

Ophtalmologie 2025 -IA

Yves Lachkar

Institut du Glaucome
Fondation Hôpital Saint Joseph





Je soutiens ce service



Ophtalmologie

L'équipe – Ophtalmologie

Numéros utiles – Ophtalmologie

Glaucome : guide patients



L'Institut de la vue

Les principales pathologies en
Ophtalmologie

Les techniques utilisées en Ophtalmologie

Le glaucome : les interventions au laser

Le glaucome : l'intervention chirurgicale

Les collyres

Examen par UBM

Enseignement en Ophtalmologie

glaucome.



Le Point 2024

Classement des meilleurs Hôpitaux en France

> Hôpitaux Paris Saint-Joseph & Marie-Lannelongue

1^{er}

Hôpital privé à but non lucratif de France

Classement des meilleures spécialités

> Hôpital Paris Saint-Joseph et Centre de Santé Marie-Thérèse

2^e

Glaucome

> Chef de service Yves LACHKAR

Il est premier au classement national dans le classement des hôpitaux du magazine Le Point depuis 2006 (classé 11 fois 1^{er} et 4 fois 2^e en 15 ans).

Il est constitué d'une équipe de 17 médecins dont 12 chirurgiens, d'orthoptistes, d'une unité d'hospitalisation pour la chirurgie classique ou ambulatoire et d'un centre de consultation et d'explorations fonctionnelles ophtalmologiques.

L'activité du service est essentiellement axée sur la prise en charge médicale et chirurgicale du **glaucome incluant toutes les techniques de chirurgie mini invasive** associé ou non à la **cataracte**. Nous prenons également en charge les patients qui nécessitent une chirurgie vitréo rétinienne. L'activité annuelle est d'environ 18 000 consultations, 2 000 interventions chirurgicales dont plus de 900 chirurgies du glaucome et 1 000 interventions laser (glaucome).

Le service est à la pointe des techniques **laser** et chirurgicales pour la prise en charge de la cataracte et du glaucome.

Le service s'est récemment doté d'un appareil à ultrasons focalisés (UC3) et d'un laser Diode sub cyclo dédiés aux traitements des glaucomes réfractaires.

- 1999: 1^{er} « Institut »
- Centre expert



Depuis 17 ans
Selon le magazine
Le Point

12 fois 1^{er} au classement
5 fois 2^{ème} au classement



GLAUCOME							
		ACTIVITE	NOTORIÉTÉ	DURÉE DE SÉJOUR	AMBULATOIRE	TECHNICITÉ	LUTTE CONTRE LES INFECTIONS
1 ^{er}	Hôpital Saint-Joseph, Paris	700	82 %	1,5	23 %	38 %	★★★★★
2 ^e	CHU, Dijon (Côte-d'Or)	139	51 %	2	77 %	60 %	★★★★
3 ^e	Fondation Rothschild, Paris	324	79 %	1,7	60 %	13 %	★★★★
4 ^e	CH nat. d'ophtalmo. des Quinze-Vingts, Paris	813	79 %	2,8	29 %	72 %	★★★★★
5 ^e	Clinique mutualiste, Pessac (Gironde)	173	35 %	1	99 %	-	★★★★★
6 ^e	CHU, Limoges (Haute-Vienne)	103	73 %	2,2	58 %	86 %	★★★★
7 ^e	Hôpital Hôtel-Dieu, Paris	148	78 %	3	63 %	23 %	★★★★★
8 ^e	CHU, Amiens (Somme)	149	70 %	2,3	7 %	67 %	★★★★
9 ^e	CHU, Lille (Nord)	126	43 %	1,9	21 %	34 %	★★★★★
10 ^e	CH, Pau (Pyrénées-Atlantiques)	95	7 %	1,6	64 %	53 %	★★★★
11 ^e	CHU, Clermont-Ferrand (Puy-de-Dôme)	166	47 %	2,4	11 %	51 %	★★★★
12 ^e	CHU, Bordeaux (Gironde)	120	44 %	2,7	21 %	56 %	★★★★
13 ^e	CHU, Nancy (Meurthe-et-Moselle)	128	53 %	2	2 %	43 %	★★★★★
14 ^e	Hôpital Edouard-Herriot, Lyon (Rhône)	278	47 %	3,2	0 %	57 %	★★★★★
15 ^e	CHU, Toulouse (Haute-Garonne)	189	61 %	4,2	21 %	7 %	★★★★
16 ^e	Hôp. St-Joseph, Marseille (Bches-du-Rhône)	97	38 %	4,3	6 %	71 %	★★★★
17 ^e	CHU, Montpellier (Hérault)	132	42 %	3,8	16 %	-	★★★★
18 ^e	CHU, Poitiers (Vienne)	88	22 %	2,6	1 %	21 %	★★★★
19 ^e	CHU, Caen (Calvados)	136	30 %	4,5	1 %	26 %	★★★★
20 ^e	CHU, Nantes (Loire-Atlantique)	69	49 %	3,2	6 %	19 %	★★★★

Palmarès des Hôpitaux - Le Point.fr - Mozilla Firefox

En savoir plus sur cette pathologie.

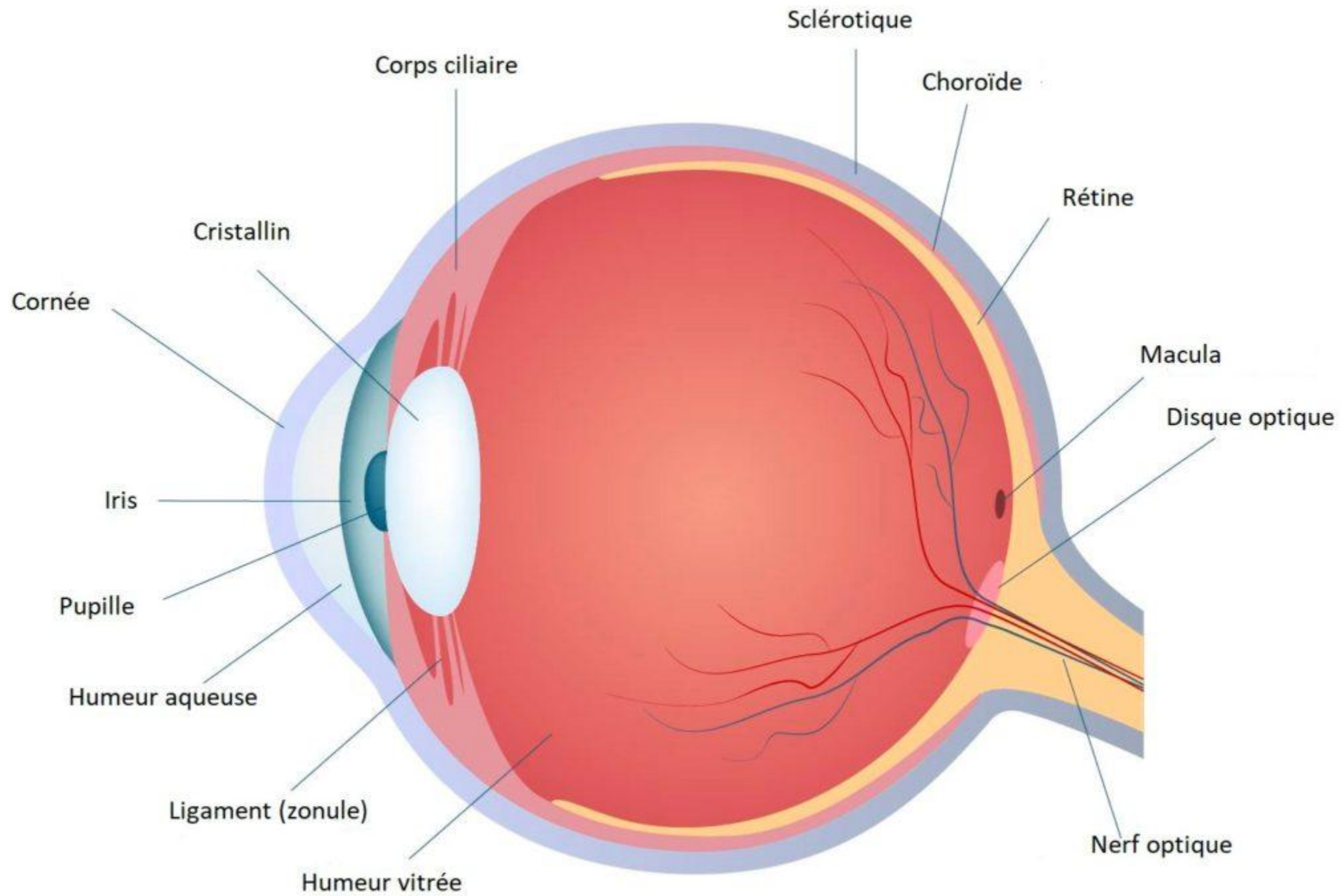
Version digitale
Espace boutique
S'abonner au magazine
Espace abonnés

TESTEZ VOTRE NIVEAU D'ORGANISATION !

Classement des 200 hôpitaux pratiquant la chirurgie du glaucome. Les 20 meilleurs.

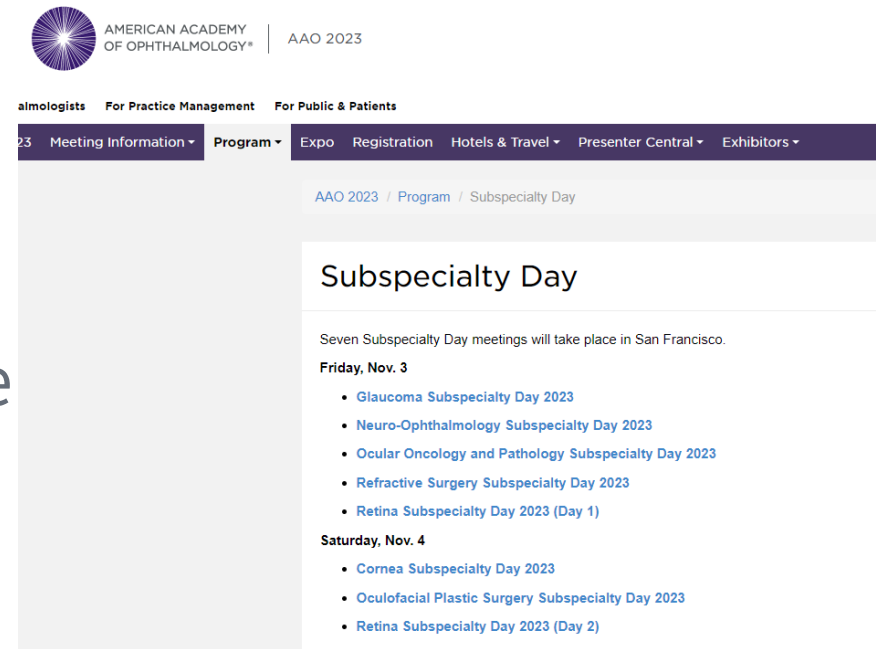
Comparer	Rang	Nom de l'établissement	Activité	Notoriété	Durée de séjour	Ambulatoire	Technicité	Note (/20)
☐	1 ^{er}	Hôpital Saint-Joseph (Paris)	679	83%	1,5	30%	35%	18,71
☐	2 ^e	Centre hospitalier national d'ophtalmologie des Quinze-Vingts (Paris)	835	79%	2,5	27%	70%	18,68
☐	3 ^e	Fondation Rothschild (Paris)	305	73%	1,5	68%	8%	18,27
☐	4 ^e	Clinique mutualiste de Pessac (Gironde)	315	29%	1,2	90%	0%	18,16
☐	4 ^e	Centre hospitalier universitaire (CHU), Limoges (Haute-Vienne)	147	76%	2,1	58%	83%	18,16
☐	6 ^e	Centre hospitalier universitaire (CHU), Dijon (Côte-d'Or)	145	54%	2,3	95%	63%	17,77
☐	7 ^e	Centre hospitalier universitaire (CHU), Bordeaux (Gironde)	137	44%	1,7	42%	67%	17,58
☐	8 ^e	Centre hospitalier universitaire (CHU), Clermont-Ferrand (Puy-de-Dôme)	149	38%	2,1	22%	55%	17,39
☐	9 ^e	Hôpital Edouard-Herriot, Lyon (Rhône)	231	49%	2,8	4%	63%	17,27
☐	10 ^e	Centre hospitalier universitaire (CHU), Lille (Nord)	139	30%	2	26%	55%	17,06
☐	11 ^e	Centre hospitalier, Pau (Pyrénées-Atlantiques)	116	5%	1,9	71%	64%	16,87
☐	12 ^e	Centre hospitalier universitaire (CHU), Toulouse (Haute-Garonne)	196	59%	5	11%	14%	16,81
☐	13 ^e	Centre hospitalier universitaire (CHU), Nancy (Meurthe-et-Moselle)	124	50%	2	7%	64%	16,62

Terminé

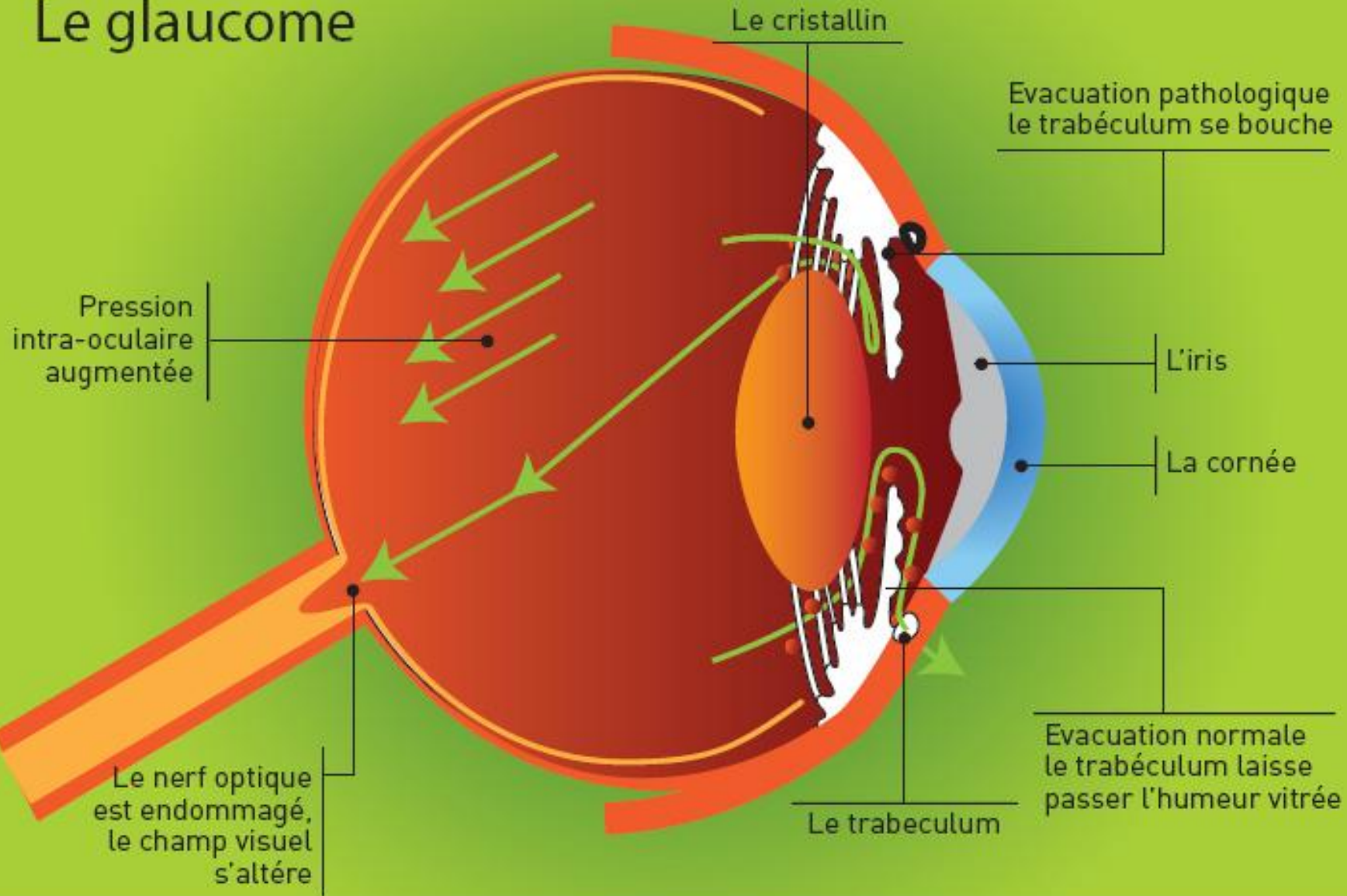


Le « découpage » de l'Ophtalmologie

- OPH Médicale = lunettes - Fond d'œil – dépistage des maladies oculaires
- OPH Chirurgicale et spécialisée
 - Paupières- voies lacrymales- orbito faciale
 - Cornée – chirurgie réfractive – cataracte
 - Glaucome
 - Chirurgie du segment postérieur = vitré rétine
 - Pédiatrie – strabisme
 - Oncologie
 - Neuro ophtalmologie
 - Maladies générales / inflammation



Le glaucome

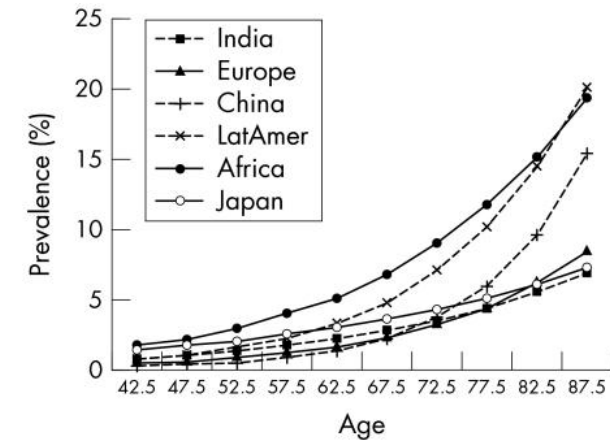


Données OMS....

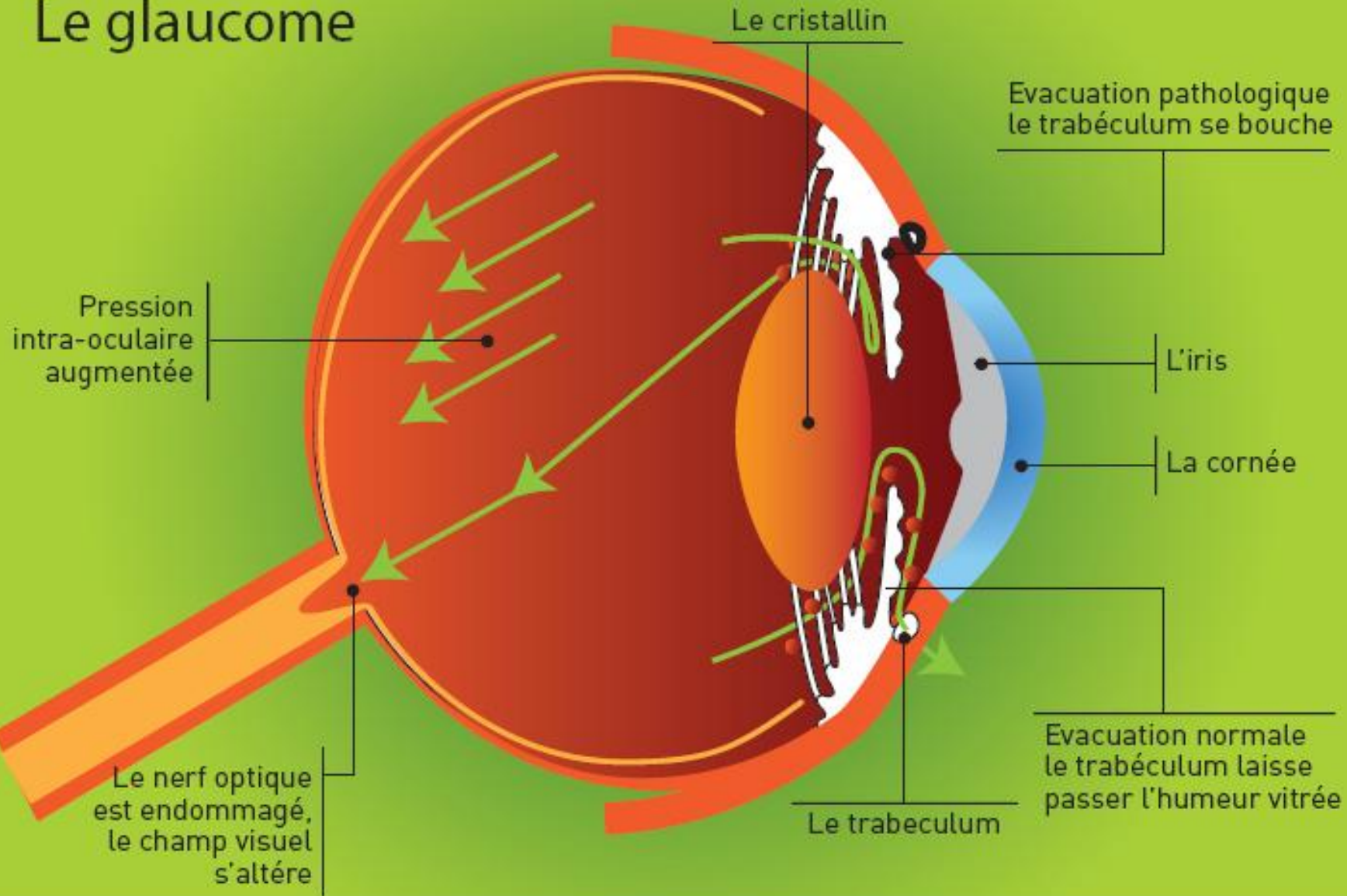
- Malgré les progrès réalisés par la chirurgie dans de nombreux pays au cours de des dernières décennies, la cataracte (47,9%) demeure la cause principale de déficience visuelle dans toutes les régions du monde, à l'exception des pays développés.
- Les autres causes majeures de déficience visuelle sont par ordre d'importance, **le glaucome (12,3%)**, la dégénérescence maculaire liée à l'âge (DMLA) (8,7%), les opacités cornéennes (5,1%), la rétinopathie diabétique (4,8%), la cécité des enfants (3,9%), le trachome (3,6%) et l'onchocercose (0,8%)

