release was measured by mesoscopic imaging in head fixed awake mice.

Method: AAV-vector expressing gACh-3.0 ACh sensor under the synapsin1 promotor was intraventrically-injected in 4–6-month-old C57BL6 mice (n=6 per group). ACh release was measured during resting state or in response to contrast variation (bilateral gratings presentation) or to kinematograms. Luminance based sinusoidal gratings (0.03cpd, 1Hz drift, 30%, 50%, 75% and 100% contrast) or 1 deg moving dots were displayed (2sec on/8sec off, 10 repetitions) on two gaming monitors (BenQ, 144Hz, 1ms) in the axis of the eyes. Cortical responses (ΔF/F, %) were measured (Labeotech, Qc) at the level of the primary visual cortex, V1, and the extrastriate visual areas LM, PM, AL. The variation of ACh signals was analyzed by Umit Toolbox in MATLAB. The effect of inhibition of ACh degradation by donepezil (DPZ, 0.1, or 1 mg/kg, s.c.) was analyzed. One-way ANOVA comparison were performed between areas.

Results: Resting state activity was correlated between AL and LM or PM and V1 for ACh signals. These correlation ratios were increased by DPZ administration. However, there was poor interhemispheric correlation during resting state. ACh Signals varied in a contrast-dependent manner in all visual areas investigated (V1, AL, LM, PM) ($p<0.0001$) although the variation was smaller in AL and LM. ACh release ranged from 67 to 150% and was maximal in V1 during 100% contrast stimuli presentation.DPZ effect was dose dependant Unlike the contrast, for rdk, no significant relationship was observed between the increase in the coherence of the moving points and the signal amplitude.

Conclusion(s): ACh release was evoked by various visual stimuli with discrete regional and temporal distribution. This evoked release suggests a contribution of ACh in visual processing of specific stimuli.

Funding: IRSC CIHR, RESEAU DE RECHERCHE EN SANTE DE LA VISION, NSERC CRSNG

Résumé des présentations par affiche / *Poster presentations abstracts*
Cerveau et perception / *Brain and perception*

101 - Asynchronous binocular summation

Dasha Vanichkina[1], Daniel Gurman[1], Alexandre Reynaud[1]

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Goal: Binocular summation refers to the function of the visual system that combines pieces of visual information, that are received separately by the two eyes, into one unified picture. In this study, our aim is to investigate how this summation operates when the visual input is asynchronous between the two eyes.

Method: To quantify binocular summation, we measured the minimum contrast needed to detect the stimulus when presented dichoptically to the two eyes using a two-alternative forced-choice task and a two-up one-down staircase procedure. We included two viewing conditions: dichoptic and monocular. We used a passive 3D screen to present the stimuli. The target that we used was a Gabor that was tilted either to the left or the right. We included two spatial frequencies of the Gabor: 0.4 and 1 c/d. In each trial, we presented the target and asked the participants to indicate which way the target was tilting. Seven interstimulus intervals (ISI) were tested: 0, 1, 2, 3, 5, 8 and 12 frames between the two presented targets. Each frame was 8.3 ms.

Results: Our results indicated that as the ISI level increased, the detection thresholds increased as well. Interestingly, the effect of varying ISIs on contrast thresholds was less apparent in the monocular condition. In addition, there was a notable difference between the contrast thresholds of the two spatial frequency conditions, with there being more evidence of binocular summation in the low spatial frequency of 0.4 c/d. Therefore, further testing should be conducted to increase our confidence in the trends that we found.

Conclusion(s): We can conclude from these results that as the asynchronicity of targets increases, the efficiency of binocular summation decreases. This stresses the importance of synchronized visual processing in assembling a coherent, unified picture of our world. This may also have implications for furthering our understanding of clinical conditions in which the two eye inputs are desynchronized, such as amblyopia, and may even contribute to the development of novel treatments.

Funding: This research was funded by a startup fund from the Research Institute of the McGill University Health Center

102 - Are crossed and uncrossed disparities processed by the same mechanism?

Penghan Wang[1], Alexandre Reynaud[1], Robert Hess[1]

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Background: Human stereo vision has always been a topic of great concern in the field of neuroscience. With the assistance of psychophysics and developed techniques, it becomes much easier to discover the fundamental mechanisms behind them. It is still unclear whether the ability to judge depth polarity relies on a single mechanism or whether there are separate mechanisms (channels) encoding crossed (“popping in”) and uncrossed (“popping out”) disparities.