Glaucomes

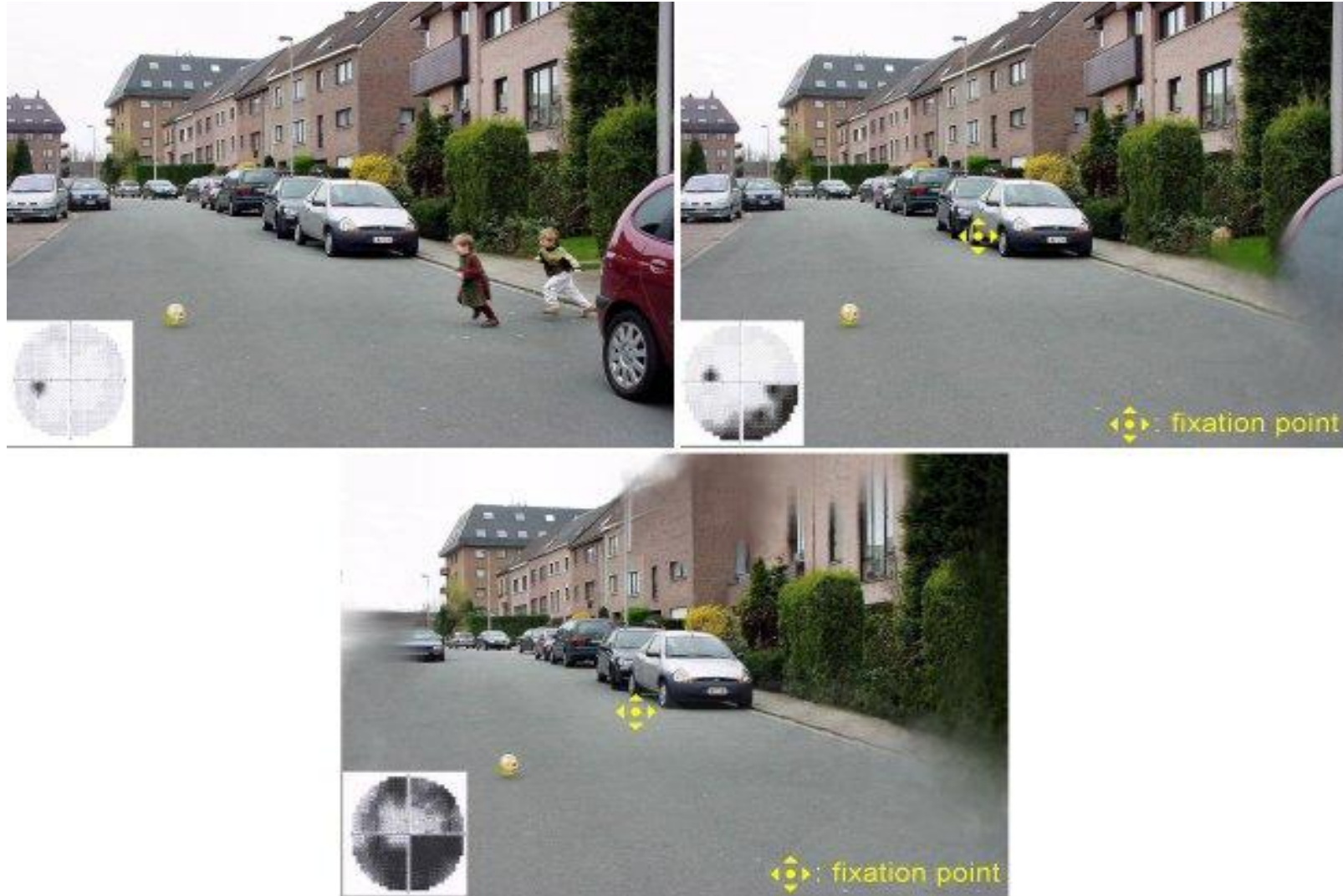
- Neuropathie optique progressive asymptomatique liée à un excès de pression intraoculaire
- Touche 2% de la population – 4% chez le sujet âgé
- 1 500 000 glaucomes en France
- Peut entraîner une cécité totale irréversible (contrairement à la cataracte et à la DMLA)



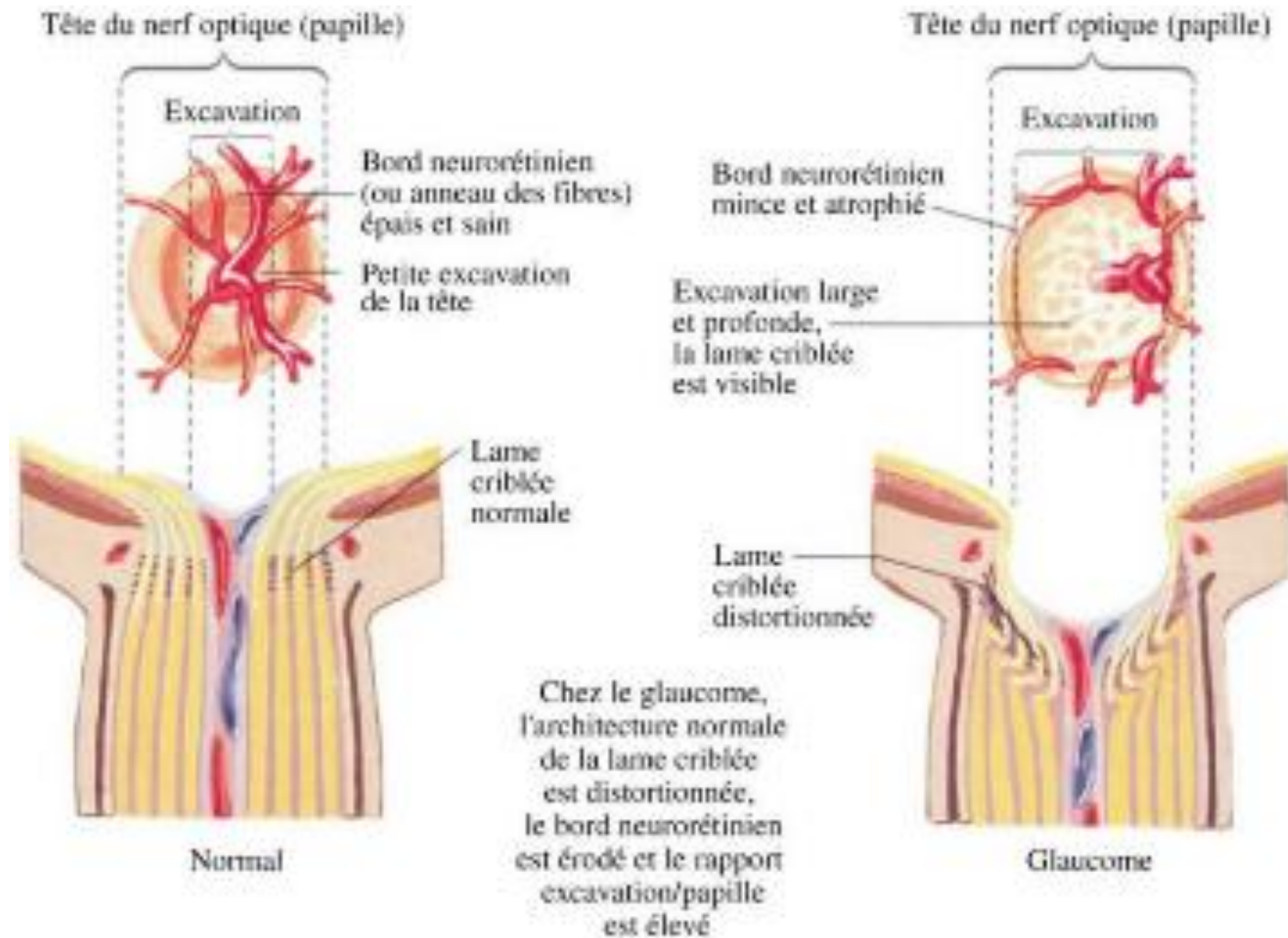
Le glaucome



Glaucomes



Glaucome = Neuropathie optique progressive

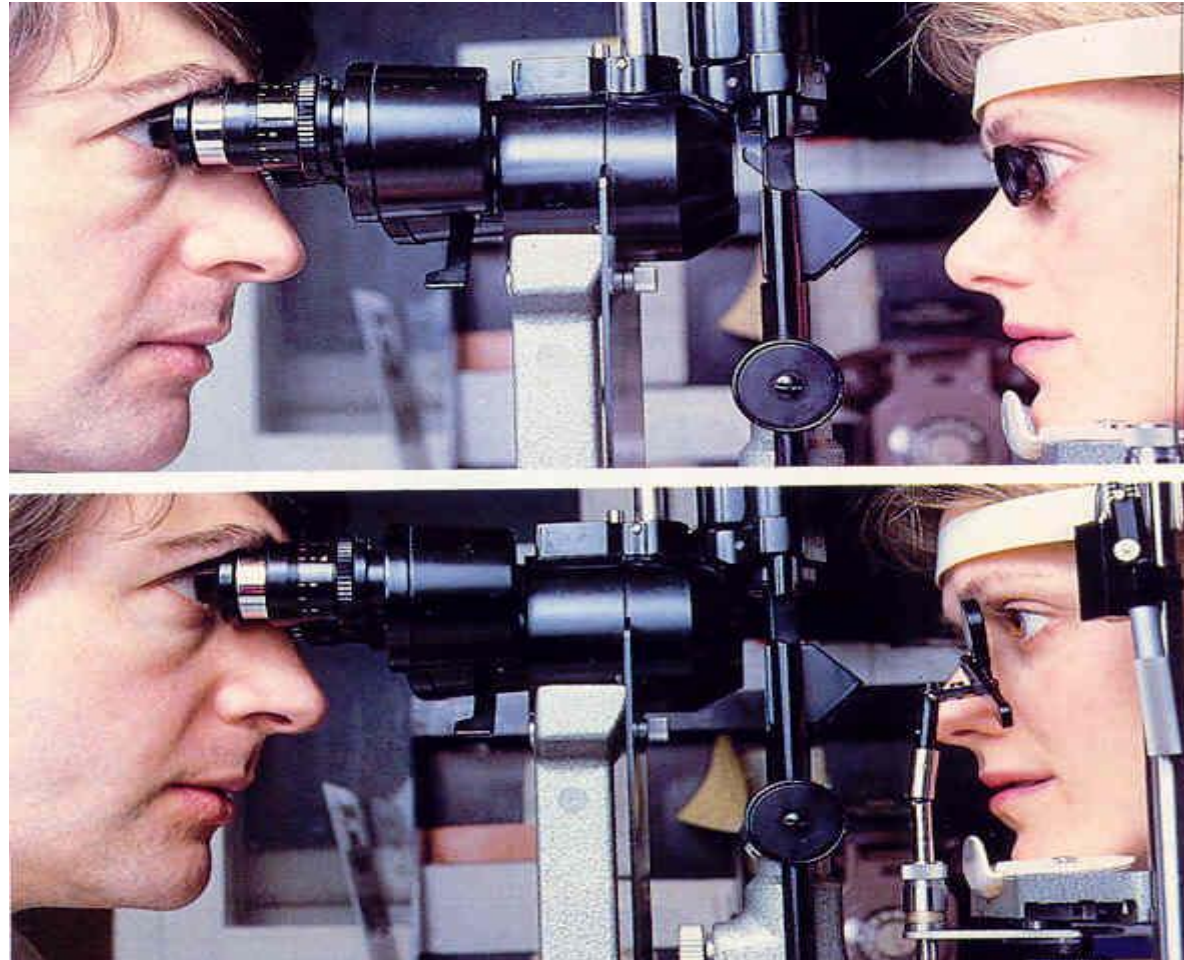


Diagnostic : Examen par l'ophtalmologiste

- Examen de la vue: acuité visuelle corrigée et non corrigée:
 myopie-hypermétropie-presbytie
 astigmatisme
- Examen de l'œil: examen à la lampe à fente par l'ophtalmologiste
 Prise de la PIO
 Examen du fond d'œil
 puis en fonction examens: OCT, CV , échographie

Tache
délégable

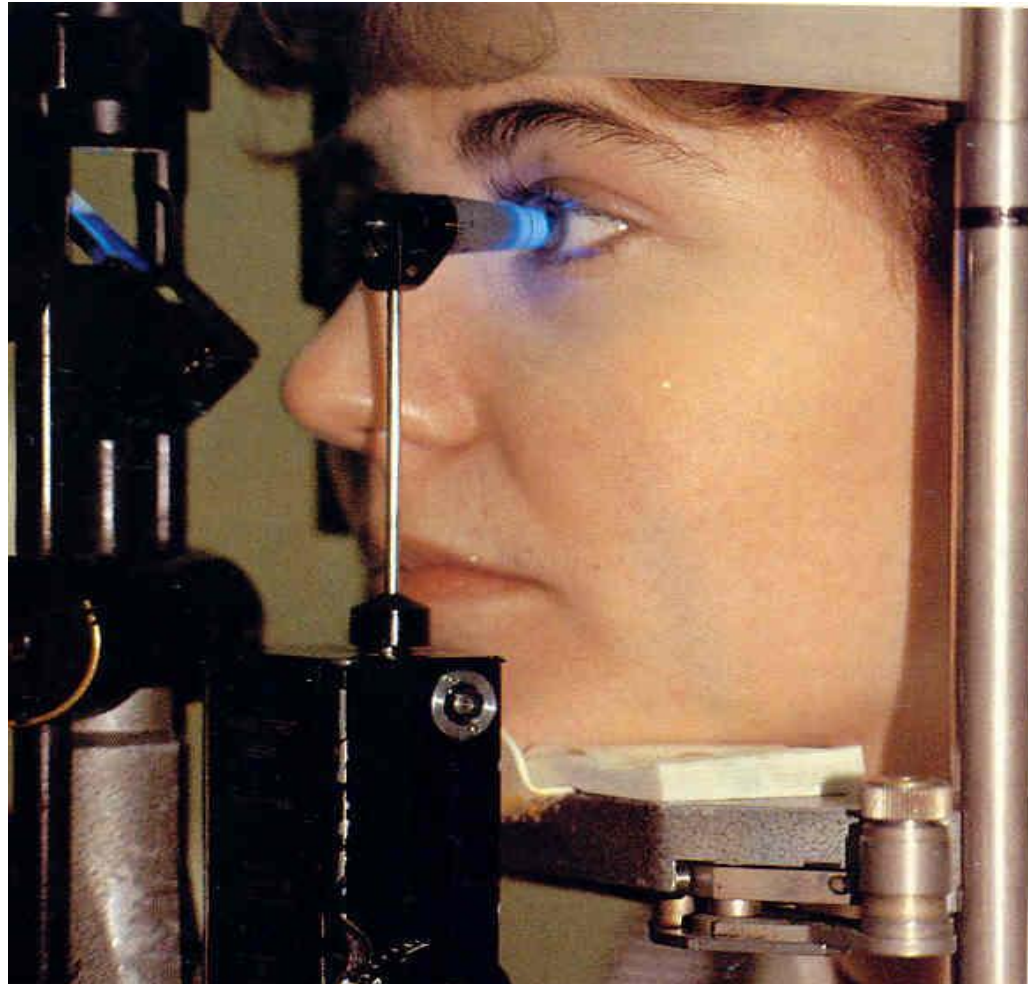
La lampe à fente



Les examens clés

- PIO
- Analyse du nerf optique
- Relevé du champ visuel
- Gonioscopie

La PIO

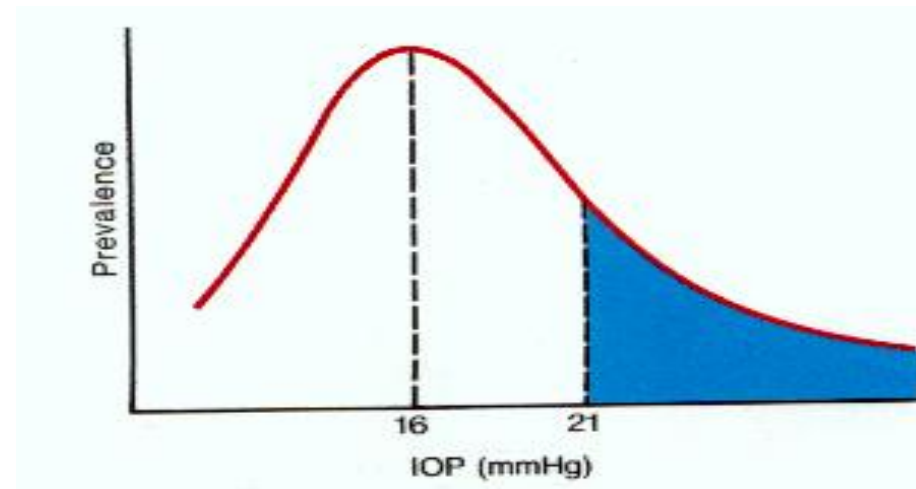


Tonomètre à air



PIO ...oui

- Simple – mesures symétriques
- Facile : tonomètre à air (= aplanation)
attention au blépharospasme
- Valeur seuil : 21 mm Hg



PIO

- « Normale » : 15 mm Hg
- Peu sensible
- Estimation de la PIO
- Grandes fluctuations de la PIO

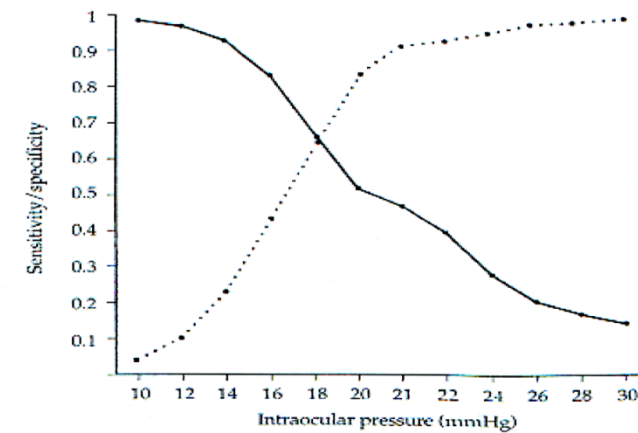
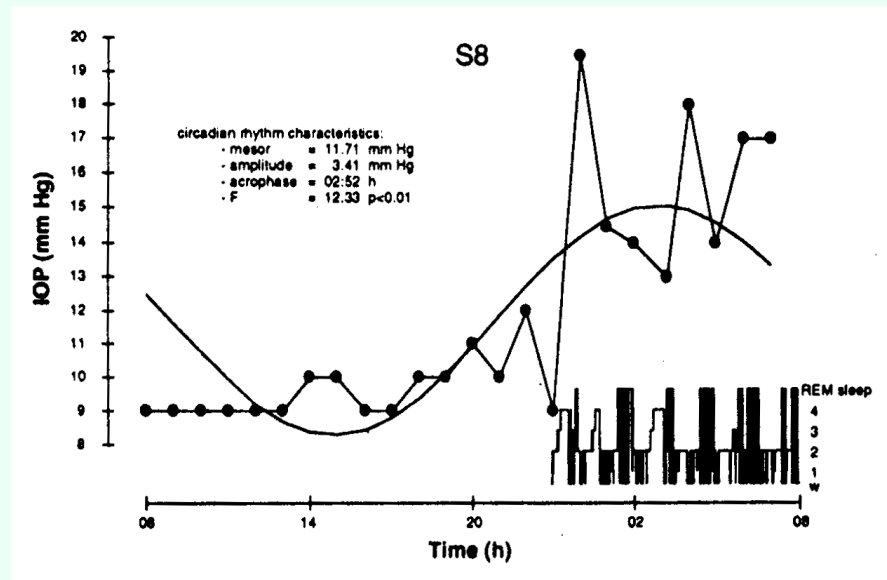


Fig. 35-2 Sensitivity and specificity curves for varying cutoff points for intraocular pressure. Curves were plotted using data from the Baltimore Eye Survey.¹³⁶ (Redrawn from Tielsch JM et al: *Arch Ophthalmol* 112:69, 1994.)

PIO= insuffisant

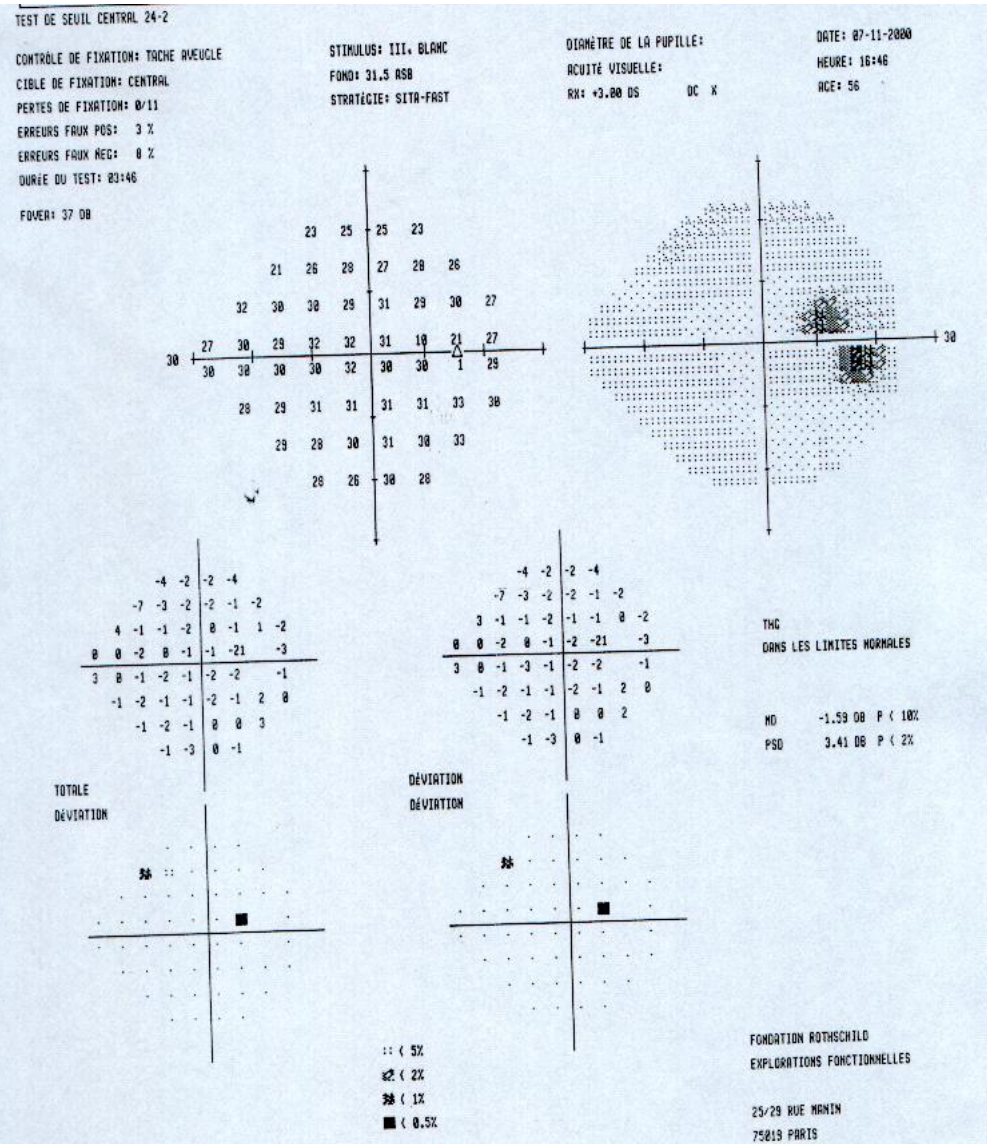
- 50 % des glaucomes ont une PIO normale au moment du diagnostic...
- interpréter en fonction de la réfraction / épaisseur de la cornée
(2.9 mm Hg-70μ)
- attention aux erreurs de mesure

Le relevé du champ visuel





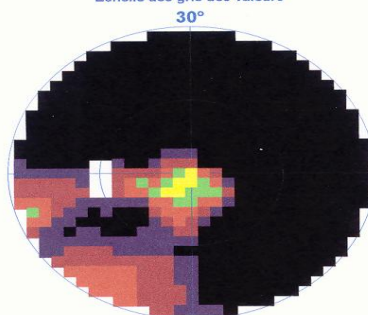
Champ visuel



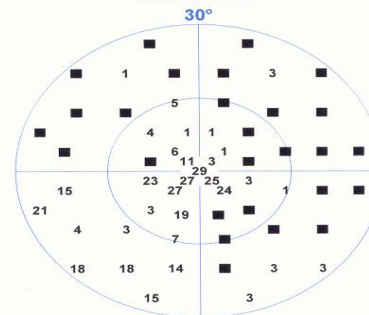
Nom: JEAN PIERRE
Prénom: JEAN PIERRE
ID #:
Date de naissance: 17/01/1931
Age: 65
Sexe: masculin
Refr. S / C / A: / /
Acuité visuelle:
Tension oculaire:
Diagnostic:
Fichier des données:

Oeil / Pupille[mm]:
Date / Heure: 10/04/1996 19:32
Durée d'examen: 10:30
Programme / Code: G2 / 0
étapes / Phases: 4 / 1
Stratégie / Méthode: Normale / Normale
Taille du stimulus / Durée: III / 100 ms
Luminance de fond: 4 asb
Questions / Répétitions: 310 / 0
Questions pièges: pos 1 / 15, neg 8 / 16
C:\OCTOPUS\EXDAT\W.PVD

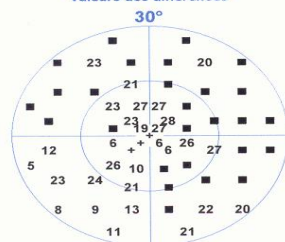
Echelle des gris des valeurs



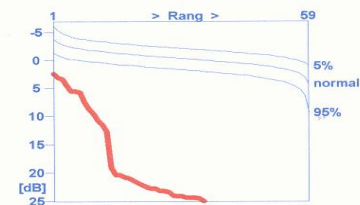
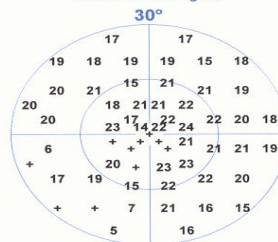
Valeurs des seuils



Valeurs des différences

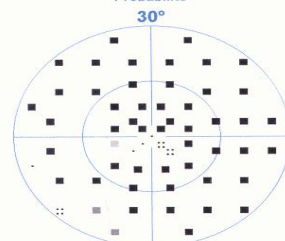


Différences corrigées

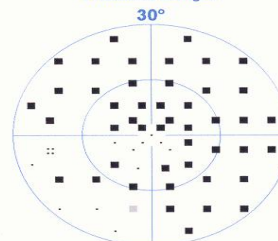


Corrigé [dB] 5.6

Probabilité



Probabilité corrigée



· P>5
:: P<5
■ P<2
■ P<1
■ P<0.5

#	Phase 1	Phase 2	Moyenne
MS	59	0	0
MD	5.8		
LV	21.0		
CLV	62.9		
SF			
RF			29.0

Nom:
Prénom: JF
ID #:
Date de naissance: 11/06/1944
Age: 58
Sexe: féminin
Refr. S / C / A: 1.5 / /
Acuité visuelle:
Tension oculaire:
Diagnostic:
Fichier des données:

Oeil / Pupille[mm]:
Date / Heure: 04/04/2003 08:13
Durée d'examen: 9: 6
Programme / Code: dG2 / 0
étapes / Phases: 8 / 2
Stratégie / Méthode: Dynamique / Normale
Taille du stimulus / Durée: III / 100 ms
Luminance de fond: 4 asb
Questions / Répétitions: 270 / 0
Questions pièges: pos 0 / 13, neg 1 / 14
D:\EXDATIGO.PVD

Gauche(OS) /

04/04/2003 08:13

9: 6

dG2 / 0

8 / 2

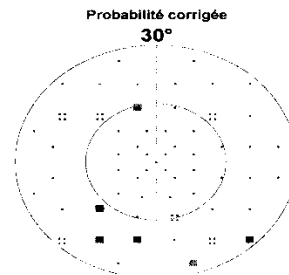
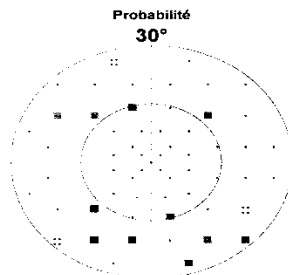
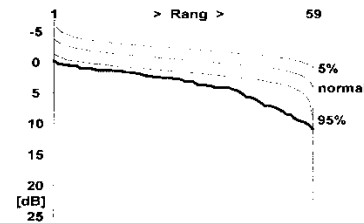
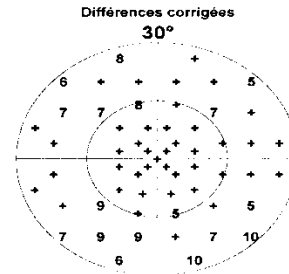
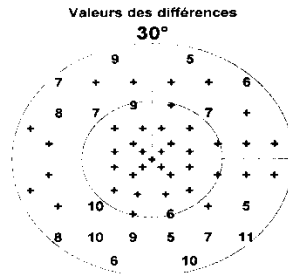
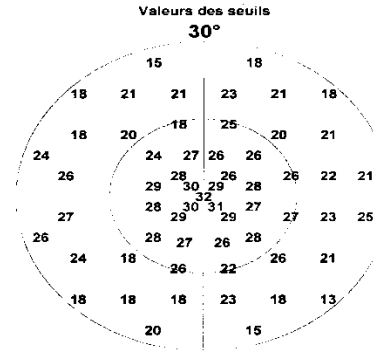
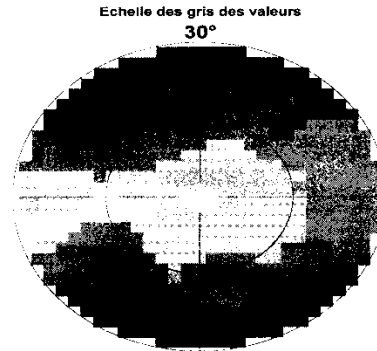
Dynamique / Normale

III / 100 ms

4 asb

270 / 0

pos 0 / 13, neg 1 / 14

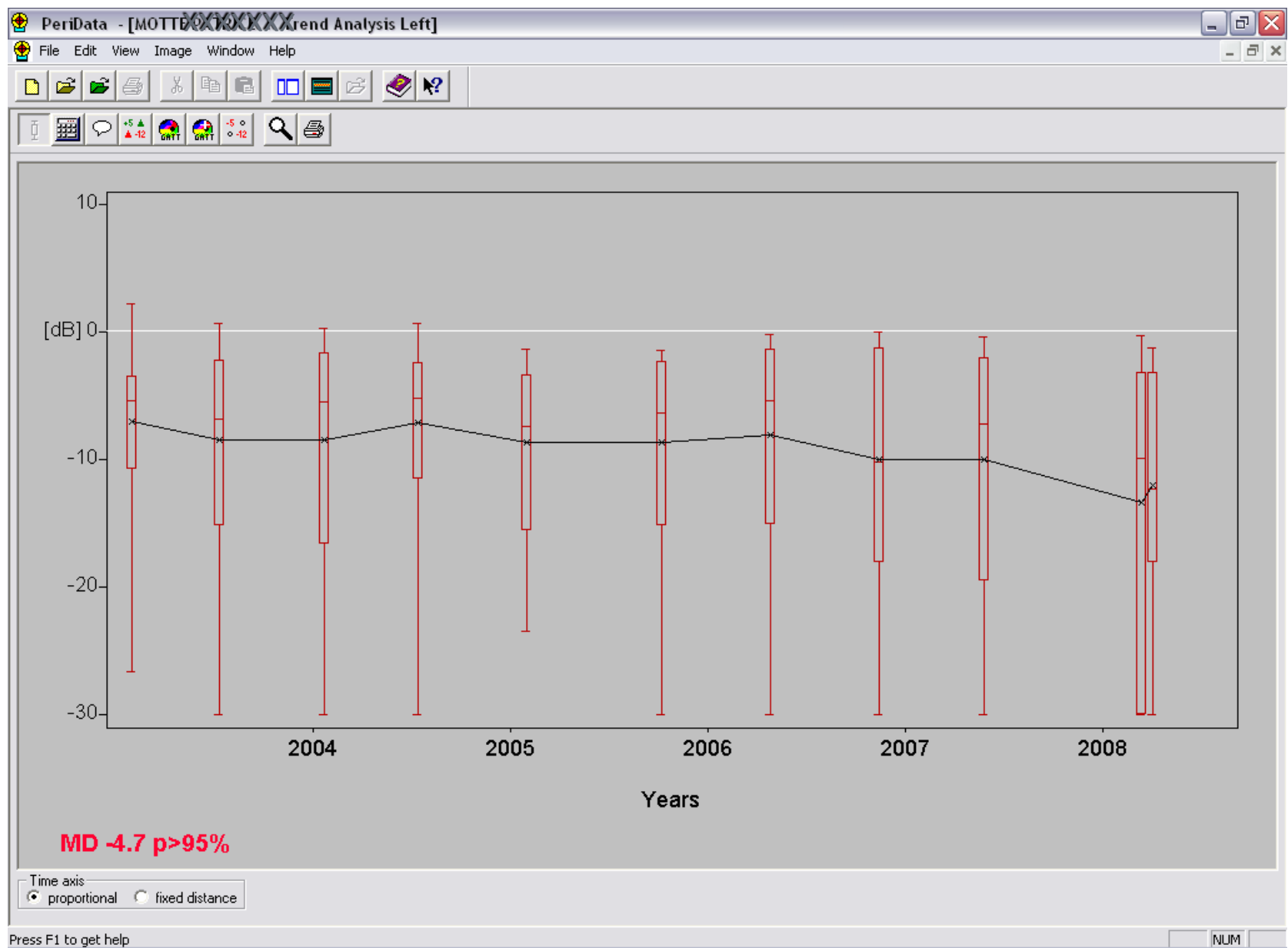


· P>5
: P<5
■ P<2
■ P<1
■ P<0.5

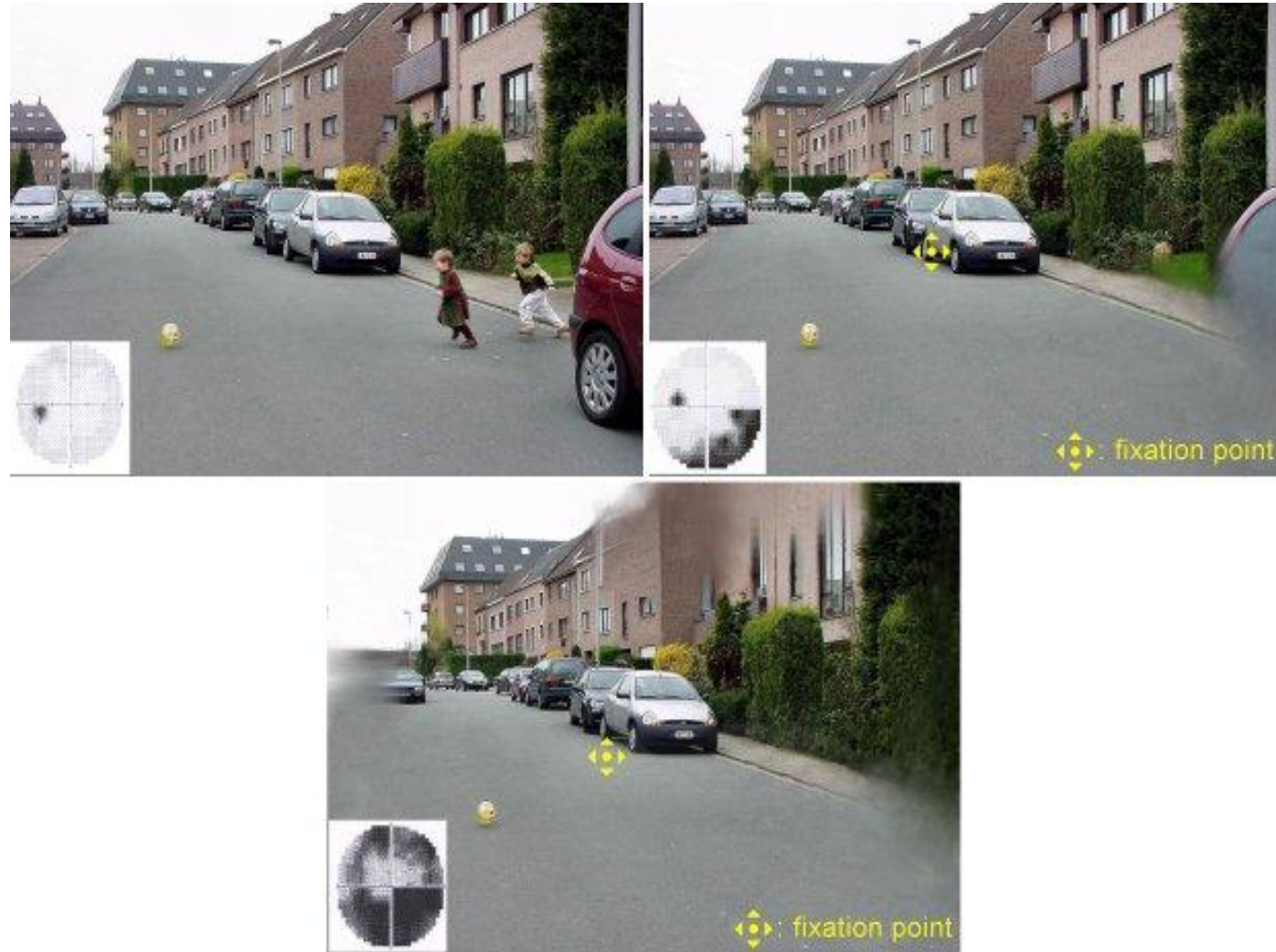
Corrigé [dB] 0.6

	Phase 1	Phase 2	Moyenne
#	59	59	59
MS	23.6	23.1	23.4
MD	3.6	4.1	3.9
LV	7.7	13.9	8.5
CLV			6.3
SF			2.1
RF			3.7

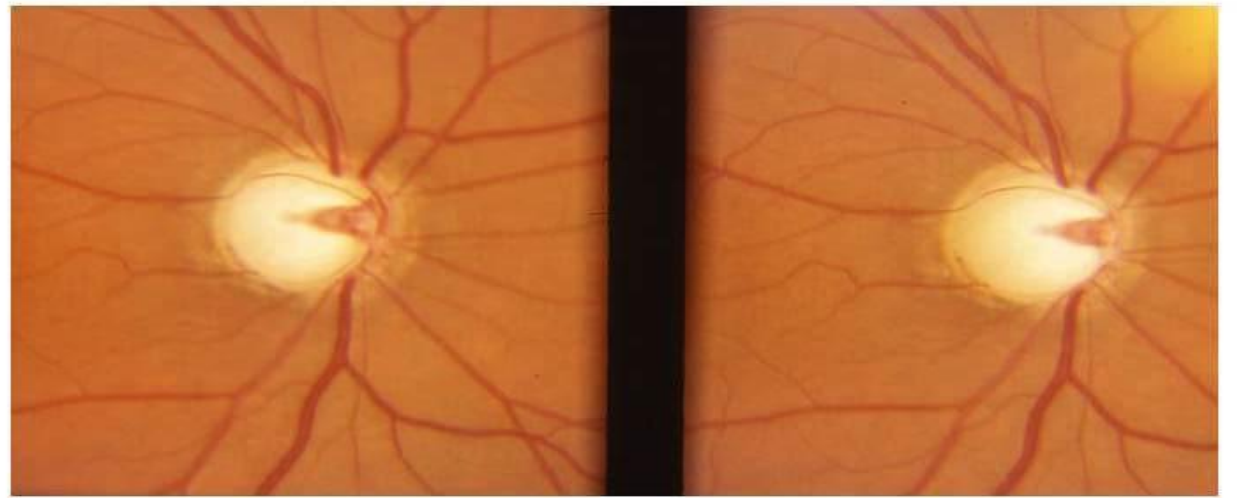
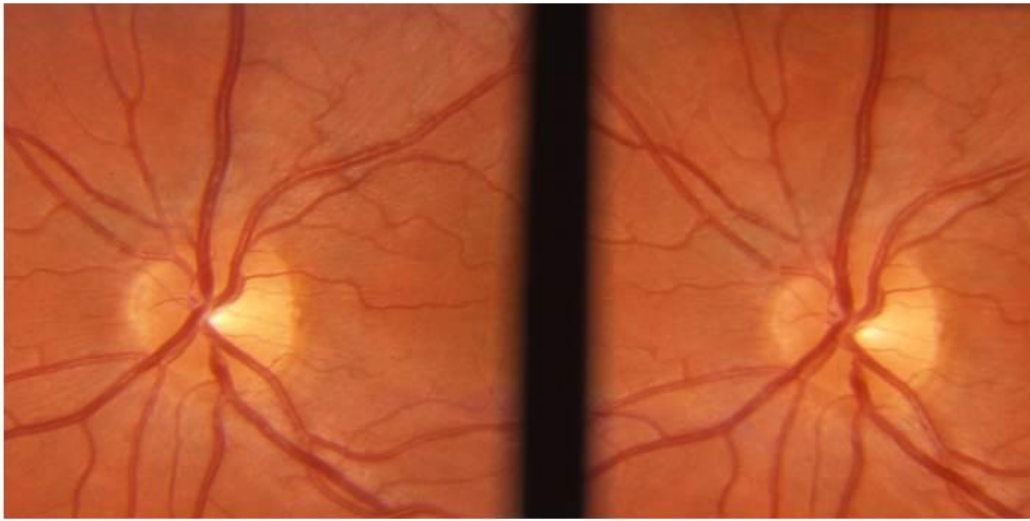




Champ visuel diminue mais AV 10/10

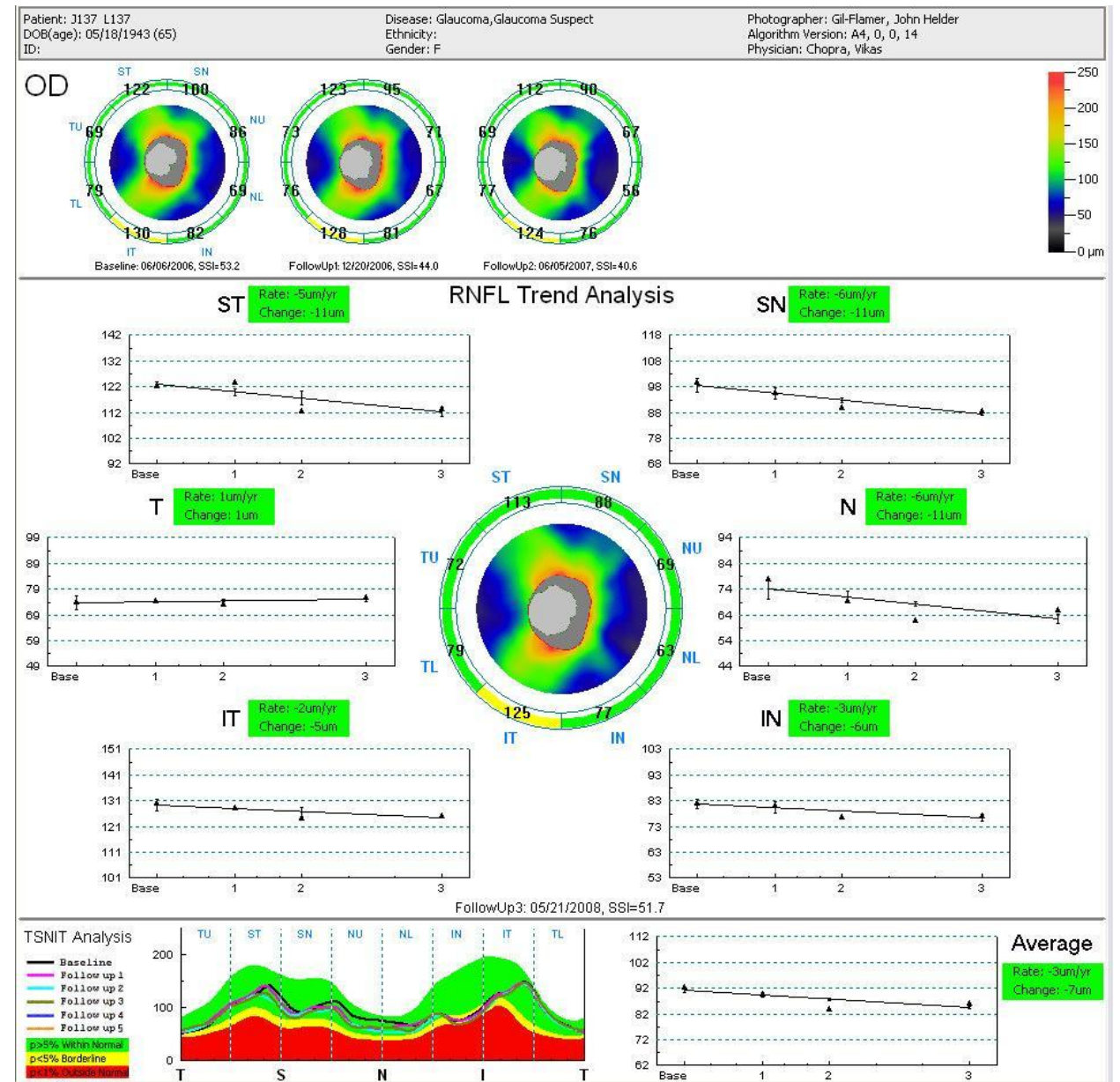


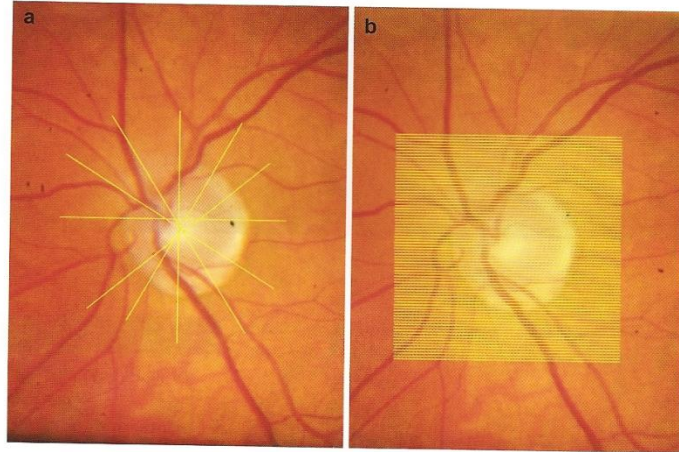
Examen du nerf optique



OCT indolore atraumatique

- Analyse de régression linéaire sur 6 quadrants
- 13 cercles concentriques de 1.3 mm à 4.9 mm tous les 0.3 mm
- 12 lignes radiales
- Soit 14241 scannés en 0.55 sec





Townsend, et al. in Pearls of Glaucoma Management 2010

Time domain OCT

400 A scans /sec

Résolution 10 μ

Temps $\sim$ 2 sec

Spectral (Fourier) Domain OCT

26.000 scans/sec

Résolution 5 μ

Temps 0,6 sec

Joseph Fourier



Joseph Fourier.

Gravure de Julien Léopold Boilly

Naissance 21 mars 1768
Auxerre (France)

Décès 16 mai 1830
Paris (France)

Nationalité  France

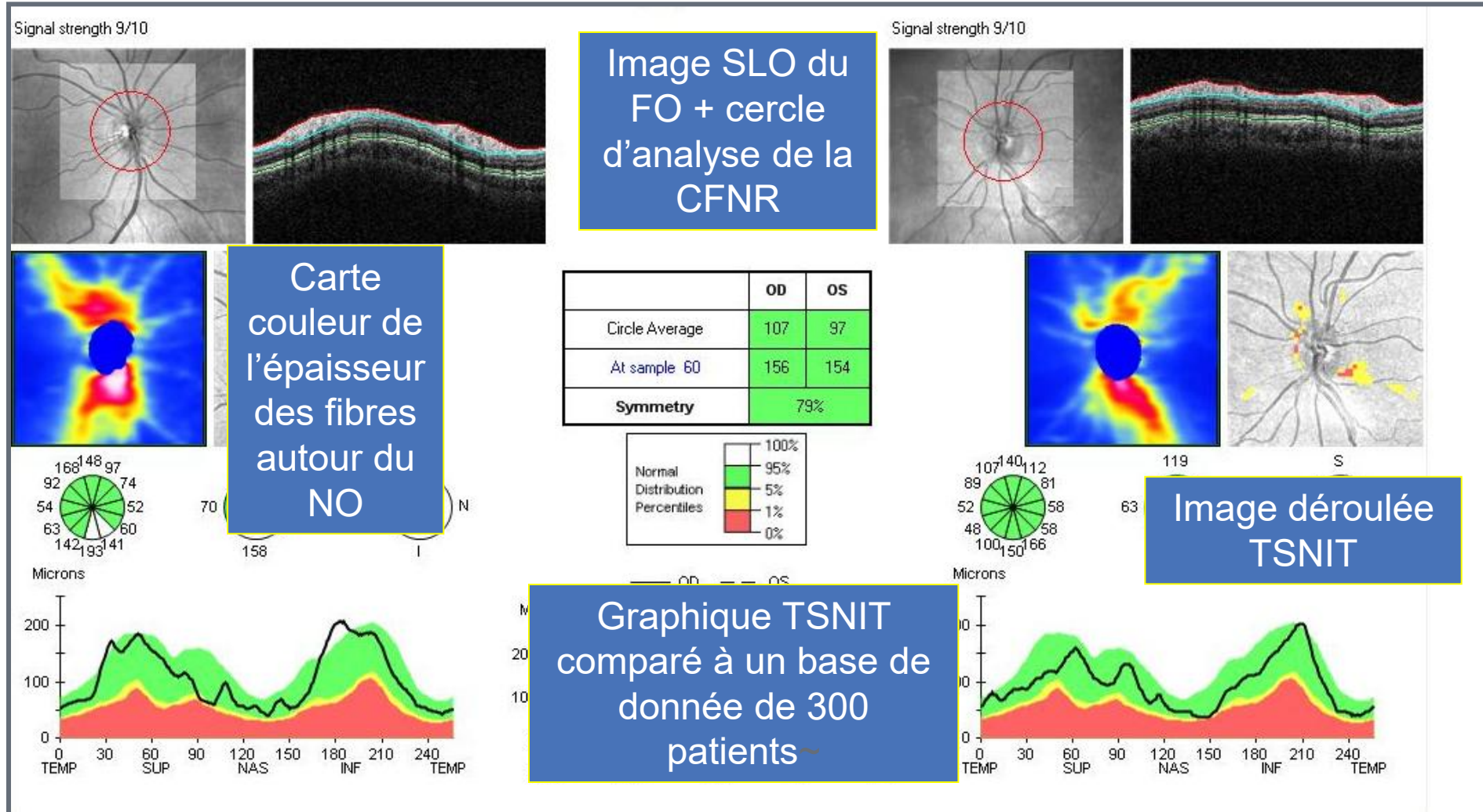
Champs mathématicien, physicien

Institution Polytechnique

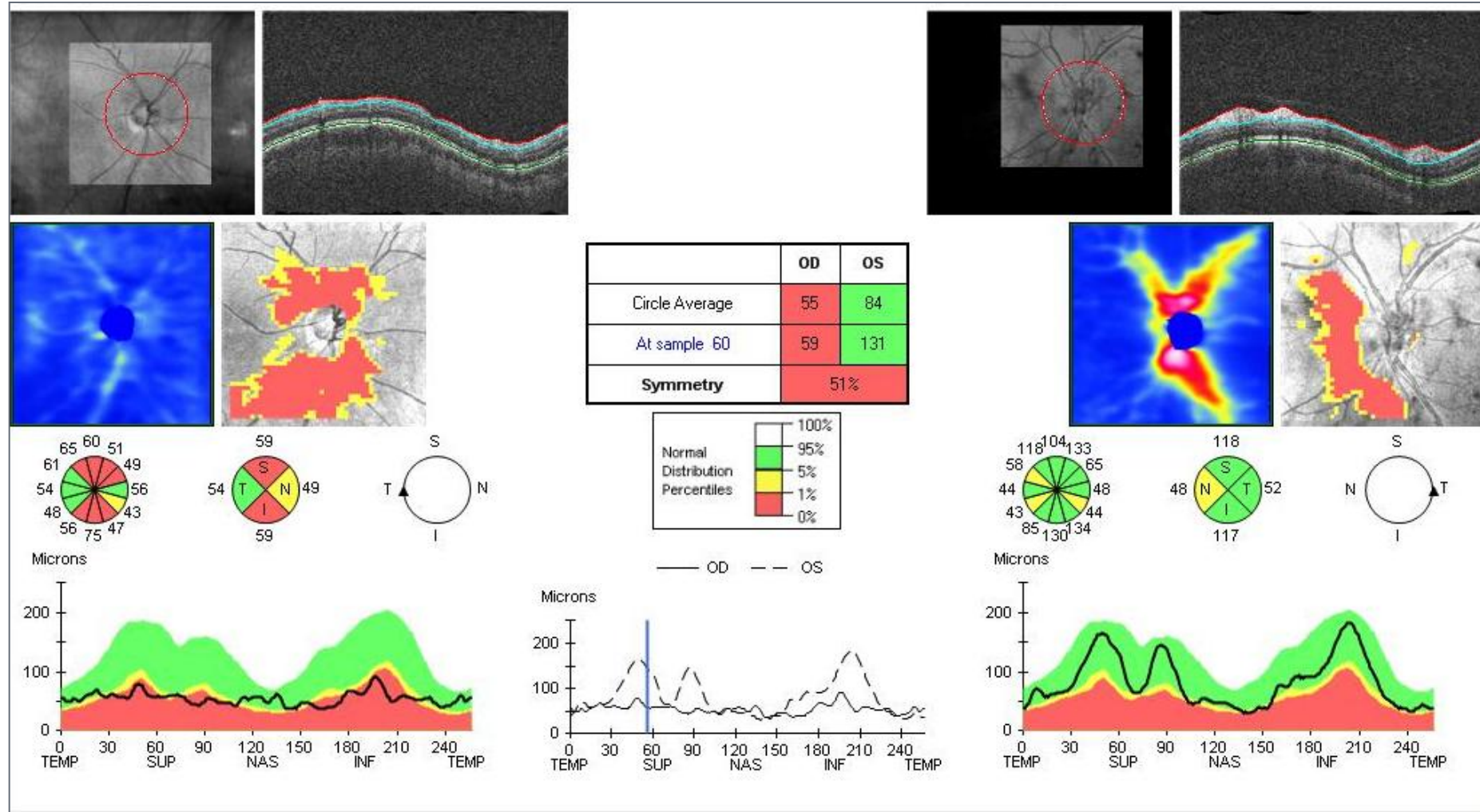
Diplômé École normale supérieure

Célèbre pour Série de Fourier, Transformée de Fourier

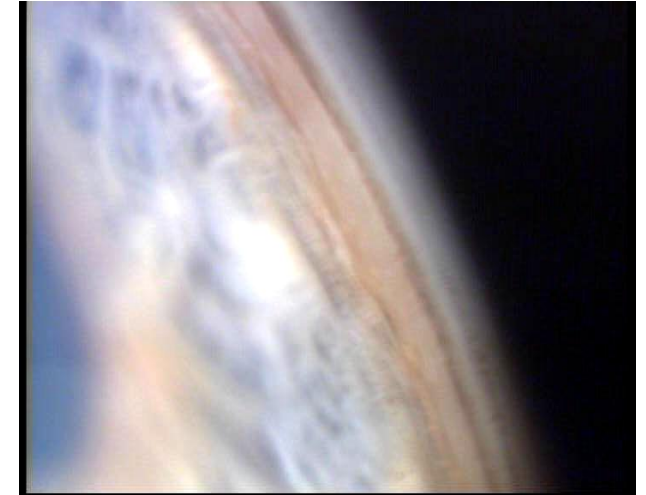
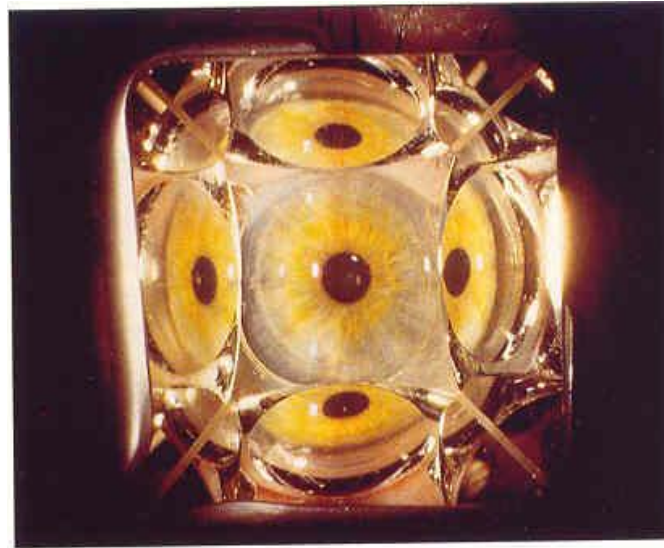
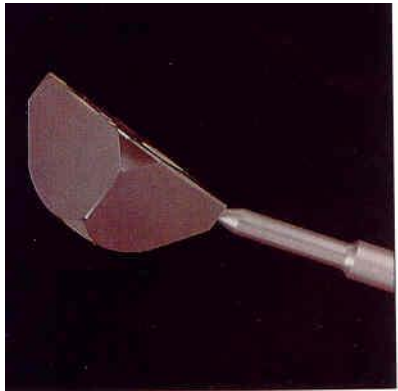
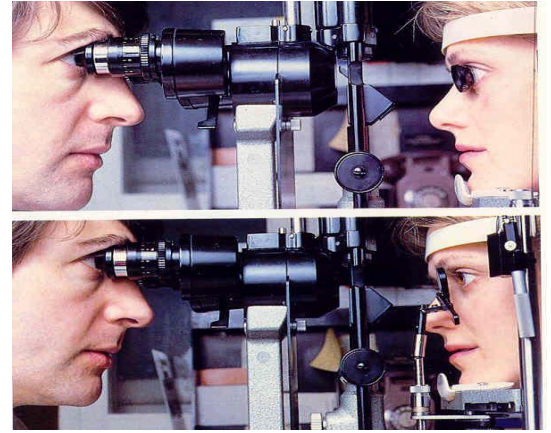
OCT SD: exemple patient normal SD



OCT SD: exemple SD patient glaucomateux



Examen de l'angle irido – cornéen à la lampe à fente après anesthésie topique



Maladie asymptomatique

- Pas de douleur
- Pas de baisse de vision (sauf au stade terminal)
- Diminution du champ de vision NON ressentie

DIAGNOSTIC

consultation de DEPISTAGE (antécédents familiaux)

consultation pour une autre cause: lunettes , oeil sec ,
allergie etc...

= attention aux lunettes sans examen !

Gravité = dépisté tard la perte liée au glaucome se cumule à la perte physiologique liée à l'âge

- Perte normale : un peu plus de 7000 cellules ganglionnaires par an (Quigley)
- Risque de cécité si le glaucome évolué

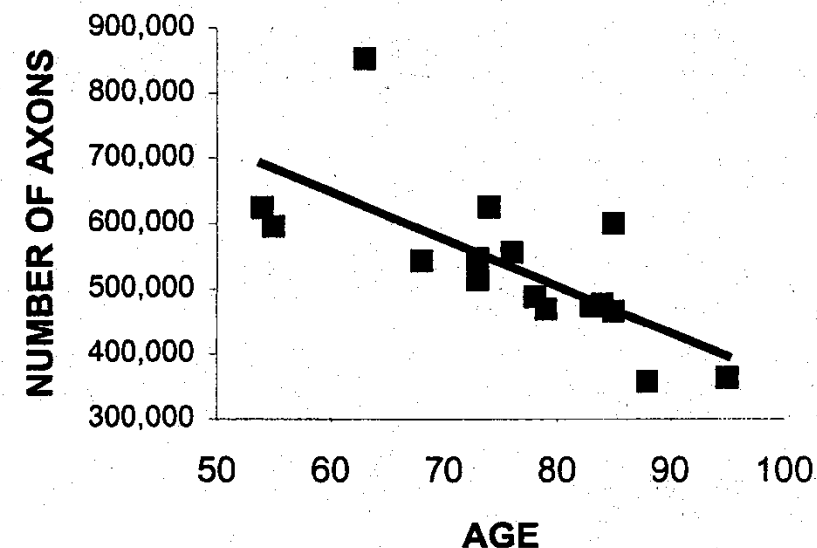
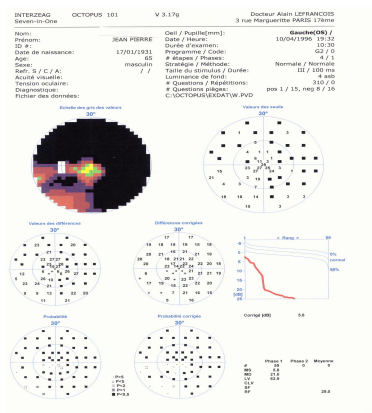


FIGURE 2. The estimated number of optic nerve axons in human eyes decreases with older donor age, with a slope of 7205 axons lost per year (linear regression: $R^2 = 0.50$, $P = 0.002$).

KERRIGAN-BAUMRIND L.A., QUIGLEY H.A. et al. Number of ganglion cells in glaucoma eyes compared with threshold visual field tests in the same persons. *Invest Ophthalmol Vis Sci.* 2000; 41: 741-748.

Maladie complexe

Formes cliniques

- Âge : Congénitales- infantile – juvénile
- Aigu/ subaigu/ chronique
- Angle ouvert /fermé
- Primitif / secondaire

Arsenal thérapeutique lourd = choix difficile

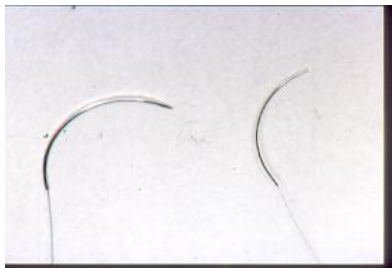
- Collyres : 7 classes thérapeutiques / associations fixes
- Lasers : iridotomie , iridoplastie, laser Selecta , Diode
- Chirurgies : trabéculéctomie , sclérectomie , MIGS, drains etc

Tous les traitements ne visent qu'à baisser le PIO pour éviter la progression de la maladie

Peu de patients sont opérés: 18000 / an France



Les techniques chirurgicales



Ab externo

Ab interno

DRAINAGE		
Sous-conjonctival	Canal de Schlemm	Supra-choroïdien
Trabéculéctomie ¹ ExPress ²	Canaloplastie ²	Gold Shunt ²
Implants de drainage ³	Extenseurs du canal ⁶	STARFlo ²
Sclérectomie profonde ⁴ CLASS		Aquashunt ⁹
InnFocus (Arrow) ⁵		
Xen ²	Trabectome ²	Cypass (retrait) ¹⁰
	iStent ²	iStent supra ²
	Hydrus ⁷	STARFlo MiniJect ¹¹
	HFDS (sclérotomie profonde à haute fréquence) ⁸	

Producteur d'humeur aqueuse
Cyclodestruction
Cryo ²
Diode MICROPULSE- SUB CYCLO ²
Ultrasons (HIFU/UC3) ²
Endophotocoagulation ²

10/0

Mitomycine C

Evaluation = Merci la pharmacie, le CRC etc ,,,

Chirurgie

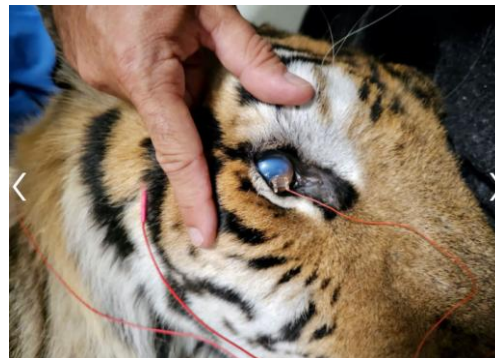
- Bloc dédié à l'ophtalmologie = indispensable
- Chirurgie douloureuse / stress = sédation
- Proche de la salle de soins post opératoires
rotation rapide
- Impose une rigueur extrême
- De l'accueil aux suites opératoires : suivi en cs
- Secrétariat, infirmière , prise des rendez-vous
opératoire, coordination consultation bloc
opératoire etc..
- Pas trop de changement !



Particularités de la chirurgie de l'oeil avec un glaucome

Chirurgie du glaucome ou chirurgie de la cataracte sur un œil glaucomateux ou chirurgie combinée cataracte et glaucome dans le même temps

- Chirurgie douloureuse : topique potentialisée
- Risque saignement : contrôle TA per op
- Risque de poussée de PIO per op : Mannitol



Laurent Bouhanna • 1er
Docteur Vétérinaire, Spécialiste en ophtalmologie, ...
1 sem. • Modifié •

Contrôle post-opératoire ce matin du Tigre « Firmin » du zoo-refuge de la Tanière que nous avons opéré il y a 3 mois avec le laser diode pour un glaucome bilatéral grave et douloureux.

Au programme ce matin : mesure de la tension, ERG, échographie oculaire, le tout sous AG bien sûr !

La pression intraoculaire est passée de 100 mm de Hg sur chaque oeil à 29 mm Hg sur un oeil et 32 mm Hg sur l'autre, sans aucun traitement médical.

Nous espérons dans les mois à venir obtenir une PIO comprise entre 10 et 20 mm de Hg. C'est l'objectif.

A suivre...



S'informer

Consulter

Traiter



Société Française du Glaucome

Le glaucome est une maladie oculaire qui touche principalement les personnes âgées de plus de 45 ans. Il est dû à une montée de la pression oculaire entraînant une atteinte du nerf optique et du champ visuel. Vous trouverez toutes les informations sur la maladie du glaucome, le dépistage et le traitement du glaucome. Des témoignages et des vidéos en ligne sont aussi disponibles pour vous aider à mieux comprendre et lutter contre la maladie.

Accueil > S'informer > Qu'est ce que le glaucome ?

Qu'est ce que le glaucome ?

Le glaucome

Le glaucome est une maladie oculaire qui touche surtout les personnes de plus de 45 ans. Il est dû à une montée de la pression oculaire entraînant une atteinte du nerf optique (qui envoie les informations visuelles au cerveau) et du champ visuel (espace de vision).

» Dictionnaire

Prostaglandine :

Hormones produites par les cellules de nombreux organes (appareil génital, artères, bronches, reins...). Elles sont impliquées dans de nombreux phénomènes inflammatoires. Certaines prostaglandines ont la

Pratique

Dictionnaire :

De A à Z

Voir tout

Accommodation
Acuité visuelle
Agonistes alpha-
aladrénergiques
Aire visuelle

Rechercher :

Vos mots clés

OK



EUROPEAN GLAUCOMA SOCIETY

Innovation, Education, Communication

[Search zone](#)[Feedback](#)

Education Subcommittee

EGS Education Subcommittee

A A - +

Main menu

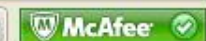
[Home](#)[About the EGS](#)[Membership](#)[Subcommittees](#)[Special Interest Groups](#)[Meetings](#)[Patient information](#)[Publications](#)[Partners in education](#)[Links](#)Username: Password:

European Glaucoma Society Education Committee

Chairman**John Thygesen, Denmark**Vice-chairmen:**Gabor Holló, Hungary****Yves Lachkar, France**

EGS Members

- Keith Barton, London, United Kingdom (DVD education)
- Andreas Böhm, Dresden, Germany (Glaucoma Journal Club)

[▶ BACK](#)

EGS Education Subcommittee - Mozilla Firefox

Fichier Édition Affichage Historique Marque-pages Outils ?

http://www.eugs.org/eng/education_committee.asp

EGS Education Subcommittee

EGS EUROPEAN GLAUCOMA SOCIETY

Innovation, Education, Communication

Search zone Feedback

Education Subcommittee

EGS Education Subcommittee

Main menu

- Home
- About the EGS
- Membership
- Subcommittees
- Special Interest Groups
- Meetings
- Patient information
- Publications
- Partners in education
- Links

Username:

Password:

Terminé

EGS European Glaucoma Society - © 2011 All rights reserved

European Glaucoma Society Education Committee

Chairman
John Thygesen, Denmark

Vice-chairmen:
Gabor Holló, Hungary
Yves Lachkar, France

EGS Memt

- Keith Barton, London, United Kingdom
- Andreas Böhm, Dresden, Germany (

EGS accredited centres

[Belgium, University of Leuven \(Ingeborg Stalmans\)](#)

[France, Institut du Glaucome de Paris \(Yves Lachkar\)](#)

[Germany, University of Mainz \(Esther Hoffmann\)](#)

[Italy, Clinica Oculistica IRCCS Ospedale Policlinico San Martino \(Carlo Traverso\)](#)

[Greece, Aristotle University of Thessaloniki \(Fotis Topouzis\)](#)

[Spain, Hospital Clinico San Carlos. Universidad Complutense Madrid \(Julian Garcia Feijoo\)](#)



World Glaucoma Association
The Global Glaucoma Network



[Home](#) [About us](#) [Events](#) [Publications & News](#) [Education](#) [Membership](#)

[Login](#) [f](#) [t](#) [in](#) [@](#)

10th WORLD GLAUCOMA CONGRESS

10th World Glaucoma Congress

Set your sights on joining us for the very special anniversary edition of the 10th World Glaucoma Congress® in Rome, Italy, this June 28 – July 1, 2023.

[Register now](#)

JUNE 28 - JULY 1, 2023 ROME, ITALY

Association France Glaucome

Nos missions

Dernières actualités

- Les rendez-vous d'avril en images
- Semaine mondiale du Glaucome
- Bourse de recherche de l'AFG, appel à candidature



Adresse postale de l'association

Association France Glaucome (AFG)

Institut du Glaucome – Hôpital Saint Joseph – Ophtalmologie

185 rue Raymond Losserand

75014 Paris

Tél. : +33 6 73 58 93 68

Email : assofrglaucome@gmail.com

World Glaucoma Week

March 12-18, 2023

Submit your activity



Thank you for being a part of our community, raising glaucoma awareness! The submission form posts your activity on the World Glaucoma Week World Map. To get you started, some guidelines:

1. Have your contact details and a great image ready, you will need it to complete the form.
2. Your activity does not need to have a physical location. For an activity without a physical location, please fill out the city/town and country of the organizer. For instance, you are located in Paris and your activity is a Facebook campaign. Please fill out Paris and France in the form.
3. There are several categories you can choose from, to make it easier for visitors of the World Map to find an activity they are interested in.



World Glaucoma Week

March 9-15, 2025



Share your stories

Don't forget to use the hashtag #glaucomaweek and tag the official WGA and the World Glaucoma Week accounts in your posts and stories.