Goal: The goal is to better understand how crossed and uncrossed disparities are processed in individuals by investigating individual cases. This study would contribute to the clinical treatment of patients with stereo blindness. It is also expected to expand to the field of computer simulation vision in the foreseeable future.

Method: We would conduct psychophysical experiments with a "2-by-2 forced-choice paradigm". This paradigm is developed based on the perfect discrimination model from Watson and Robson (Watson & Robson, 1981). It allows us to tell how different depth polarities are processed from a subject’s performance in detection (noticing an in-depth stimulus) and discrimination (recognizing the polarity of the stimulus). This paradigm helps us to determine when the subject hit a certain level of detection or discrimination performance in a trial.

Results: Some subjects could achieve perfect discrimination at the detection threshold. But there were still 2 subjects that couldn't make a discrimination at all. The normals may have preferences to either crossed or uncrossed disparities, while anomalous subjects treated them equally.

Conclusion(s): A subject whose discrimination can be perfectly accomplished at the detection threshold should has separate channels involved in both disparities. However, things may vary for other stimuli.

Funding: Startup Fund

Résumé des présentations par affiche / *Poster presentations abstracts*
Cerveau et perception / *Brain and perception*

103 - Corrélats neurophysiologiques du traitement émotionnel dynamique de visages couverts

Naomi White[1, 2, 3, 4], Alicia Francoeur[1, 2, 3, 4], Bernadette Fortier[1, 2, 3, 4], Vanessa Hadid[2, 3, 4, 5], Franco Lepore[1, 2, 3, 4]

[1]Université de Montréal, [2]Montréal, [3]Québec, [4]Canada, [5]McGill University

Goal: Our research aims to explore the effects of masks on facial emotion processing, focusing on attentional processes and resulting behavioral responses.

Method: Participants identified emotions (joy, neutrality, or fear) in dynamic facial stimuli, presented with masks, without masks, or with sunglasses. The study used EEG to measure the participants' cortical activity to masked emotional faces. We focused our analyses on the reaction times and specific evoked responses as the N170, P300, and LPP. Statistical analysis included linear mixed models and linear regression, examining inter-condition and inter-hemispheric differences, and predicting behavior based on the EEG components.

Results: Masks affected emotion recognition, resulting in longer reaction times. Significant EEG changes were primarily observed in parietal brain regions, crucial for attention and information integration. The N170 component displayed variations across emotions, masking conditions, and hemispheres showing great interaction effects between factors. On the other hand, masks consistently increased P3 amplitudes in the right hemisphere, particularly for joyful expressions, indicating heightened attention requirements for masked faces. LPP responses varied between sunglasses and masks; sunglasses increased LPP, while masks decreased it. Notably, LPP reactions were reduced for masked fearful stimuli, suggesting that masks may hinder the perception of emotionally intense facial features. Importantly, behavioral responses were accurately predicted from the EEG components.

Conclusion(s): Face masks alter emotional processing leading to longer reaction times across emotions which can directly affect social interactions. Supporting this claim, the EEG results revealed distinct cognitive changes related to masked emotions, with both hemispheres playing a distinct role in emotional processing. These findings show that our perception of masked emotions changes in interpersonal situations and has important implications for understanding the psychological and societal effects of regular mask usage on well-being.

Funding: Canada Research Chair in Cognitive Neuroscience

104 - Apparent motion-induced activity in the early visual cortex of macaque monkeys

Yurou Zhang[1, 2], Amir Shmuel[1, 3]

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Goal: Apparent motion (AM) is an illusory perception of motion induced by successively presenting two stationary visual stimuli with appropriate spatial and temporal separations. With inducer stimuli of different spatiotemporal properties, long-range AM (lrAM) is thought to arise from neuronal processing distinct from that of the well-studied short-range AM (srAM). Neuroimaging studies supporting the perceptual filling-in hypothesis suggest that AM triggers neuronal activation between the inducing stimuli in the early visual cortex, giving rise to the internal representation of an object moving across the illusory motion path, and impairing the detectability of real stimuli presented along that path. However, a recently developed neurocomputational model and a subsequent human functional MRI study report that rather than activation, suppression is induced in the early visual cortex. The AM-triggered early visual cortex suppression has been proposed to result from feedback from higher-level visual areas (MT/V5) with larger receptive fields encompassing the entire lrAM trajectory. Other studies, including a recent monkey voltage-sensitive dye imaging experiment, have demonstrated the importance of intracortical horizontal connections within V1 with a high-resolution retinotopic map for computing and representing the AM path.