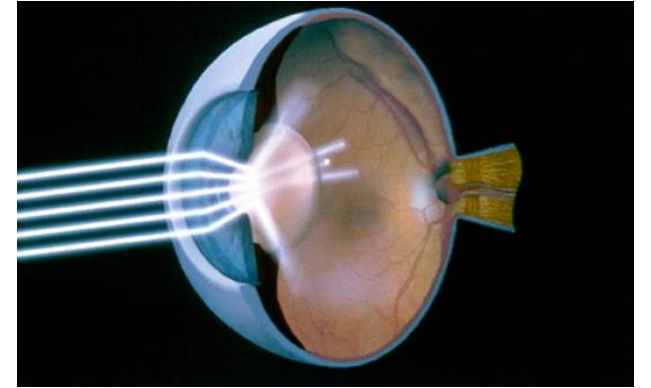
[READ MORE](#)

[SUBMIT ACTIVITY](#)

Welcome to World Glaucoma Week

Cataracte

- 1^{ere} cause de cécité curable dans le monde
- Evolution des techniques depuis des années
 - abaissement du cristallin
 - extraction du cristallin sans implant
 - extraction du cristallin avec implant en avant de l'iris
 - extraction du cristallin avec implant en arrière de l'iris rigide
 - extraction du cristallin avec implant en arrière de l'iris pliable

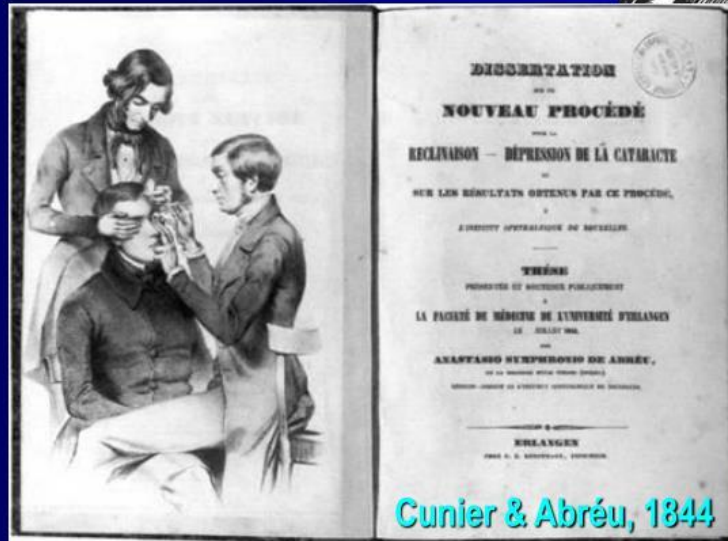


Jusqu'en 1920

Modern Age
Couching
Ophthalmodoyleia
(Bartisch, 1583)



XIXth century, today?



Cunier & Abréu, 1844



Brisseau, 1703

Cataracte

- Un exemple il y a1 siècle

- Patient opéré en 1923

opéré début janvier : peu content
début récupération visuelle en plusieurs mois
septembre 1923 arrive à lire
ne veut pas se faire opérer le 2eme œil

Toutes mes excuses de n'être pas venu au rendez-vous. Je suis absolument découragé et, bien que je lise, non sans efforts, de 15 à 20 pages chaque jour, dehors et de loin, je n'y vois plus rien avec ou sans lunettes. Et depuis deux jours, les points noirs m'obsèdent.

Songez que voilà six mois de la première opération, cinq que j'ai quitté la clinique, et bientôt quatre que je porte les lunettes, ce qui est loin des quatre à cinq semaines pour m'habituer à ma nouvelle vision ! Six mois que j'aurais pu si bien employer, si vous m'aviez dit la vérité. J'aurais pu terminer les *Décorations* que je dois livrer au mois d'avril et que je suis certain maintenant de ne pouvoir finir comme je le voudrais.

C'est là mon grand chagrin et me fait regretter cette fatale opération. Pardonnez-moi de vous parler si franchement et laissez-moi vous dire que c'est criminel de m'avoir mis dans cette situation.

Bien tristement à vous.

Cher Docteur et Ami,

Je ne puis décidément pas me décider. J'ai trop peur du résultat. Je viens donc vous prier de dire non à la clinique et d'en informer le docteur Coutela. Si, ce que je ne crois pas, je me décidais, ce serait (*sic*) qu'un peu plus tard.

Je ne sors plus, des cauchemars. Bref, dans un trop fâcheux état pour me laisser opérer.

Amitiés.

Mon cher Docteur,

Rassurez-vous, au reçu de votre dépêche, j'ai repris les lunettes et, ma foi, j'ai pu lire un peu d'abord et pas mal ensuite, avec un peu de fatigue naturellement. Déformation comme avant, mais subie courageusement. Grande difficulté pour me diriger avec. Aujourd'hui, j'ai renouvelé les mêmes exercices un peu plus longtemps, mais comme je ne puis mettre mes lunettes dès le réveil, il arrive que je n'y vois pas assez pour me lever et faire le nécessaire. J'ai donc eu recours à l'euphtalmine dès 6 heures du matin, afin de m'occuper de ce que j'ai à faire jusqu'à dix où je recommence mes exercices. Je dois vous dire que, pour unifier la vision, j'ai collé un papier sur le verre de l'œil gauche.

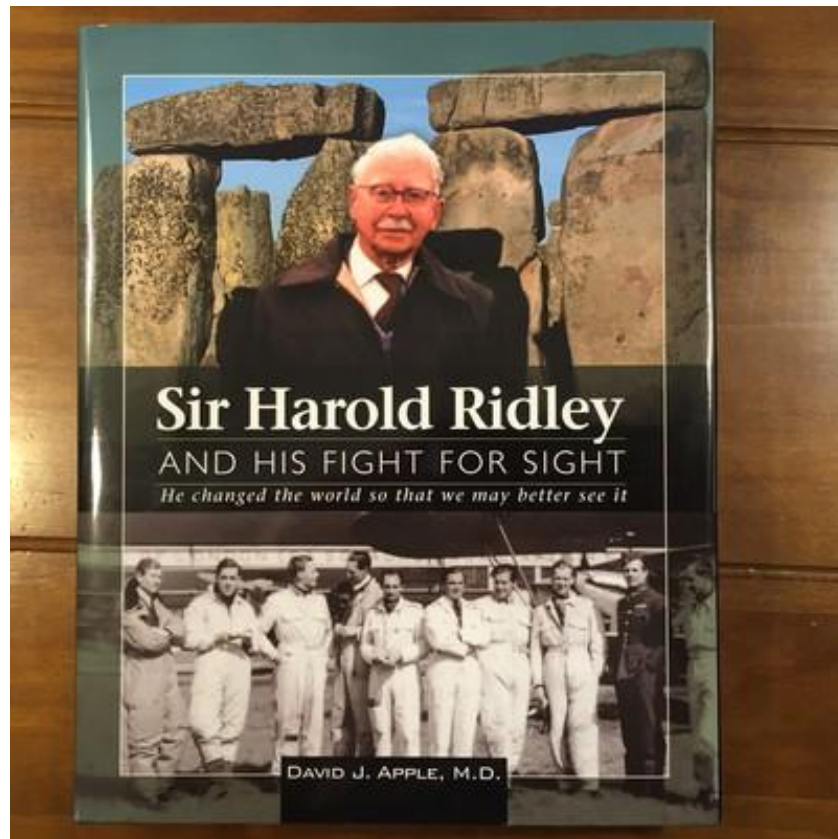
Je voudrais savoir de vous si vous m'autorisez à continuer l'euphtalmine le matin jusqu'à ce que sois accoutumé aux verres. Je ne crois pas utile d'aller vous voir le 4. Je crois que le mieux serait de vous voir quelques jours plus tard.

Bien cordialement à vous.

1923: cataractes opérées avec acuité $< 1/10$



1943

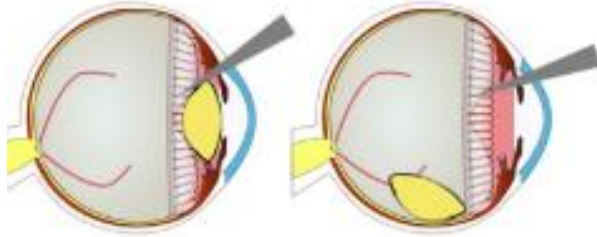


PMMA 1950

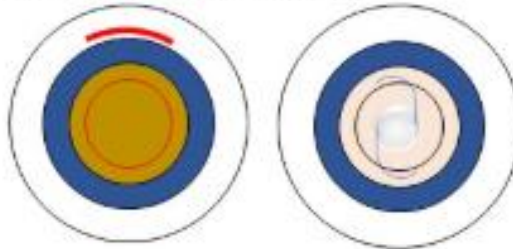


History and Other Types of Cataract Surgery

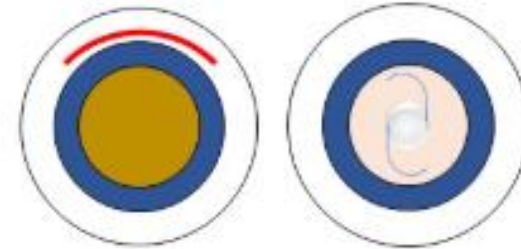
- Couching**
(fifth century BC)
- A needle displaces the opacified lens into the posterior segment



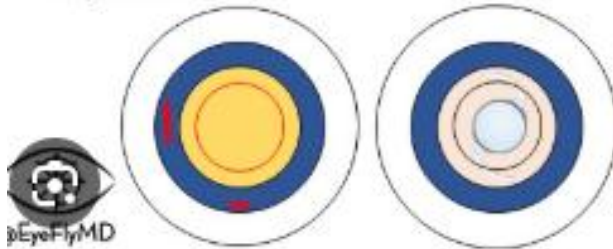
- Extracapsular Cataract Extraction (ECCE)**
(1696–1762)
- The lens is removed through an opening in the anterior capsule and 8–12 mm scleral tunnel



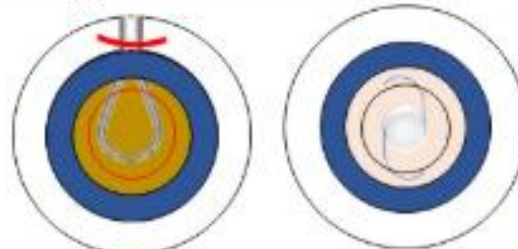
- Intracapsular Cataract Extraction (ICCE)**
(1709–1778)
- Extraction of lens with capsule intact through a 12–14 mm incision around the limbus



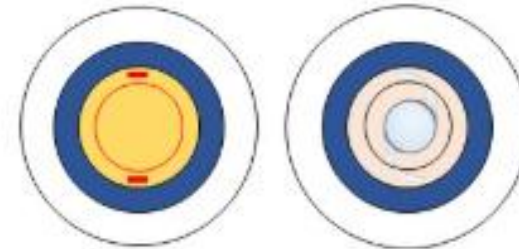
- Phacoemulsification**
(1967)
- Small corneal incisions (< 3.0 mm)
 - Phacoemulsification and removal of the lens through a capsulorhexis



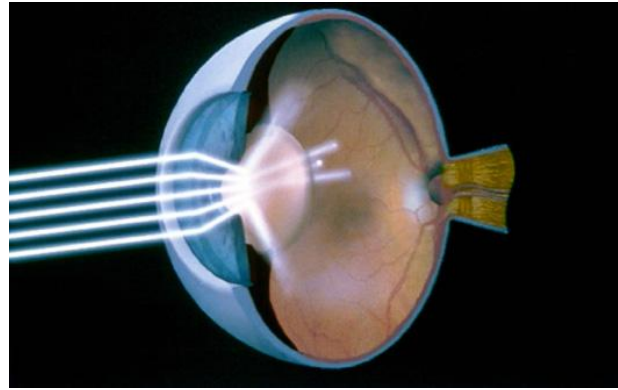
- Manual Small-incision Cataract Surgery (MSICS)**
(1994)
- Smaller incision (6–7 mm) and mechanical fragmentation of the nucleus for delivery
 - Does not require access to other high-technology instrumentation



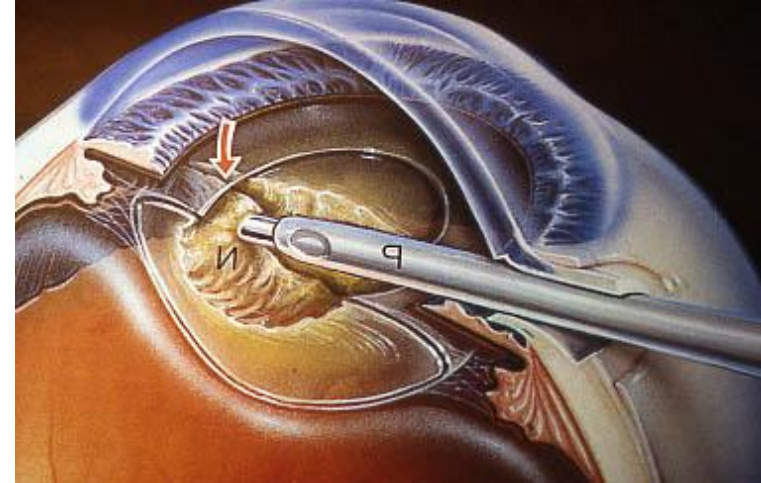
- Microincision Cataract Surgery (MICS)**
(2002)
- Bimanual phaco through very small corneal incisions (< 1.8 mm)



CATARACTE



PHAKO EMULSIFICATION



- Elle permet l'ablation de la cataracte à travers une petite incision (inf à 3 mm) avec maintien des pressions intra-oculaires durant l'intervention.
 - sécurité accrue
 - récupération visuelle plus rapide
- Cataracte sur œil glaucomateux = difficile / contrôle TA/ sédation

Prise en charge chirurgicale de la cataracte = quels bénéfices ?

- Chez les sujets de 65 à 78 ans, **le risque de chute** est multiplié par 2.8 en cas d 'acuité visuelle inférieure à 4/10
- 2600 sujets âgés suivi pendant 10 ans.
Le risque de fracture du fémur est égal à:
 - 3% si AV supérieure à 8/10
 - 8.5% si AV comprise entre 3 et 6/10
 - 11.3% si AV inférieure ou égale à 2/10

Framingham Study

Lien vision et Alzheimer

Etude prospective 625 personnes âgées (moyenne 85 ans) sans déficit cognitif à l'entrée (Medicare)

- Sur une durée de suivi de 8 ans et demi, les patients conservant une bonne ou une excellente vision ont un risque de démence réduit de 63% par rapport à ceux ayant une mauvaise vision.
- Le risque de « démence » augmentait de 52% à chaque accroissement d'une unité de l'échelle d'évaluation de la vision (de excellent à aveugle)
- Les patients qui avaient une mauvaise vision et qui ne consultaient pas un ophtalmologiste avaient un risque de maladie d'Alzheimer multiplié presque par 10 et un risque de déclin cognitif sans démence multiplié par 5

Untreated Poor Vision: A Contributing Factor to Late-Life Dementia [*Mary A. M. Rogers**](#) and [*Kenneth M. Langa*](#) *Am. J. Epidemiol.* (2010)

Cataracte : chirurgie rapide sous locale etc ...
mais on rentre dans l'œil donc ne pas relâcher la rigueur et la
sécurité

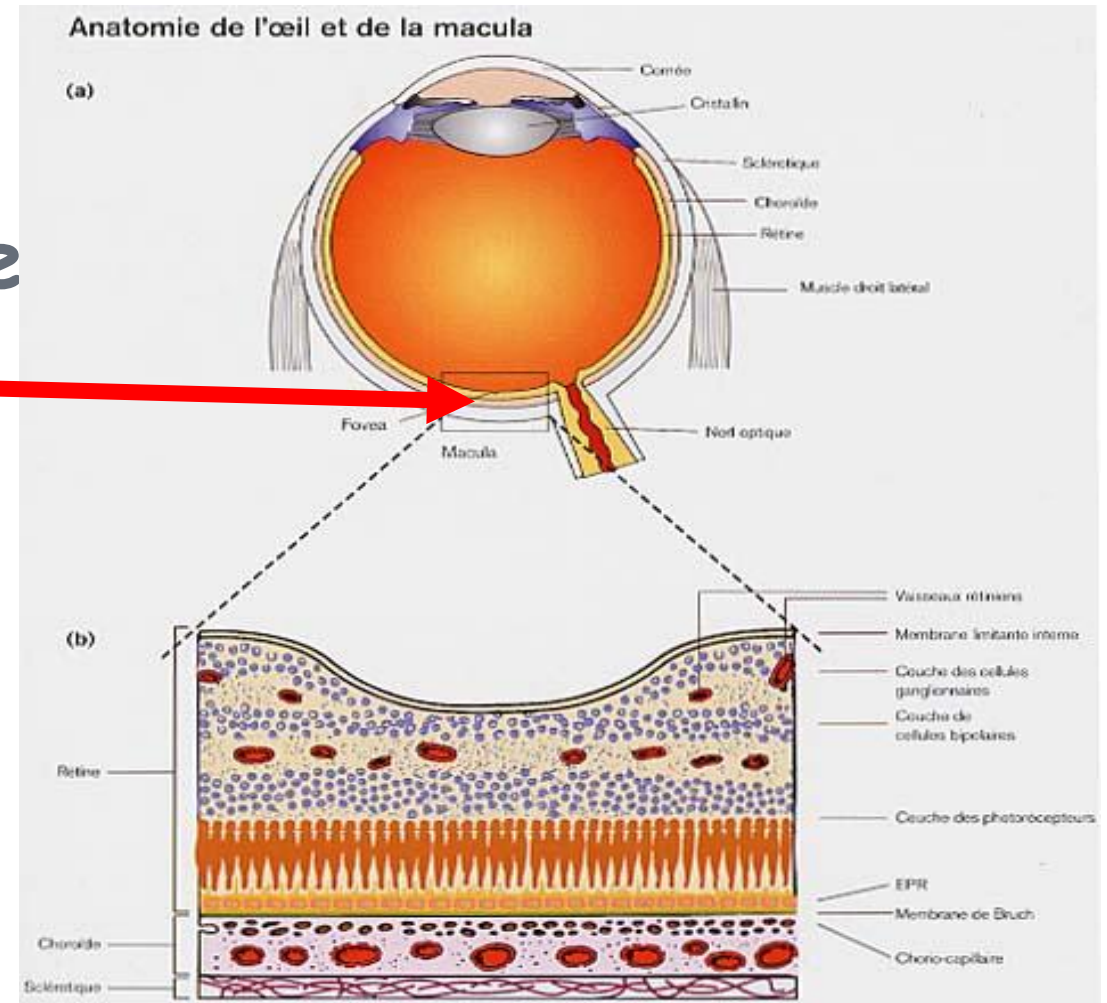


Les autres

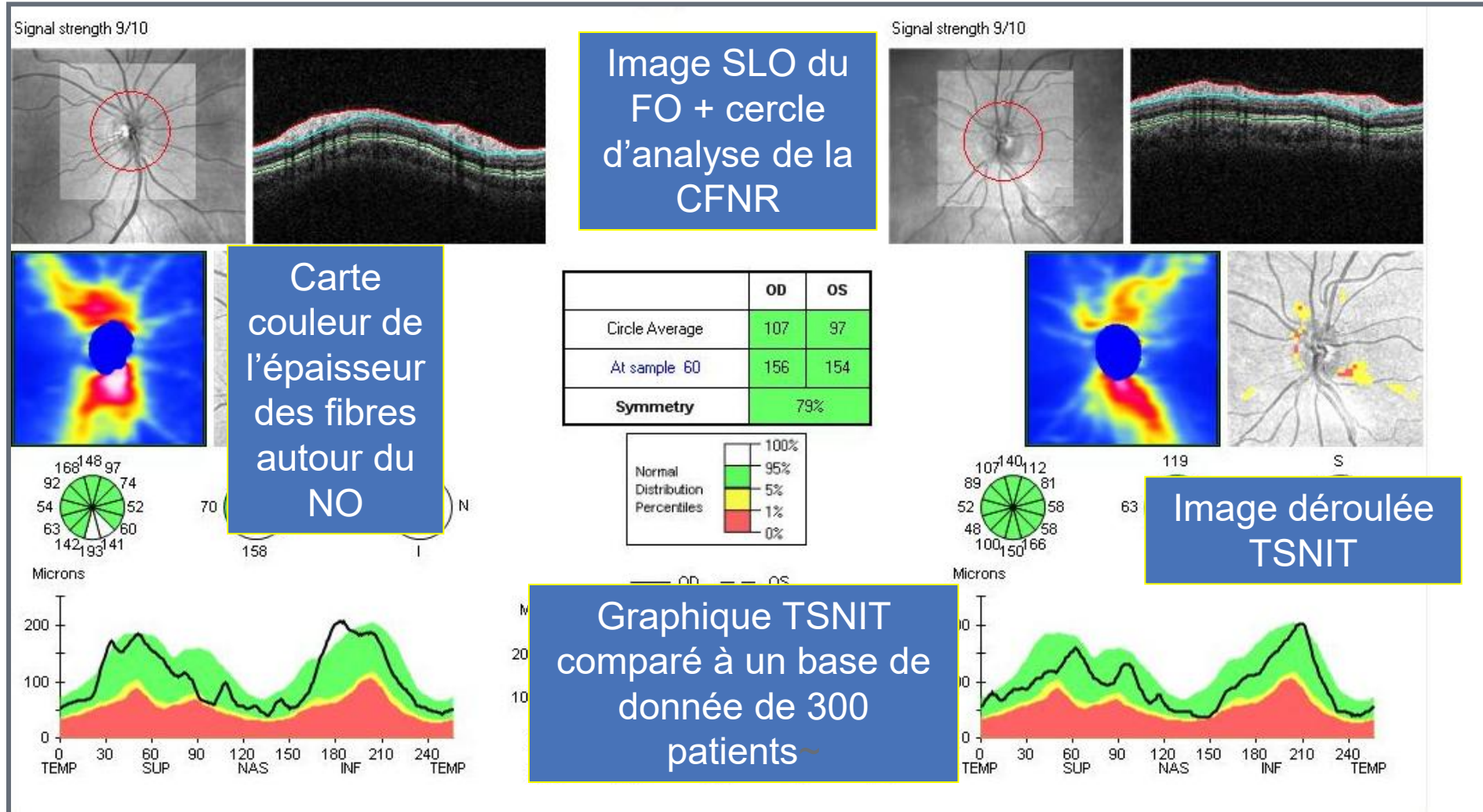
- Chirurgie de la myopie = coût - dépend de l'économie
- Chirurgie du segment antérieur = spécialité du service
- Chirurgie du segment postérieur = chirurgiens- accueil des urgences- matériel
- Pathologies du sujet âgé

DMLA et diabète

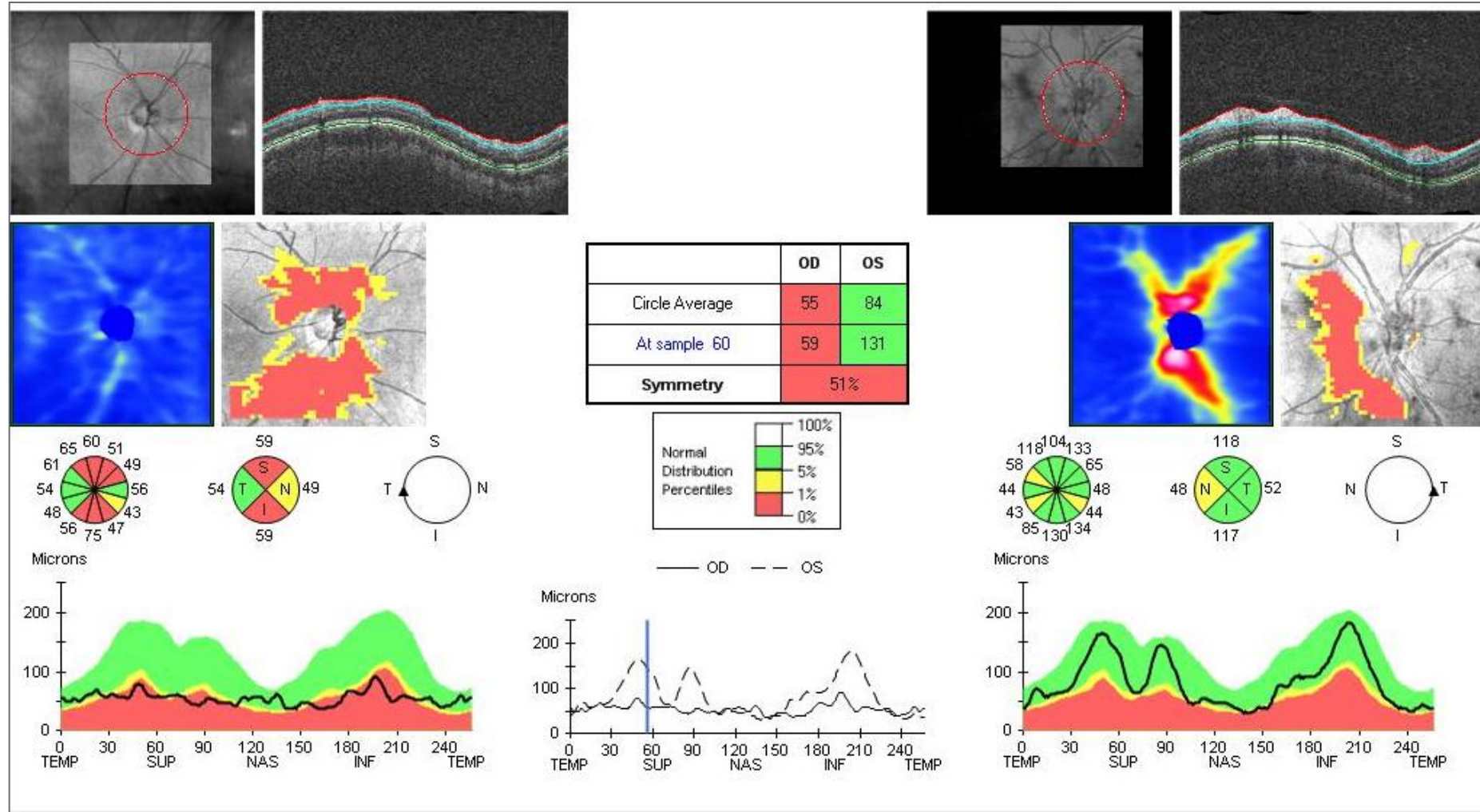
DMLA = Dégénérescence
Maculaire
Liée à l'
Age



OCT SD: exemple patient normal SD



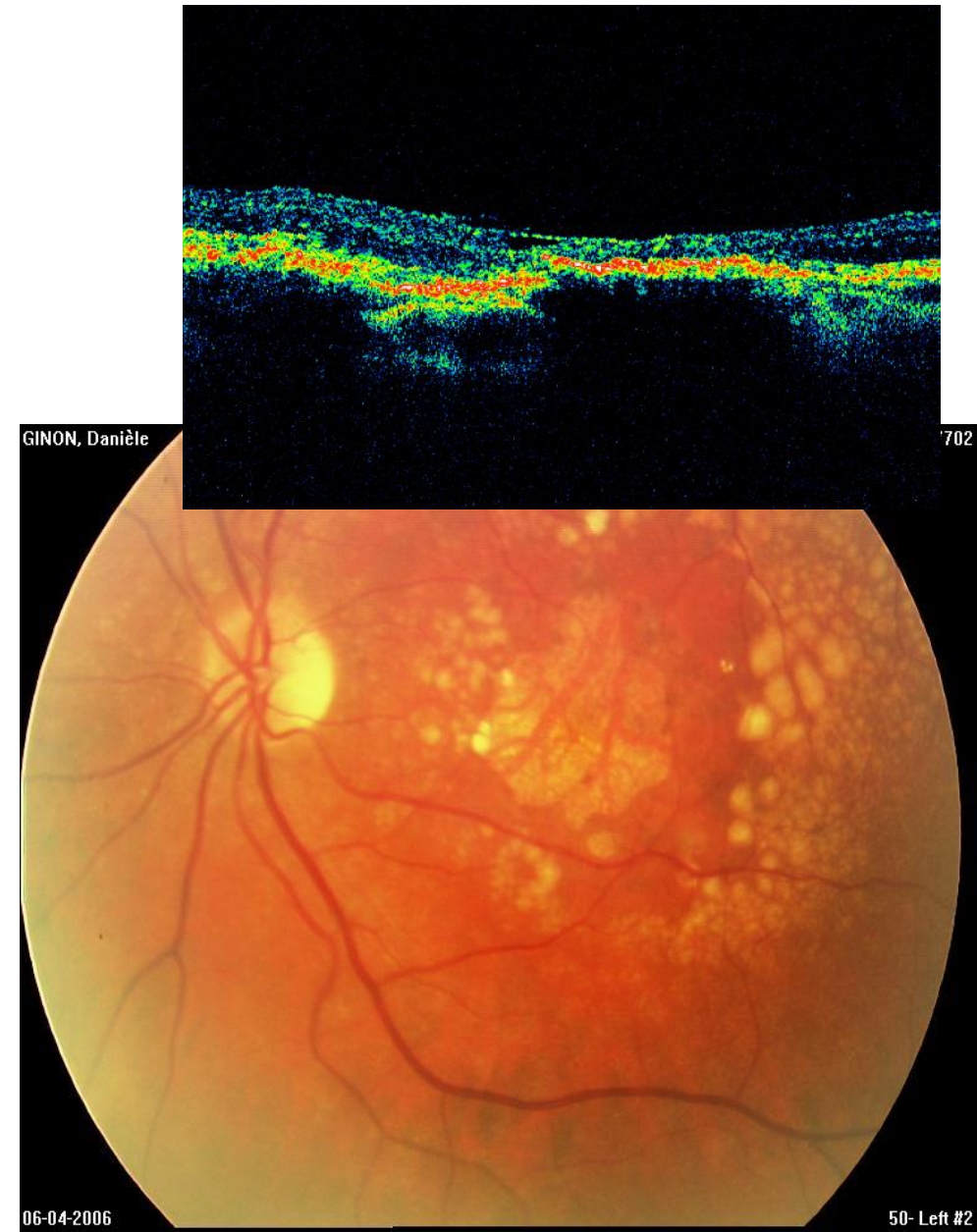
OCT SD: exemple SD patient glaucomateux



DMLA débutante

50 %

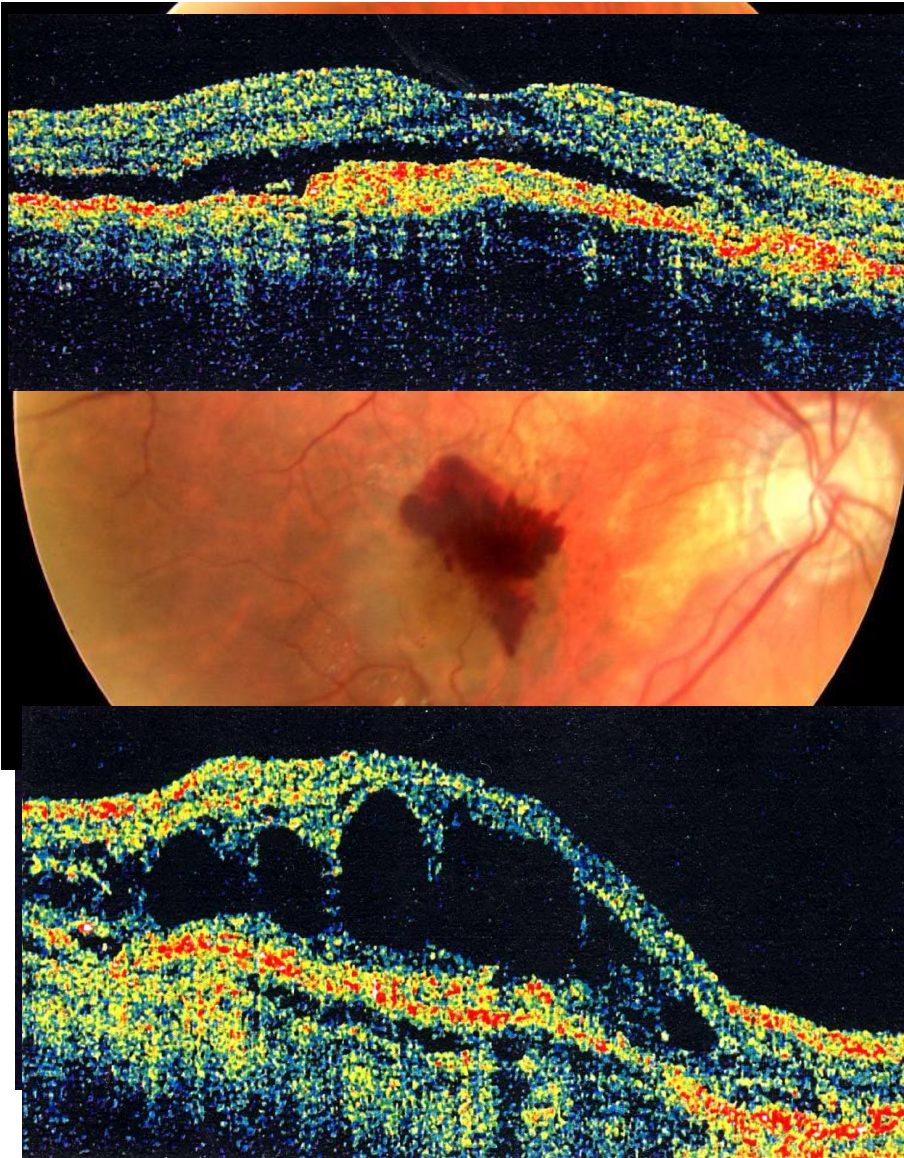
DMLA atrophique
ou sèche



DMLA débutante

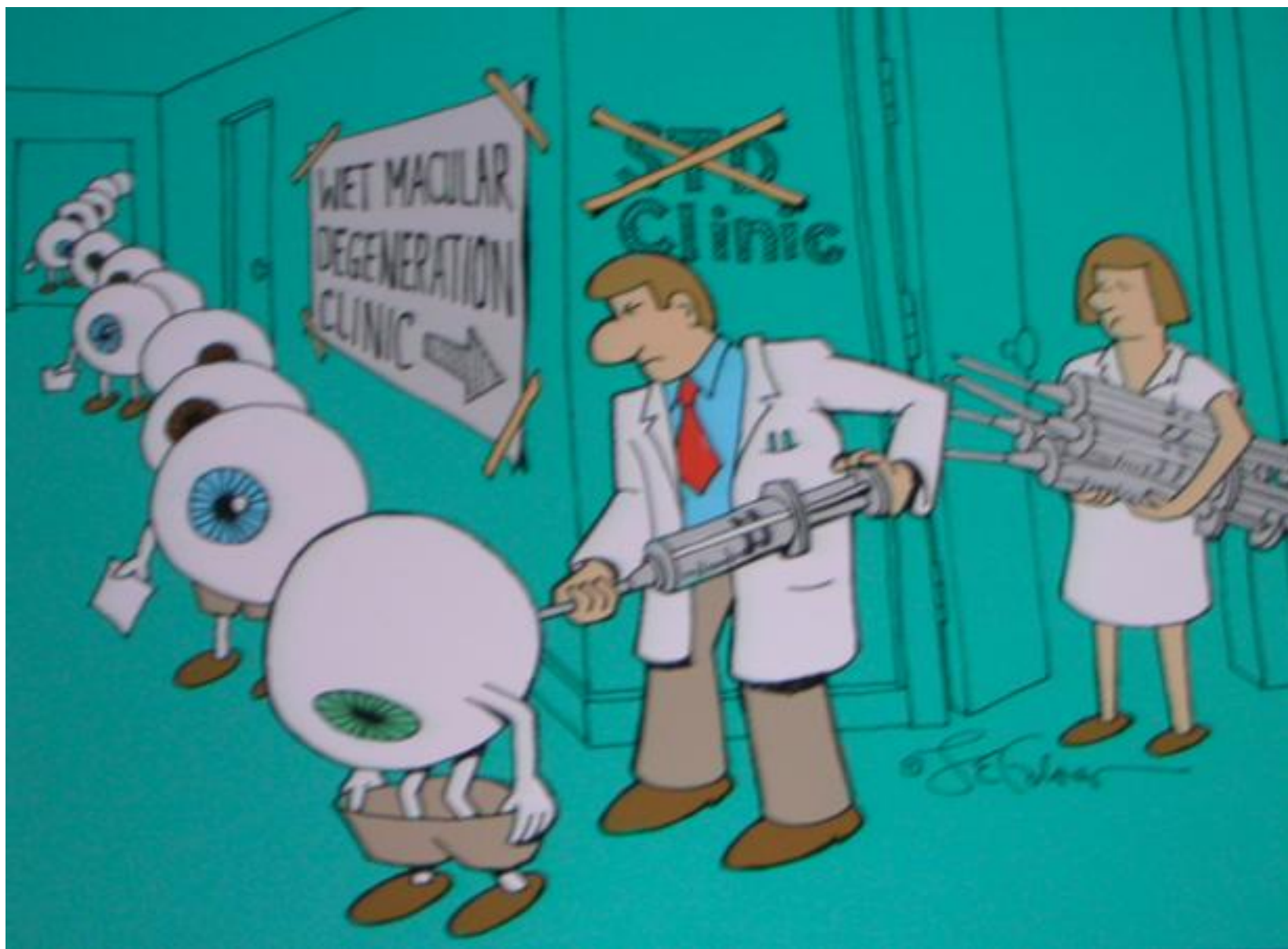
50 %

DMLA exsudative
ou humide



Forme humide et rétinopathie diabétique

- Prise en charge
OCT tomographie à cohérence optique
angiographie
laser
injections intra vitréenne: IVT anti VEGF(type Avastin)
très codifiées
salle dédiée (risque infectieux)
injections répétées toutes les 4 à 6
semaines
- Développé depuis quelques années à St Jo: 1200/ an



Intelligence artificielle

- Pas de conflit d'intérêt
- Présentation non réalisée par Chat GPT

ChatGPT		
 Examples	 Capabilities	 Limitations
"Explain quantum computing in simple terms" →	Remembers what user said earlier in the conversation	May occasionally generate incorrect information
"Got any creative ideas for a 10 year old's birthday?" →	Allows user to provide follow-up corrections	May occasionally produce harmful instructions or biased content
"How do I make an HTTP request in Javascript?" →	Trained to decline inappropriate requests	Limited knowledge of world and events after 2021

Les Glaucomes: vous pensez à

- Neuropathie optique progressive asymptomatique liée à un excès de pression intraoculaire

- Touche 2% de la population – 4% chez le sujet âgé

65 millions	2013
80 millions	2020
111,8 millions	2040

- 1 200 000 glaucomes en France dont la moitié non diagnostiquée
(Données CNAM : 1400000 patients traités)

- Peut entraîner une cécité totale irréversible (contrairement à la cataracte et à la DMLA)
- Majorité des examens : **délégation de tâches**

Intelligence artificielle ?

SI JE VOUS PARLE
D'INTELLIGENCE
ARTIFICIELLE
VOUS PENSEZ À ?



IA : Faut-il croquer dedans ?

ROBOTIQUE, IA

L'intelligence artificielle s'apprête à croquer les ophtalmos



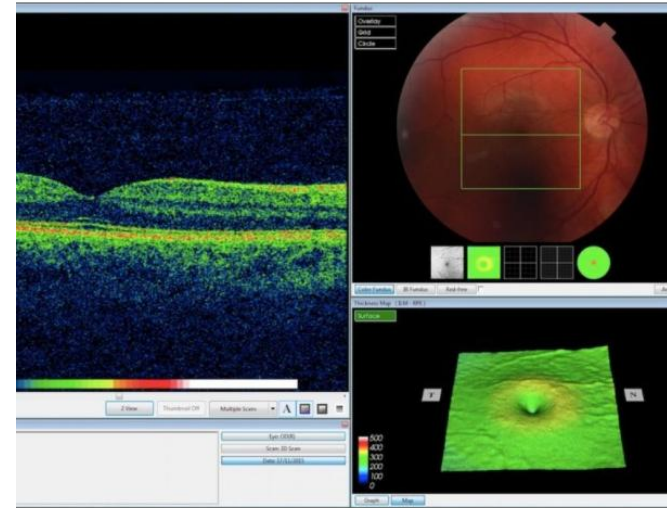
21/07/2017 - 00:00
Par LA RÉDACTION

SANTÉ

L'intelligence artificielle DeepMind, de Google, peut détecter 50 maladies oculaires aussi bien que votre ophtalmo

Par Hugo Jalinière le 28.08.2018 à 19h25

L'entreprise de Google, DeepMind, spécialisée dans l'intelligence artificielle, a mis au point un logiciel capable de dépister plus de 50 maladies oculaires avec la même précision que des ophtalmologues aguerris.



+ LUS + COMMENTÉS + PARTAGÉS SUR f

 Ce fossile d'araignée est un faux !

 Première biothérapie anticancer de l'OMS

 Les câbles de télécommunications sous-marins, des capteurs sismiques insoupçonnés

 Mais qui est le père Noël ?

 YouTube : les vidéos à ne pas manquer

NEWSLETTER SCIENCES ET AVENIR

Entrez votre E-mail

JE M'ABONNE

À LA UNE CETTE SEMAINE



Intelligence artificielle = un lexique pour comprendre les études

- Machine Learning

- Deep learning

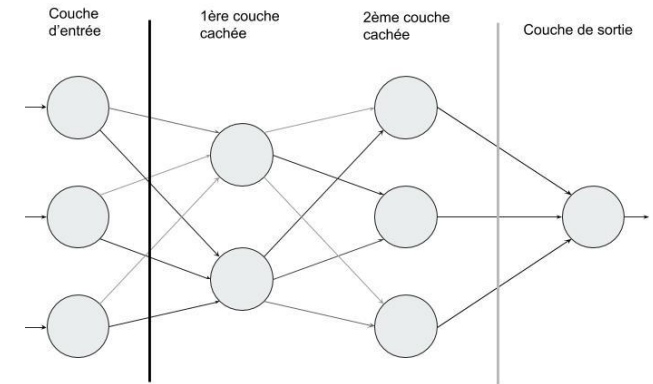
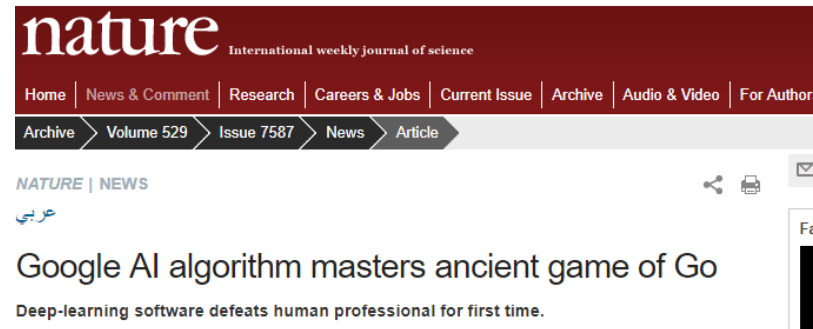
- Reseaux neuronaux (neural networks)

Le ML est de l'IA reposant sur des statistiques.

Le DL est du ML utilisé avec des réseaux de neurones.

L'IA est l'imitation d'une réponse (par un algorithme) d'un expert dans un domaine.

- Le combat = homme machine



L'apprentissage

- Par renforcement = utilisé sur certains algorithmes pour permettre, notamment, à une voiture d'apprendre à conduire toute seule par la pratique. C'est ce type d'apprentissage qui a aussi permis à Google DeepMind de gagner aux échecs.
- Fonctionne par retour d'erreur = système de récompenses et de pénalités pour permettre à l'ordinateur d'apprendre à résoudre un problème de manière autonome.
- Peut être « supervisé », confronté au ground truth = la vérité terrain . Différence entre prédiction du réseau neuronal et vérité terrain = fonction de coût
- Contrairement aux êtres humains, l'intelligence artificielle peut effectuer des milliers de tentatives simultanément.

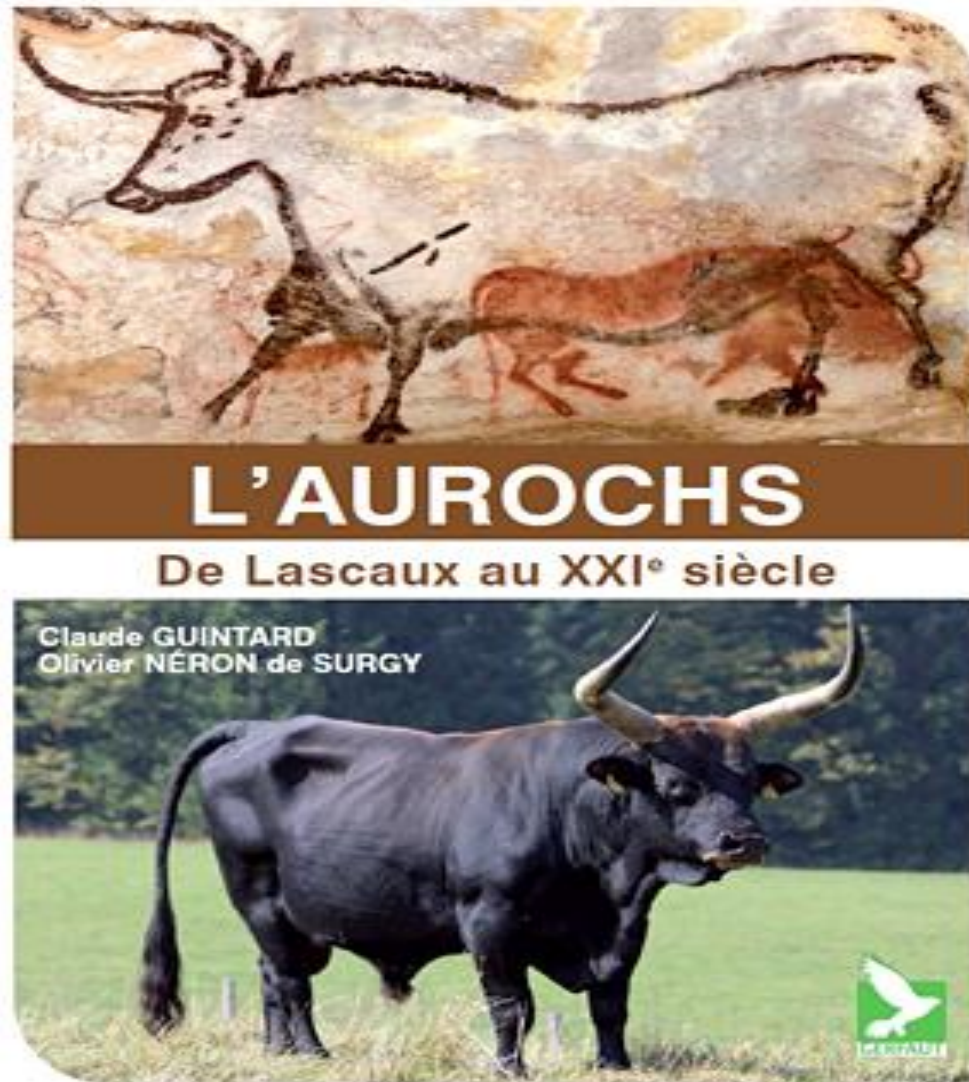
Maladie asymptomatique= diagnostique difficile à « dompter »

- PIO / pachymétrie
- Gonioscopie
- Analyse du Champ visuel
- Analyse des nerfs (fibres) optiques



Télemédecine
Délégation de
tâches

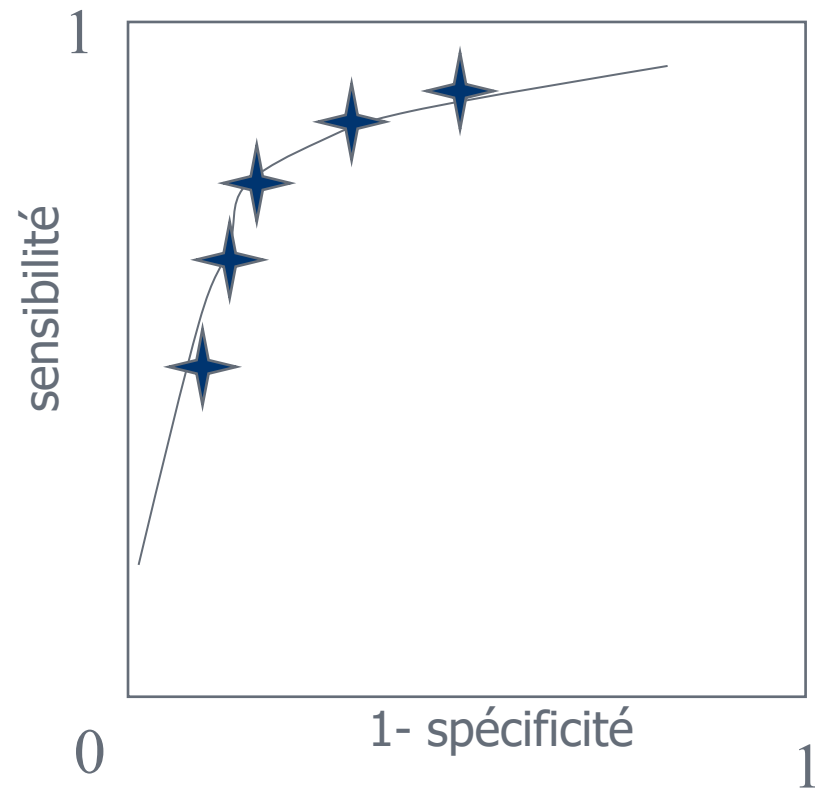
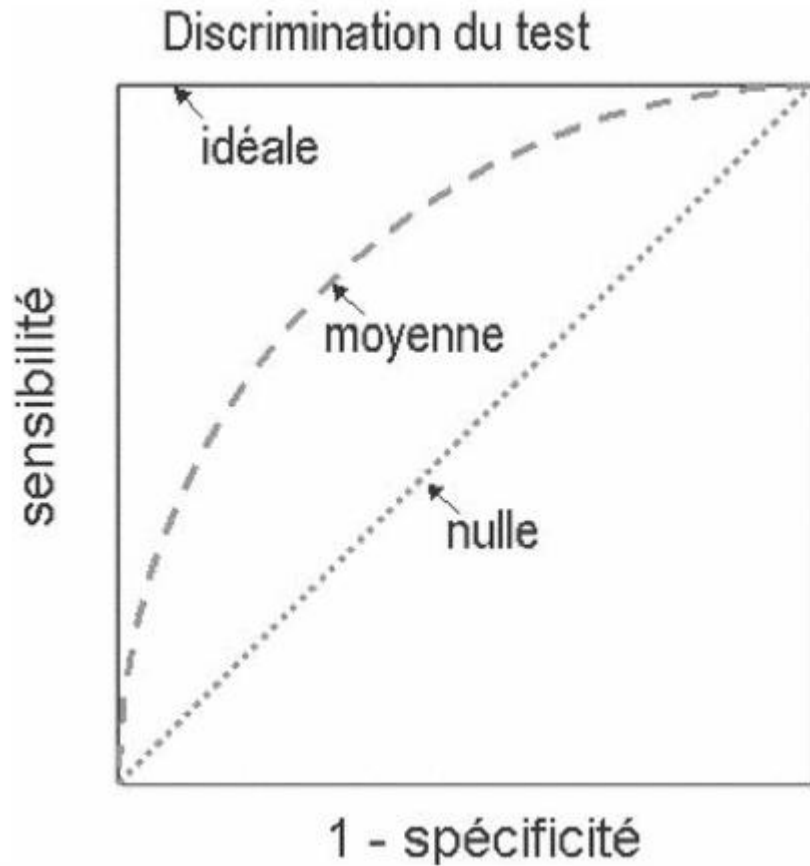
Combat homme machine = AUROC ?