In an attempt to reconcile the conflicting evidence on this topic, we aim to further investigate the role of early visual cortices in lrAM perception and the underlying neural mechanisms.

Method: To investigate the presence of AM-induced activation / suppression in V1 and determine its spatial and temporal properties, we will first use functional MRI to measure the BOLD responses to optimal lrAM inducer stimuli in awake macaque monkeys. In addition, we will present to the animal a range of lrAM-inducing stimuli with different spatiotemporal properties to probe the relationship between V1 suppression strength and the temporal offset (i.e., interstimulus interval, in ms) & spatial offset (i.e., spatial separation, in degrees) of the inducer stimuli. Visual stimuli with disparate colors and shapes will also be incorporated to elucidate the neural mechanisms underlying observations from previous psychophysical studies that successfully created AM illusions using mismatching stimuli. Potentially, further experiments using neurophysiological recordings could be conducted to validate the fMRI responses with greater spatial and temporal precision.

Results: We expect to find AM-induced BOLD response suppression along the early visual representations (V1/V2) of the AM path, especially in the midpoint where no physical stimuli are presented. Furthermore, we hypothesize that as the inducer stimulus onset asynchrony (i.e., ISI) and the spatial separation between the 2 inducer stimuli (SI, in degree) increase, there will be a corresponding reduction in V1 suppression strength. Lastly, under optimal spatiotemporal parameters, we anticipate that inducers with mismatched physical properties will still elicit neural activities in V1 comparable to those induced by matching inducers.

Conclusion(s): In conclusion, this project will provide insight into the neural mechanisms underlying AM perception by studying the temporal, spatial, and feature-dependant aspects of AM-induced activities in primate early visual areas. Furthermore, investigating visual illusions to elucidate how primate brains link visual stimuli across space and time may also contribute to the theory of constructive / inferential visual processing.

Funding: Natural Sciences and Engineering Research Council of Canada grant RGPIN-2020-06930

Résumé des présentations par affiche / *Poster presentations abstracts*
Cerveau et perception / *Brain and perception*

105 - Identification of spatially scrambled letters in human vision is inconsistent with a simple matched template model

Xinggi Zhu[1], Robert Hess[1], Alex Baldwin[1]

[1]McGill Vision Research, Department of Ophthalmology and Visual Sciences, Faculty of Medicine and Health Sciences, McGill University, Montreal, Quebec, Canada.