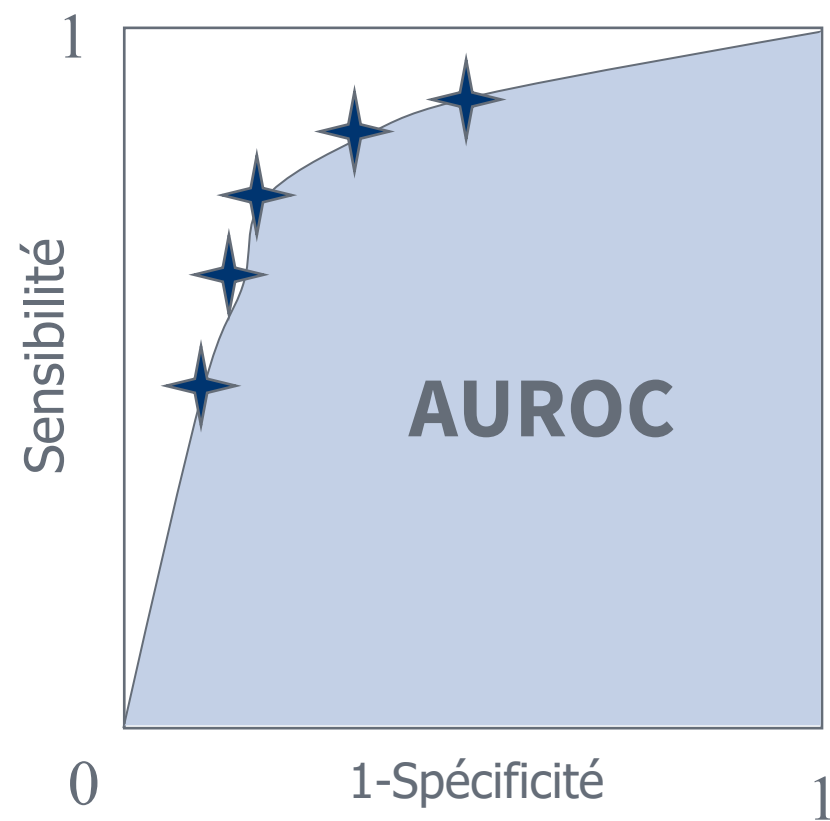
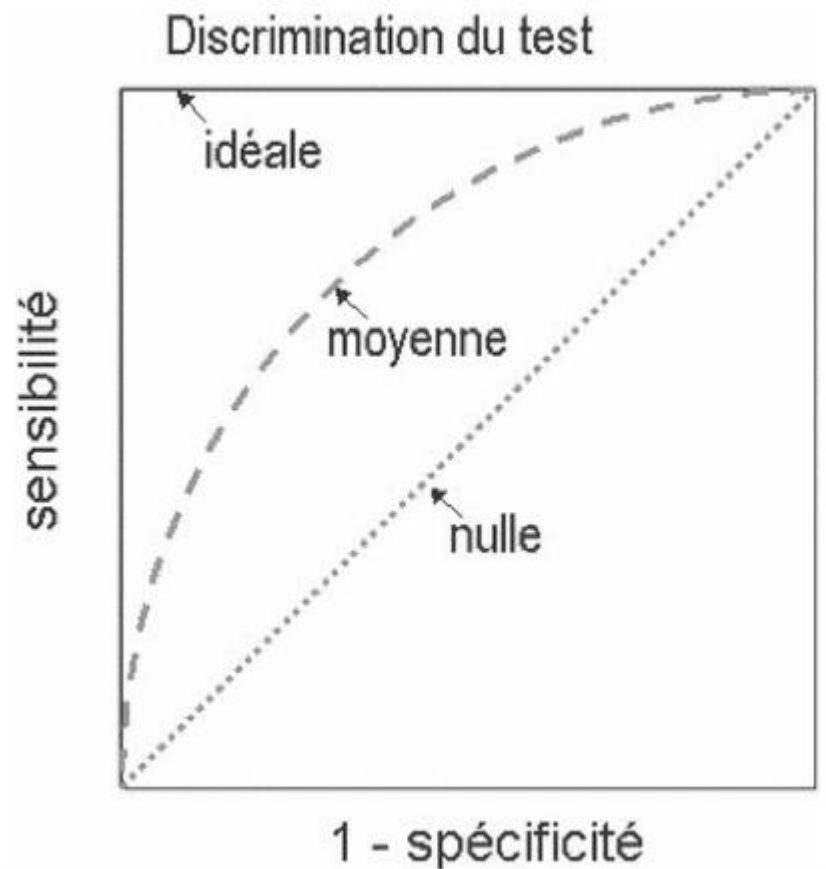
Sensibilité- Spécificité

	Glaucomes	Pas de glaucome	Total tests	Valeur prédictive
Test positif	Vrai positifs (VP)	Faux Positifs (FP)	Total positifs (TP)	VPP = VP/TP
Test négatif	Faux négatifs (FN)	Vrai négatifs (VN)	Total négatifs (TN)	VPN= VN/TN
Total tests	Total malades (TM)	Total (TBP)		
	Sensibilité VP / TM	Spécificité VN/TBP		

Courbe ROC = Receiver Operating Characteristic et AUROC



AUROC= Area Under Receiver Operating Characteristic



IA

- Le clinicien
 - c/d – taille du disque
 - Déficit fasciculaire fibres
 - Hémorragies
 - Encoche ANR
 - Non respect de la règle ISNT
 - Vaisseau circum linéaire

December 12, 2017

Development and Validation of a Deep Learning System for Diabetic Retinopathy and Related Eye Diseases Using Retinal Images From Multiethnic Populations With Diabetes

Daniel Shu Wei Ting, MD, PhD^{1,2}; Carol Yim-Lui Cheung, PhD^{1,3}; Gilbert Lim, PhD⁴; [et al](#)

» [Author Affiliations](#) | [Article Information](#)

JAMA. 2017;318(22):2211-2223. doi:10.1001/jama.2017.18152

- La machine= elle apprend
(réseaux neuronaux convolutifs)
 - Segmentation NO
 - Puis extraction données = c/d - surface papille - distribution des vaisseaux

Développement d'algorithmes = deep learning

Results In the primary validation dataset (n=14 880 patients; 71 896 images; mean [SD] age, 60.2 [2.2] years; 54.6% men), the prevalence of referable diabetic retinopathy was 3.0%; vision-threatening diabetic retinopathy, 0.6%; possible glaucoma, 0.1%; and AMD, 2.5%. The AUC of the DLS for referable diabetic retinopathy was 0.936 (95% CI, 0.925-0.943), sensitivity was 90.5% (95% CI, 87.3%-93.0%), and specificity was 91.6% (95% CI, 91.0%-92.2%). For vision-threatening diabetic retinopathy, AUC was 0.958 (95% CI, 0.956-0.961), sensitivity was 100% (95% CI, 94.1%-100.0%), and specificity was 91.1% (95% CI, 90.7%-91.4%). For possible glaucoma, AUC was 0.942 (95% CI, 0.929-0.954), sensitivity was 96.4% (95% CI, 81.7%-99.9%), and specificity was 87.2% (95% CI, 86.8%-87.5%). For AMD, AUC was 0.931 (95% CI, 0.928-0.935), sensitivity was 93.2% (95% CI, 91.1%-99.8%), and specificity was 88.7% (95% CI, 88.3%-89.0%). For referable diabetic retinopathy in the 10 additional datasets, AUC range was 0.889 to 0.983 (n=40 752 images).

Photos NO

- Sensible et spécifique
 - Faux neg = myopie forte
- RD- DMLA
- Faux + = GLD – myopie
- autres atrophies optiques
- AUC moins bonne (0,89)
- avec glaucome débutant

Glaucomatous Optic Neuropathy Based on Color Fundus Photographs

Zhixi Li ¹, Yifan He ², Stuart Keel ³, Wei Meng ², Robert T Chang ⁴, Mingguang He ⁵

Affiliations + expand

PMID: 29506863 DOI: [10.1016/j.ophtha.2018.01.023](https://doi.org/10.1016/j.ophtha.2018.01.023)

Abstract

Purpose: To assess the performance of a deep learning algorithm for detecting referable glaucomatous optic neuropathy (GON) based on color fundus photographs.

Design: A deep learning system for the classification of GON was developed for automated classification of GON on color fundus photographs.

Participants: We retrospectively included 48 116 fundus photographs for the development and validation of a deep learning algorithm.

Methods: This study recruited 21 trained ophthalmologists to classify the photographs. Referable GON was defined as vertical cup-to-disc ratio of 0.7 or more and other typical changes of GON. The reference standard was made until 3 graders achieved agreement. A separate validation dataset of 8000 fully gradable fundus photographs was used to assess the performance of this algorithm.

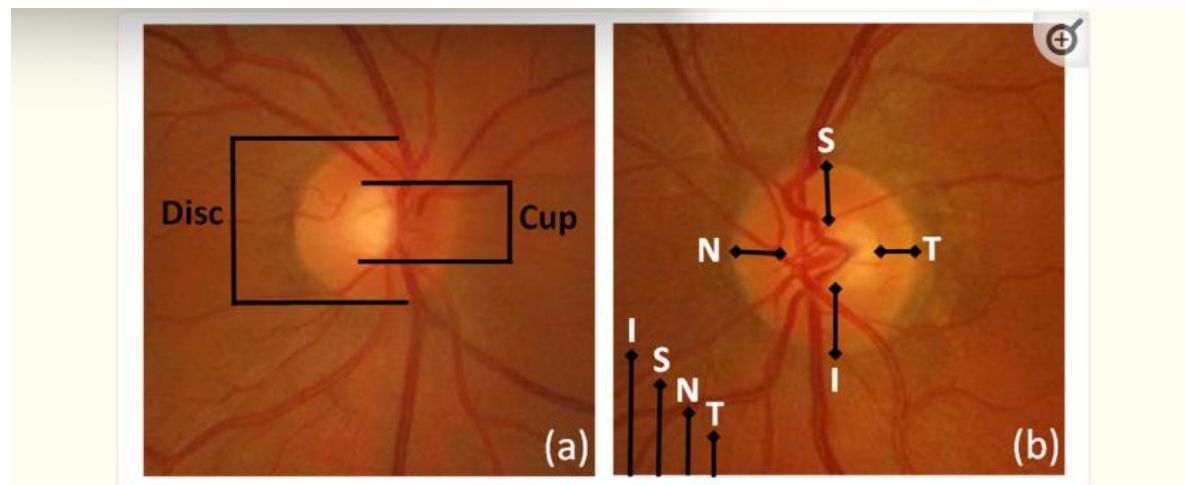
Main outcome measures: The area under receiver operator characteristic curve (AUC) with sensitivity and specificity was applied to evaluate the efficacy of the deep learning algorithm detecting referable GON.

Results: In the validation dataset, this deep learning system achieved an AUC of 0.986 with sensitivity of 95.6% and specificity of 92.0%. The most common reasons for false-negative grading (n = 87) were GON with coexisting eye conditions (n = 44 [50.6%]), including pathologic or high myopia (n = 37 [42.6%]), diabetic retinopathy (n = 4 [4.6%]), and age-related macular degeneration (n = 3 [3.4%]). The leading reason for false-positive results (n = 480) was having other eye conditions (n = 458 [95.4%]), mainly including physiologic cupping (n = 267 [55.6%]). Misclassification as false-positive results amidst a normal-appearing fundus occurred in only 22 eyes (4.6%).

Conclusions: A deep learning system can detect referable GON with high sensitivity and specificity. Coexistence of high or pathologic myopia is the most common cause resulting in false-negative results. Physiologic cupping and pathologic myopia were the most common reasons for false-positive results.

Automatic glaucoma classification using color fundus images based on convolutional neural networks and transfer learning

[Juan J. Gómez-Valverde](#),^{1,2,*} [Alfonso Antón](#),^{3,4,5} [Gianluca Fatti](#),³ [Bart Liefers](#),⁶ [Alejandra Herranz](#),³ [Andrés Santos](#),^{1,2} [Clara I. Sánchez](#),⁶ and [María J. Ledesma-Carbayo](#)^{1,2}



[Fig. 1](#)

Example of findings used to detect glaucoma in color fundus images. (a) Quantification of the optic cup to disc ratio (CDR). The reduction of the optic nerve fibres (typically related with glaucoma) provokes optic disc cupping, central cup becomes larger, with respect to the optic disc (b) The neuroretinal rim usually follows a normal pattern (ISNT rule) where the inferior region is broader than the superior, broader than the nasal, and broader than the temporal region. The alteration of this pattern is a suspicious sign of glaucoma

Am J Ophthalmol. 2019 Nov 12. pii: S0002-9394(19)30543-4. doi: 10.1016/j.ajo.2019.11.006. [Epub ahead of print]

Human versus Machine: Comparing a Deep Learning Algorithm to Human Gratings for Detecting Glaucoma on Fundus Photographs.

Jammal AA¹, Thompson AC², Mariottoni EB², Berchuck SI³, Urata CN², Estrela T², Wakil SM², Costa VP⁴, Medeiros FA⁵.

Author information

- 1 Vision, Imaging and Performance Laboratory (VIP), Duke Eye Center and Department of Ophthalmology, Duke University, Durham, NC; Department of Ophthalmology, State University of Campinas, Campinas, Brazil.
- 2 Vision, Imaging and Performance Laboratory (VIP), Duke Eye Center and Department of Ophthalmology, Duke University, Durham, NC.
- 3 Vision, Imaging and Performance Laboratory (VIP), Duke Eye Center and Department of Ophthalmology, Duke University, Durham, NC; Department of Statistical Science and Forge, Duke University, Durham, NC.
- 4 Department of Ophthalmology, State University of Campinas, Campinas, Brazil.
- 5 Vision, Imaging and Performance Laboratory (VIP), Duke Eye Center and Department of Ophthalmology, Duke University, Durham, NC. Electronic address: felipe.medeiros@duke.edu.

Abstract

PURPOSE: To compare the diagnostic performance of human gradings versus predictions provided by a machine-to-machine (M2M) deep learning (DL) algorithm trained to quantify retinal nerve fiber layer (RNFL) damage on fundus photographs.

DESIGN: Evaluation of a machine learning algorithm.

METHODS: A M2M DL algorithm trained with RNFL thickness parameters from spectral-domain optical coherence tomography was applied to a subset of 490 fundus photos of 490 eyes of 370 subjects graded by two glaucoma specialists for the probability of glaucomatous optical neuropathy (GON), and estimates of cup-to-disc (C/D) ratios. Spearman correlations with standard automated perimetry (SAP) global indices were compared between the human gradings versus the M2M DL-predicted RNFL thickness values. The area under the receiver operating characteristic curves (AUC) and partial AUC for the region of clinically meaningful specificity (85-100%) were used to compare the ability of each output to discriminate eyes with repeatable glaucomatous SAP defects versus eyes with normal fields.

RESULTS: The M2M DL-predicted RNFL thickness had a significantly stronger absolute correlation with SAP mean deviation ($\rho=0.54$) than the probability of GON given by human graders ($\rho=0.48$; $P<0.001$). The partial AUC for the M2M DL algorithm was significantly higher than that for the probability of GON by human graders (partial AUC = 0.529 vs. 0.411, respectively; $P=0.016$).

CONCLUSION: A M2M DL algorithm performed as well as, if not better than, human graders at detecting eyes with repeatable glaucomatous visual field loss. This DL algorithm could potentially replace human graders in population screening efforts for glaucoma.

Homme vs machine
Deep Learning algorithm
AUC

Machine learning et photos NO

Ophthalmology. 2018 Aug;125(8):1199-1206. doi: 10.1016/j.ophtha.2018.01.023. Epub 2018 Mar 2.

Efficacy of a Deep Learning System for Detecting Glaucomatous Optic Neuropathy Based on Color Fundus Photographs.

Li Z¹, He Y², Keel S³, Meng W², Chang RT⁴, He M⁵.

Author information

- 1 State Key Laboratory of Ophthalmology, Zhongshan Ophthalmic Center, Sun Yat-sen University, Guangzhou 510060, China.
- 2 Guangzhou Healgo Interactive Medical Technology Co. Ltd., Guangzhou, China.
- 3 Centre for Eye Research Australia; Departments of Ophthalmology and Surgery, University of Melbourne, Melbourne, Australia.
- 4 Department of Ophthalmology, Byers Eye Institute, Stanford University, Palo Alto, California.
- 5 State Key Laboratory of Ophthalmology, Zhongshan Ophthalmic Center, Sun Yat-sen University, Guangzhou 510060, China; Centre for Eye Research Australia; Departments of Ophthalmology and Surgery, University of Melbourne, Melbourne, Australia. Electronic address: mingguang.he@unimelb.edu.au.

Abstract

PURPOSE: To assess the performance of a deep learning algorithm for detecting referable glaucomatous optic neuropathy (GON) based on color fundus photographs.

DESIGN: A deep learning system for the classification of GON was developed for automated classification of GON on color fundus photographs.

PARTICIPANTS: We retrospectively included 48 116 fundus photographs for the development and validation of a deep learning algorithm.

METHODS: This study recruited 21 trained ophthalmologists to classify the photographs. Referable GON was defined as vertical cup-to-disc ratio of 0.7 or more and other typical changes of GON. The reference standard was made until 3 graders achieved agreement. A separate validation dataset of 8000 fully gradable fundus photographs was used to assess the performance of this algorithm.

MAIN OUTCOME MEASURES: The area under receiver operator characteristic curve (AUC) with sensitivity and specificity was applied to evaluate the efficacy of the deep learning algorithm detecting referable GON.

RESULTS: In the validation dataset, this deep learning system achieved an AUC of 0.986 with sensitivity of 95.6% and specificity of 92.0%. The most common reasons for false-negative grading (n = 87) were GON with coexisting eye conditions (n = 44 [50.6%]), including pathologic or high myopia (n = 37 [42.6%]), diabetic retinopathy (n = 4 [4.6%]), and age-related macular degeneration (n = 3 [3.4%]). The leading reason for false-positive results (n = 480) was having other eye conditions (n = 458 [95.4%]), mainly including physiologic cupping (n = 267 [55.6%]). Misclassification as false-positive results amidst a normal-appearing fundus occurred in only 22 eyes (4.6%).

CONCLUSIONS: A deep learning system can detect referable GON with high sensitivity and specificity. Coexistence of high or pathologic myopia is the most common cause resulting in false-negative results. Physiologic cupping and pathologic myopia were the most common reasons for false-positive results.

Am J Ophthalmol. 2019 Nov 12. pii: S0002-9394(19)30543-4. doi: 10.1016/j.ajo.2019.11.006. [Epub ahead of print]

Human versus Machine: Comparing a Deep Learning Algorithm to Human Gratings for Detecting Glaucoma on Fundus Photographs.

Jammal AA¹, Thompson AC², Mariottoni EB², Berchuck SI³, Urata CN², Estrela T², Wakil SM², Costa VP⁴, Medeiros FA⁵.

– Author information

- 1 Vision, Imaging and Performance Laboratory (VIP), Duke Eye Center and Department of Ophthalmology, Duke University, Durham, NC; Department of Ophthalmology, State University of Campinas, Campinas, Brazil.
- 2 Vision, Imaging and Performance Laboratory (VIP), Duke Eye Center and Department of Ophthalmology, Duke University, Durham, NC.
- 3 Vision, Imaging and Performance Laboratory (VIP), Duke Eye Center and Department of Ophthalmology, Duke University, Durham, NC; Department of Statistical Science and Forge, Duke University, Durham, NC.
- 4 Department of Ophthalmology, State University of Campinas, Campinas, Brazil.
- 5 Vision, Imaging and Performance Laboratory (VIP), Duke Eye Center and Department of Ophthalmology, Duke University, Durham, NC. Electronic address: felipe.medeiros@duke.edu.

Abstract

PURPOSE: To compare the diagnostic performance of human gradings versus predictions provided by a machine-to-machine (M2M) deep learning (DL) algorithm trained to quantify retinal nerve fiber layer (RNFL) damage on fundus photographs.

DESIGN: Evaluation of a machine learning algorithm.