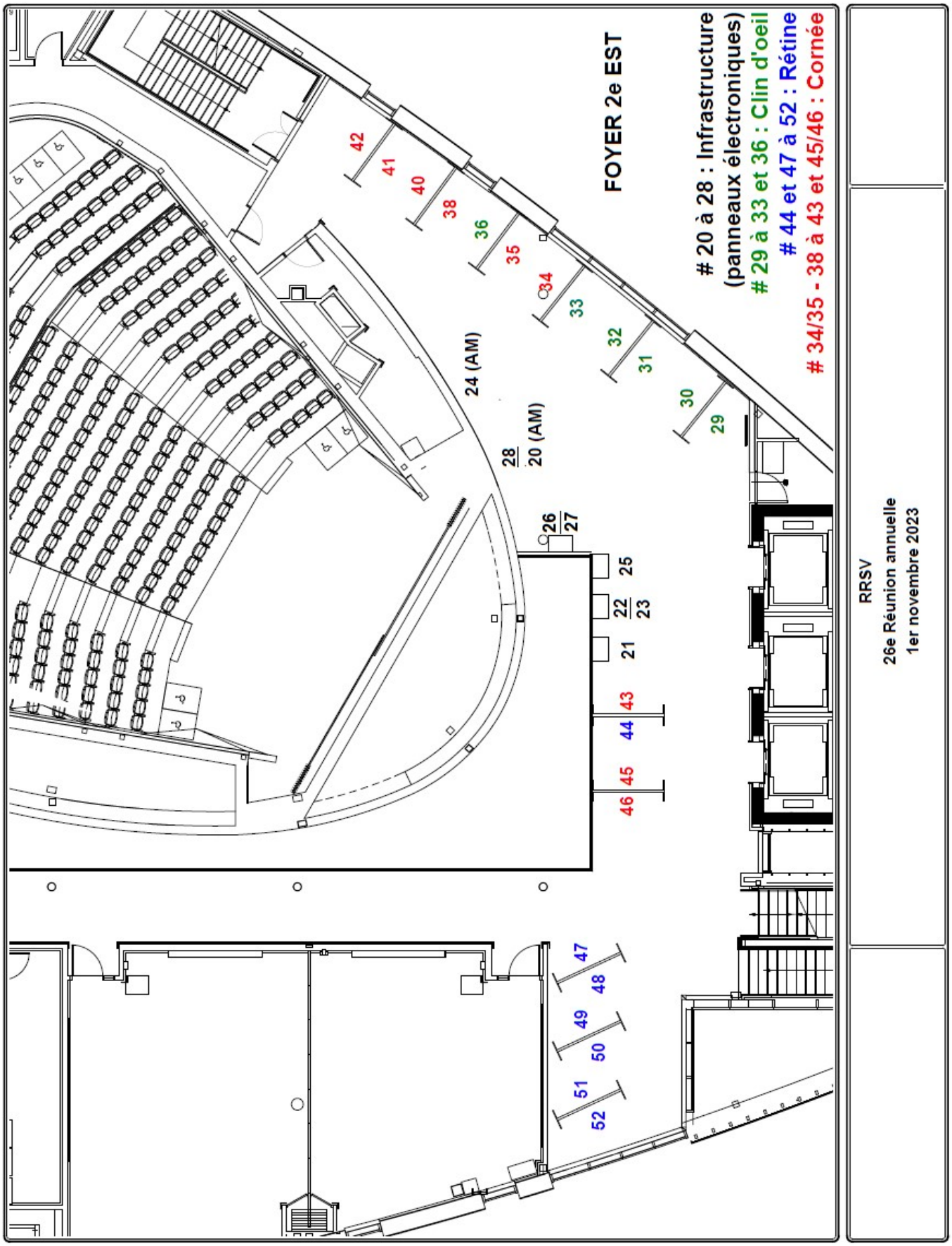
Goal: To a first approximation, the visual system contains a feedforward hierarchy between visual areas. We are interested in the fidelity of the projections between these areas. To this end, we have tested human performance for identifying letters that have been scrambled by different algorithms that simulate the effects of miswiring at different levels of the visual hierarchy. For the detection of a known (unscrambled) target presented in white noise, a simple template matching between the noiseless target and stimulus is the optimal strategy for the task. When the target is distorted by scrambling, however, it is no longer optimal. Here, we explore the question of whether human behaviour in the letter identification task is similar to that of the simple template-matching observer. We also explore the use of deep Convolutional Neural Networks (CNNs), which have shown promise in their utility to study human vision.

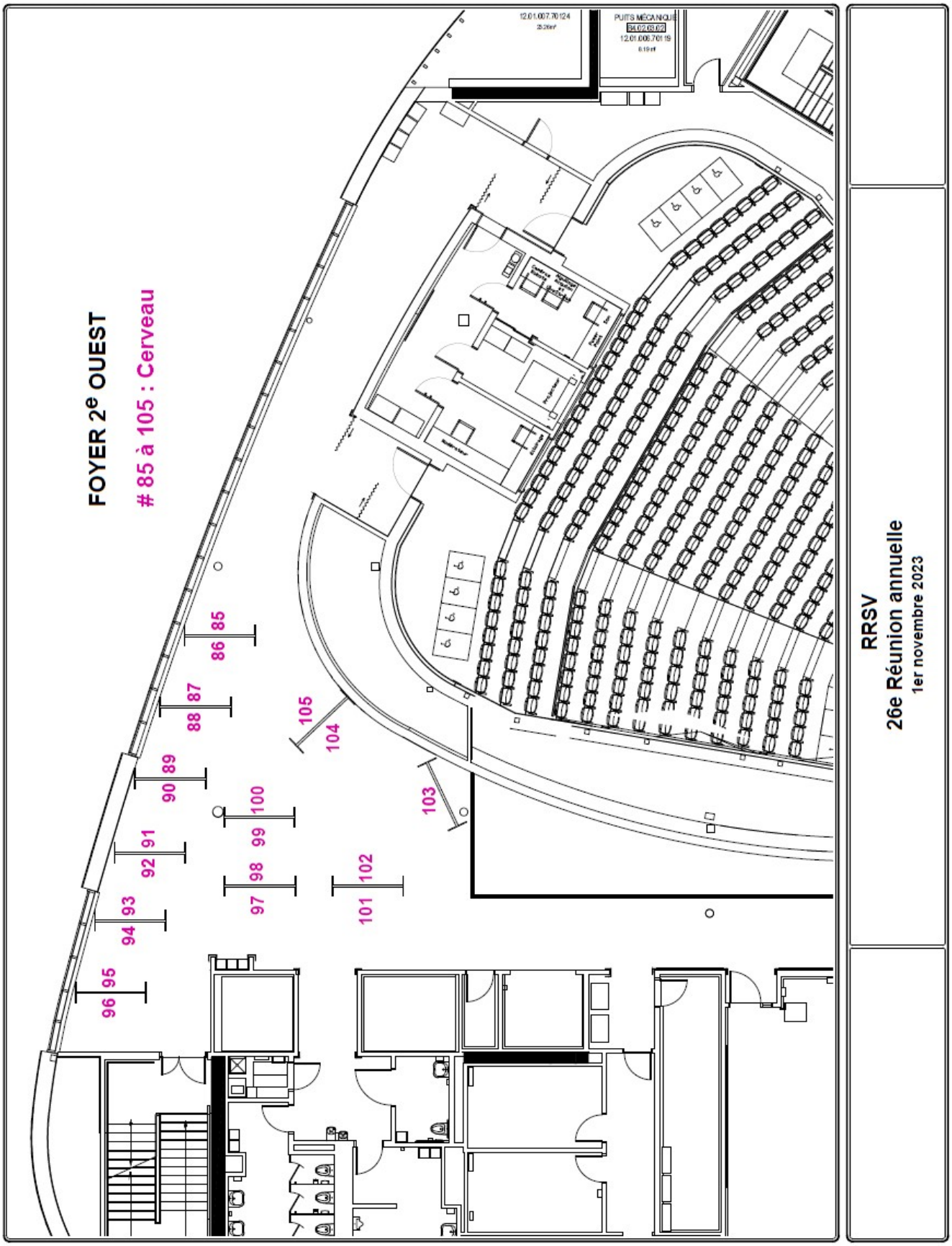
Method*:* Our physiologically inspired stimulus scrambling synthesis scheme mimics the hierarchical computations of the early visual stream. We applied this processing to generate spatially bandpass letter stimuli composed of log Gabor wavelets. There were two scrambling noise conditions, distinguished by whether positional jittering was applied prior to the "oriented receptive field" stage or at the output from that stage. We also tested using an additive bandpass noise condition, where no jittering was applied to the stimulus. On each trial, we presented one of four lowercase Times New Roman font letters. The task was a four-alternative forced choice letter identification. We collected data on five humans with normal healthy vision and also simulated the responses of the template-matching observer (TMO) and three CNNs trained on letter stimuli of each noise condition. Along with an analysis of performance, we constructed the letter biases and confusion matrices for each observer.

Results: In terms of performance, TMO outperformed humans for the bandpass noise condition but not the scrambling conditions. In bandpass noise, we saw both the TMO and CNNs matched well with humans in the letter bias. For confusion patterns, however, the CNNs provided much better linear fits than the TMO, specifically the output scrambling trained CNN. In the two scrambling noises, the TMO drastically diverged from humans in letter biases. For both input and output scrambling, the template-matching observer poorly predicted humans for confusion patterns.

Conclusion(s): Our results suggest that humans did not use template-matching for identifying scrambled letters. In the bandpass noise, faced with letter targets that were not disrupted positionally, we found the CNNs, not TMO, shared more mistake pattern similarities with humans, especially the output scrambling trained CNN. The moderate correlations we obtained between CNNs, and humans suggest that CNNs trained this way may share more similar internal representations with humans than previously thought and could be used as tools to study human strategy in psychophysical tasks.

Funding: Vision Sciences Research Network (VHRN) Master's recruitment scholarship, Fonds de Recherche du Québec - Santé (FRQ-S) Master's scholarship, Canadian Institute of Health Research (CIHR)


FOYER 2e EST
20 à 28 : Infrastructure (panneaux électroniques)
29 à 33 et 36 : Clin d'oeil
44 et 47 à 52 : Rétine
34/35 - 38 à 43 et 45/46 : Cornée
24 (AM)
28
20 (AM)
26
27
22
23
RRSV
26e Réunion annuelle
1er novembre 2023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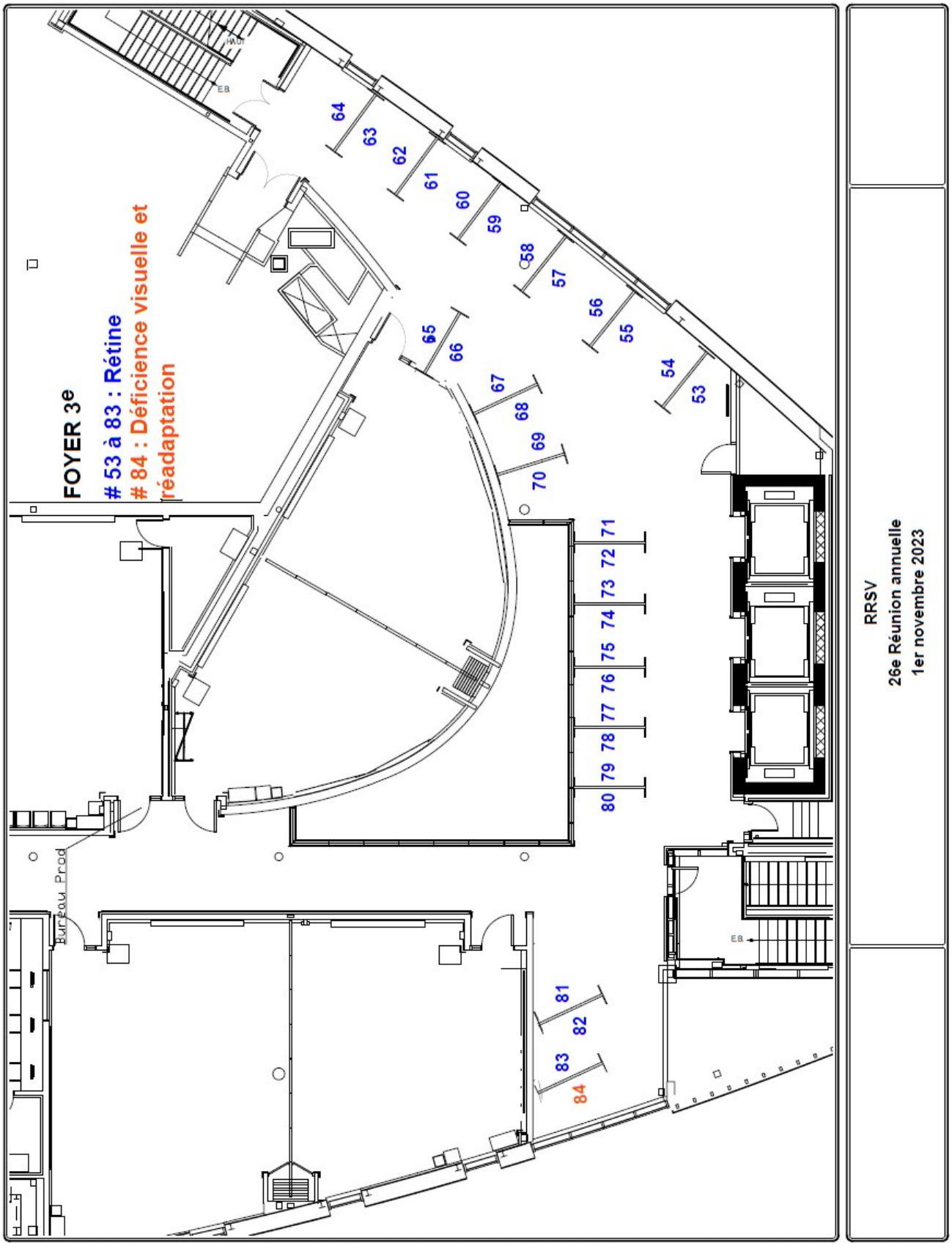
85 à 105 : Cerveau
PUITS MÉCANIQUE
RRSV
26e Réunion annuelle
1er novembre 2023


FOYER 3e
53 à 83 : Rétine
84 : Déficience visuelle et réadaptation
RRSV
26e Réunion annuelle
1er novembre 2023
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53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84

Formulaire d'évaluation

25e Réunion annuelle du Réseau de recherche en santé de la vision

Mercredi, 9 novembre 2022, Amphithéâtre Pierre-Péladeau, Montréal

À quelle catégorie appartenez-vous ?
☐ Chercheur ☐ Clinicien ☐ Clinicien-chercheur
Étudiant : ☐ BSc ☐ MSc ☐ PhD ☐ Md☐ SPD
☐ Résident ☐ Fellow ☐ Personnel de recherche
☐ Industrie ☐ Autre (précisez):_____

De quel axe êtes-vous membre ?
☐ Cornée et segment antérieur
☐ Cerveau-perception
☐ Déficience visuelle et réhabilitation
☐ Rétine et segment antérieur
☐ N/A

	excellent	bon	moyen	mauvais	sans opinion
Quelle est votre évaluation globale de la journée ?					
Avez-vous apprécié le concours « Mes recherches en un clin d'œil » ?					
	très en accord	**en accord**	**sans opinion**	**en désaccord**	**très en désaccord**
Cette conférence vous a-t-elle donné une bonne idée de ce qui se fait présentement en recherche en vision au Québec ?					
Que penseriez-vous d'alterner, un symposium une année et une réunion générale du Réseau l'année suivante ? (la réunion générale aurait lieu aux 2 ans)					
RÉSIDENTS : Avez-vous des suggestions de sujets pour l'an prochain (formation aux résidents) ?					
Dans un contexte où le FRQS demande au RRSV de favoriser le rapprochement entre la recherche fondamentale et la recherche clinique, quelles seraient vos suggestions ?					
Le rôle du Réseau étant de promouvoir le maillage entre les chercheurs, quelles seraient vos suggestions pour la réunion de l'année prochaine ?					
Autres commentaires :					

Pour les cliniciens (éducation médicale continue) :			
L'activité respectait-elle le Code d'éthique du Conseil québécois de développement continu des médecins ? (www.cqdpcm.ca)	___oui	___non	Si non, précisez
Avez-vous l'impression qu'il y avait un biais commercial durant cette activité de formation ?	___oui	___non	Si oui, précisez
La divulgation des conflits d'intérêt par les responsables de l'activité était-elle adéquate ?	___oui	___non	Si non, précisez
Mentionnez brièvement ce que vous avez appris et/ou ce que vous prévoyez intégrer à votre pratique.			

RÉSEAU DE RECHERCHE EN SANTÉ DE LA VISION
VISION HEALTH RESEARCH NETWORK

Evaluation form

Vision Health Research Network 25th Annual Meeting

Wednesday, November 9 2022, Amphithéâtre Pierre-Péladeau, Montréal

To which category are you?
☐ Researcher ☐ Clinician ☐ Clinician-scientist
Student: ☐ Undergrad ☐ MSc ☐ PhD ☐ Md
☐ PDF ☐ Clinical fellow ☐ Research fellow
☐ Resident ☐ Research staff ☐ Industry
☐ Other (specify):_____

Which axis are you a member of?
☐ Cornea and Anterior Segment
☐ Retina and Posterior Segment
☐ Brain and Perception
☐ Visual Impairment and Rehabilitation
☐ N/A

	excellent	good	average	poor	noopinion
What is your overall assessment of the day?					
Did you enjoy the "A wink at my research" contest?					
	strongly agree	**agree**	**noopinion**	**disagree**	**Strongly disagree**
Did this conference give you a good idea of what research is done in the province of Quebec?					
What would you think of alterning the International Symposium and Network general meeting every other year (the Network general meeting would then be help once every 2 years)					
REDISENTS: Any topics suggestions for next year (workshop for residents)?					
In a context where the FRQS strongly encourages the VHRN to develop closer ties between basic and clinical research, what actionyou suggest to facilitate this ?					
Considering that the role of the Network is to promote networking among researchers, what are your suggestions for the next Annual Meeting?					
Other commentairies :					

For clinicians (Continuous medical education):			
Did this activity obey the code of ethics of the stakeholders in continuing medical education? (www.cqdpcm.ca)	___yes	___no	If not, specify :
In general, do you feel that there was a commercial aspect during the training?	___yes	___no	If not, specify
Was the disclosure of conflicts of interest by the organizers of the activity adequate ?	___yes	___ no	If not, specify
Mention briefly what you learned and/or what you plan to integrate to your practice.			