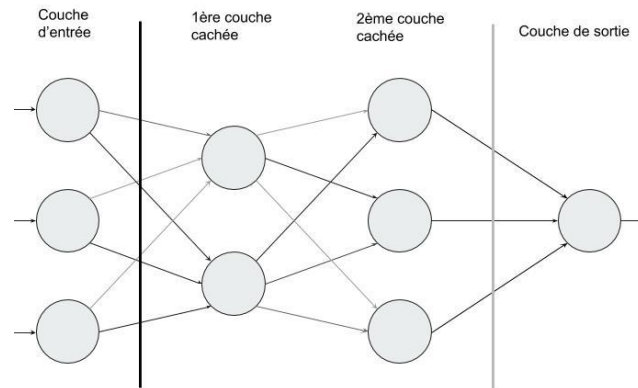
METHODS: A M2M DL algorithm trained with RNFL thickness parameters from spectral-domain optical coherence tomography was applied to a subset of 490 fundus photos of 490 eyes of 370 subjects graded by two glaucoma specialists for the probability of glaucomatous optical neuropathy (GON), and estimates of cup-to-disc (C/D) ratios. Spearman correlations with standard automated perimetry (SAP) global indices were compared between the human gradings versus the M2M DL-predicted RNFL thickness values. The area under the receiver operating characteristic curves (AUC) and partial AUC for the region of clinically meaningful specificity (85-100%) were used to compare the ability of each output to discriminate eyes with repeatable glaucomatous SAP defects versus eyes with normal fields.

RESULTS: The M2M DL-predicted RNFL thickness had a significantly stronger absolute correlation with SAP mean deviation ($\rho=0.54$) than the probability of GON given by human graders ($\rho=0.48$; $P<0.001$). The partial AUC for the M2M DL algorithm was significantly higher than that for the probability of GON by human graders (partial AUC = 0.529 vs. 0.411, respectively; $P=0.016$).

CONCLUSION: A M2M DL algorithm performed as well as, if not better than, human graders at detecting eyes with repeatable glaucomatous visual field loss. This DL algorithm could potentially replace human graders in population screening efforts for glaucoma.

Glaucoma FO

- Algorithmes différents
- ex : Convolutional Neural Network
- AUC: 87-96,5



Summary of methods for the detection of glaucoma in color fundus images. In the data sets column we indicate the number of normal cases (-) and glaucoma cases (+). For the performance we used the reported metric used in the study: AUC, accuracy (Acc) and specificity (Sp) and sensitivity (Sn).

Authors	Method	Data sets	Performance
Bock et al. (2010) [19]	Pixel values FFT coefficients, B-spline and probabilistic SVM	Private (336 -/239 +)	AUC – 87% Acc – 80%
Krishnan et al. (2013) [21]	HOS, TT, DWT with SVM	Private (30-/30 +)	Acc – 91.67%
Maheshwari et al. (2017) [23]	2D EWT and LS-SVM	Private (30-/30 +) RIM-ONE (255-/250 +)	Acc – 98.33% (Private) Acc – 81.32% (RIM-ONE)
Acharaya et al. (2017) [24]	Texton, LCP features and KNN	Private (143-/559 +)	Acc – 95,7%
Chen et al. (2015) [40]	CNN (6 layers)	ORIGA (168 + 482-) SCES (46+/1676-)	AUC (83.1%-88.7%)
Al-Bander et al. (2017) [41]	CNN 23 layers and SVM	RIM-ONE (200+/255-)	Acc – 88.2%, Sn – 85%, Sp – 89.8%
Fu et al. (2018) [42]	Ensemble of 4 CNNs	ORIGA (168+/482-) SCES (1636-/46 +)	AUC-91.83%, Sn – 84.78%, Sp – 83.80%
Li et al. (2018) [44]	Transfer Learning with Inception Network	Private (48116)	AUC – 98.6%, Sn – 95.6%, Sp – 92.0%
Christopher et al. (2018) [43]	Transfer Learning with ResNet, VGG16 and Inception v3	Private (5633+/9189-)	AUC-91%, Sn – 88%, Sp – 95%
Shibata et al. (2018) [45]	Transfer Learning with ResNet	Private (1364+/1768-)	AUC – 96.5%

SVM= support vector machine

Glaucoma et Photos NO



ORIGINAL ARTICLE

Deep learning versus ophthalmologists for screening for glaucoma on fundus examination: A systematic review and meta-analysis

Mathieu Buisson MD, Valentin Navel MD , Antoine Labbé MD, PhD, Stephanie L. Watson MD, PhD, Julien S. Baker MD, PhD, Patrick Murtagh MD, PhD, Frédéric Chiambaretta MD, PhD, Frédéric Dutheil MD, PhD ... [See fewer authors](#) 

First published: 10 September 2021 | <https://doi.org/10.1111/ceo.14000>

Results

We included six studies in our meta-analysis. There was no difference in AUC between ophthalmologists (AUC = 82.0, 95% confidence intervals [CI] 65.4–98.6) and deep learning (97.0, 89.4–104.5). There was also no difference using several pessimistic and optimistic variants of our meta-analysis: the best (82.2, 60.0–104.3) or worst (77.7, 53.1–102.3) ophthalmologists versus the best (97.1, 89.5–104.7) or worst (97.1, 88.5–105.6) deep learning of each study. We did not retrieve any factors influencing those results.

Conclusion

Deep learning had similar performance compared to ophthalmologists in glaucoma diagnosis from fundus examinations. Further studies should evaluate deep learning in clinical situations.

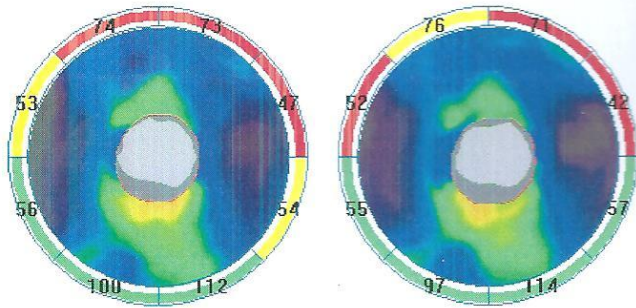
Les OCT actuels comparent mais n'apprennent pas



Glaucoma versus red disease: imaging and glaucoma diagnosis

Gabriel T. Chong and Richard K. Lee

HEALTH ANALYSIS



FollowUp2: 04/16/2013, SSI=62.7

FollowUp3: 11/12/2013, SSI=68.0

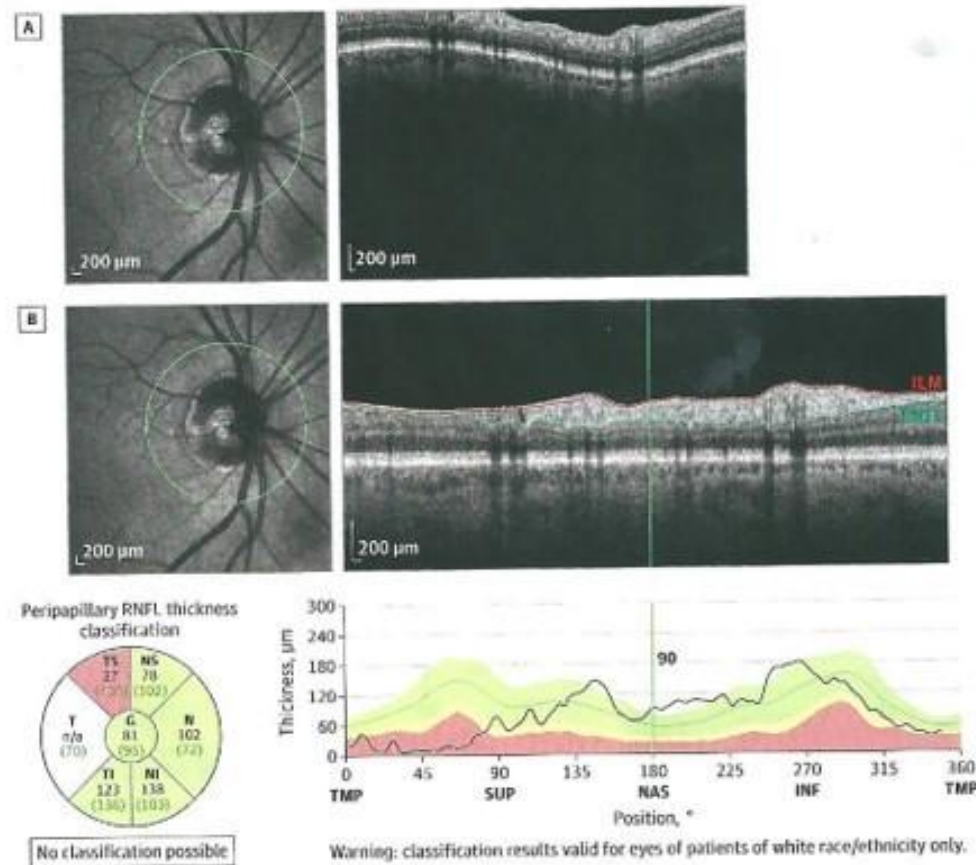
Bases de comparaisons

- OCT Optovue
480 dont Caucasiens , Afro C, Hispanic Indiens
refraction: sphère +/-8 d cyl +/-2d
- Zeiss Cirrus
284 dont Caucasiens , Africains, Chinois, Hispanic
refraction : -12 à +8d
- Spectralis
201 Caucasiens...nouvelle base prévue
refraction -7 à +5d
- Canon
482 patients 4 groupes ethniques 18 à 85 ans
refraction

Failles = dysversion, drusen, myope fort

Pertes en fibres ?

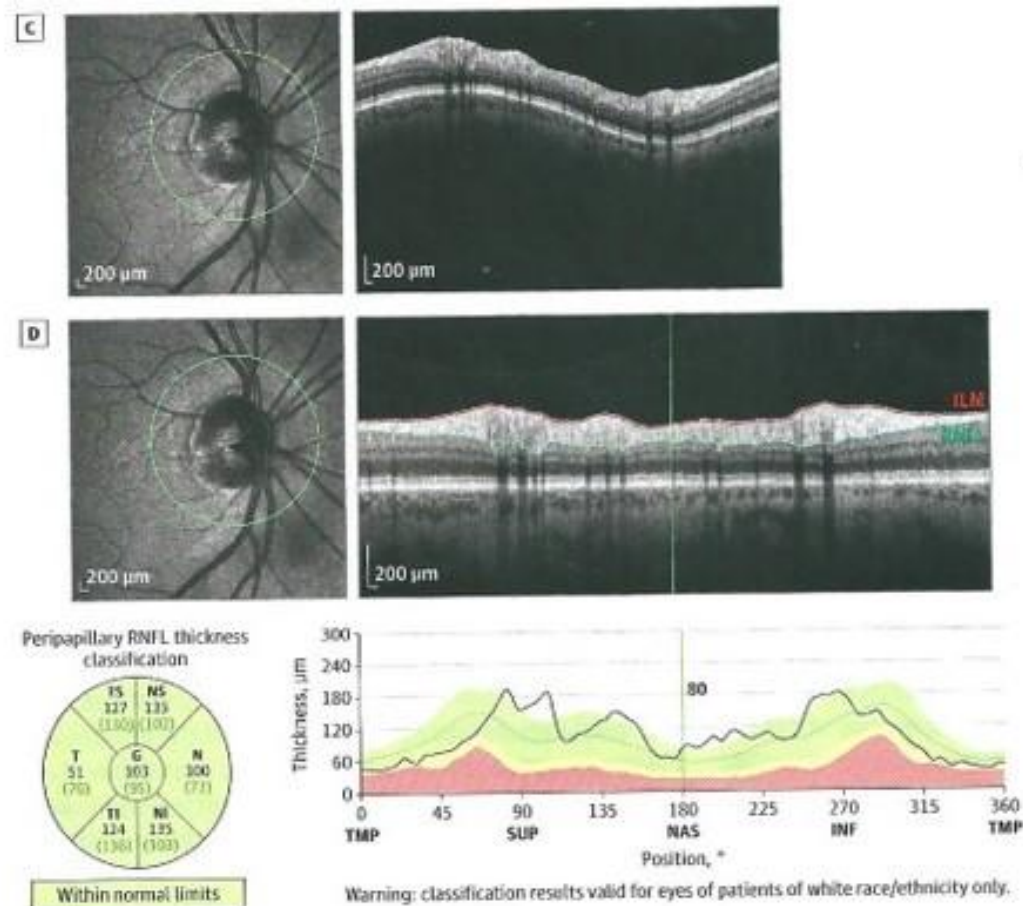
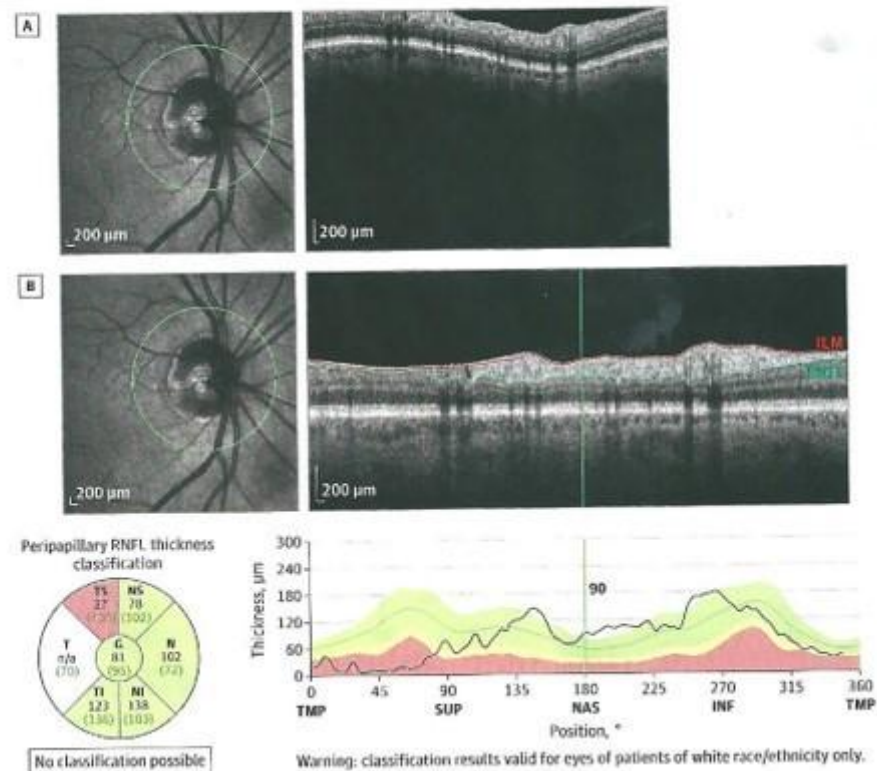
Figure 3. Operator-Dependent Artifacts Included Truncation of the Acquired Spectral-Domain Optical Coherence Tomography (SD-OCT) Image (ie, All Edges of the Image Were Not Within the Acquisition Window)



Transmission par web de la perte en fibres

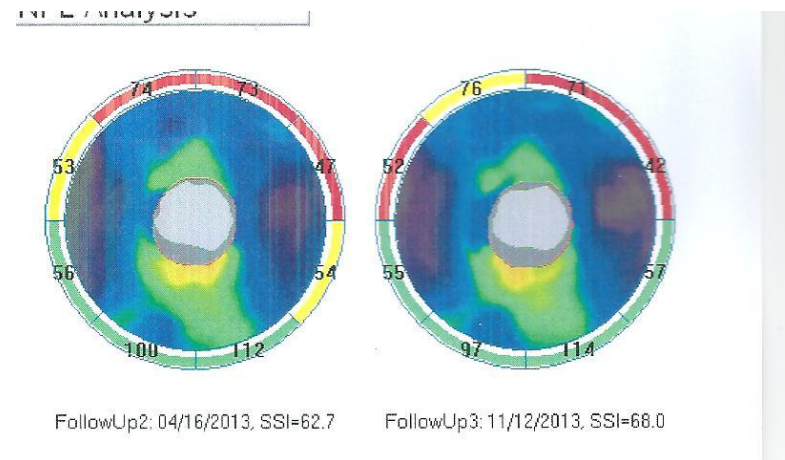
Image en dehors de la fenêtre d'acquisition

Figure 3. Operator-Dependent Artifacts Included Truncation of the Acquired Spectral-Domain Optical Coherence Tomography (SD-OCT) Image (ie, All Edges of the Image Were Not Within the Acquisition Window)



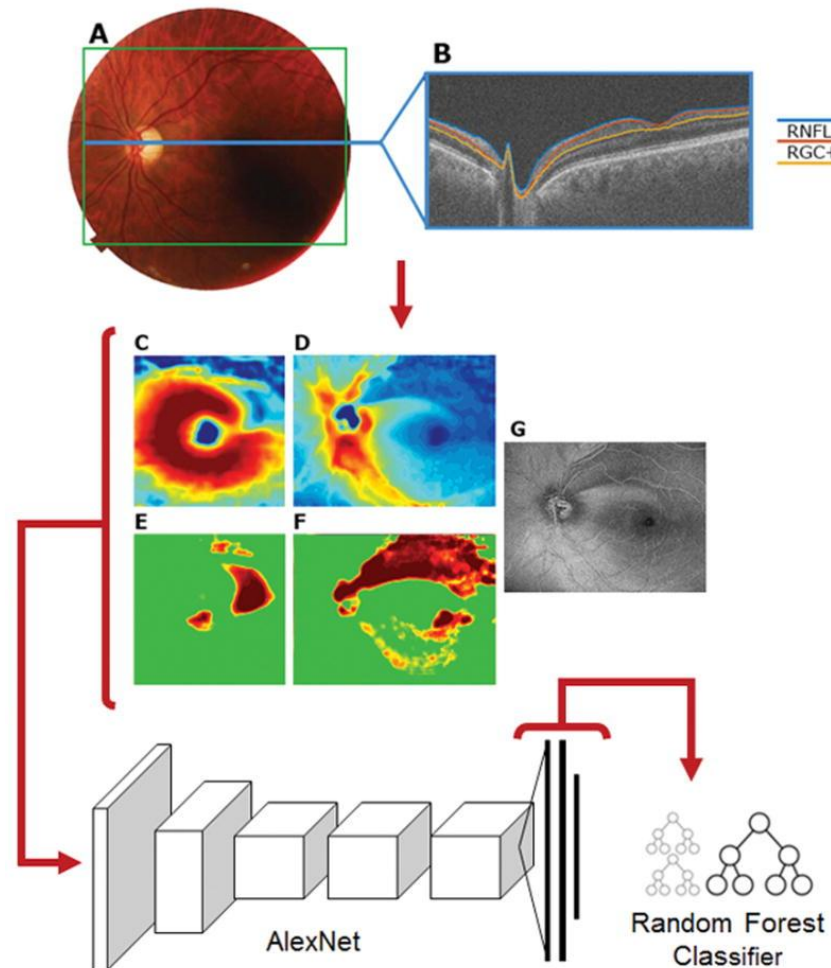
OCT et IA

- Re analyser les images ...
- Re Analyser les données en big data: les cartes d'épaisseur, les cartes de probabilités, OCT maculaire etc ...



Hybrid Deep Learning on Single Wide-field Optical Coherence tomography Scans Accurately Classifies Glaucoma Suspects

Hassan Muhammad ^{1 2}, Thomas J Fuchs ^{1 2 3 4}, Nicole De Cuir ^{5 6}, Carlos G De Moraes ⁷,
Dana M Blumberg ⁷, Jeffrey M Liebmann ⁷, Robert Ritch ⁸, Donald C Hood ^{5 7}



Methods: In total, 102 eyes from 102 patients, with or suspected open-angle glaucoma, had previously been classified by 2 glaucoma experts as either glaucomatous (57 eyes) or healthy/suspects (45 eyes). The HDLM had access only to information from a single, wide-field (9×12 mm) swept-source OCT scan per patient. Convolutional neural networks were used to extract rich features from maps derived from these scans. Random forest classifier was used to train a model based on these features to predict the existence of glaucomatous damage. The algorithm was compared against traditional OCT and VF metrics.

Results: The accuracy of the HDLM ranged from 63.7% to 93.1% depending upon the input map. The retinal nerve fiber layer probability map had the best accuracy (93.1%), with 4 false positives, and 3 false negatives. In comparison, the accuracy of the OCT and 24-2 and 10-2 VF metrics ranged from 66.7% to 87.3%. The OCT quadrants analysis had the best accuracy (87.3%) of the metrics, with 4 false positives and 9 false negatives.

Conclusions: The HDLM protocol outperforms standard OCT and VF clinical metrics in distinguishing healthy suspect eyes from eyes with early glaucoma. It should be possible to further improve this algorithm and with improvement it might be useful for screening.

Analyse d'image

Detection of glaucomatous optic neuropathy with spectral-domain optical coherence tomography: a retrospective training and validation deep-learning analysis

An Ran Ran, Carol Y Cheung*, Xi Wang, Hao Chen, Lu-yang Luo, Poemen P Chan, Mandy O M Wong, Robert T Chang, Suria S Mannil, Alvin L Young, Hon-wah Yung, Chi Pui Pang, Pheng-Ann Heng, Clement C Tham*

Summary

Background Spectral-domain optical coherence tomography (SDOCT) can be used to detect glaucomatous optic neuropathy, but human expertise in interpretation of SDOCT is limited. We aimed to develop and validate a three-dimensional (3D) deep-learning system using SDOCT volumes to detect glaucomatous optic neuropathy.

Methods We retrospectively collected a dataset including 4877 SDOCT volumes of optic disc cube for training (60%), testing (20%), and primary validation (20%) from electronic medical and research records at the Chinese University of Hong Kong Eye Centre (Hong Kong, China) and the Hong Kong Eye Hospital (Hong Kong, China). Residual network was used to build the 3D deep-learning system. Three independent datasets (two from Hong Kong and one from Stanford, CA, USA), including 546, 267, and 1231 SDOCT volumes, respectively, were used for external validation of the deep-learning system. Volumes were labelled as having or not having glaucomatous optic neuropathy according to the criteria of retinal nerve fibre layer thinning on reliable SDOCT images with position-correlated visual field defect. Heatmaps were generated for qualitative assessments.

Findings 6921 SDOCT volumes from 1384200 two-dimensional cross-sectional scans were studied. The 3D deep-learning system had an area under the receiver operation characteristics curve (AUROC) of 0.969 (95% CI 0.960–0.976), sensitivity of 89% (95% CI 83–93), specificity of 96% (92–99), and accuracy of 91% (89–93) in the primary validation, outperforming a two-dimensional deep-learning system that was trained on en face fundus images (AUROC 0.921 [0.905–0.937]; $p < 0.0001$). The 3D deep-learning system performed similarly in the external validation datasets, with AUROCs of 0.893–0.897, sensitivities of 78–90%, specificities of 79–86%, and accuracies of 80–86%. The heatmaps of glaucomatous optic neuropathy showed that the learned features by the 3D deep-learning system used for detection of glaucomatous optic neuropathy were similar to those used by clinicians.

Interpretation The proposed 3D deep-learning system performed well in detection of glaucomatous optic neuropathy in both primary and external validations. Further prospective studies are needed to estimate the incremental cost-effectiveness of incorporation of an artificial intelligence-based model for glaucoma screening.

Using Deep Learning and Transfer Learning to Accurately Diagnose Early-Onset Glaucoma From Macular Optical Coherence Tomography Images

Ryo Asaoka¹, Hiroshi Murata², Kazunori Hirasawa³, Yuri Fujino², Masato Matsuura⁴, Atsuya Miki⁵, Takashi Kanamoto⁶, Yoko Ikeda⁷, Kazuhiko Mori⁸, Aiko Iwase⁸, Nobuyuki Shoji⁹, Kenji Inoue¹⁰, Junkichi Yamagami¹¹, Makoto Araie¹²

Methods: This multi-institution study included pretraining data of 4316 OCT images (RS3000) from 1371 eyes with open angle glaucoma (OAG) regardless of the stage of glaucoma and 193 normal eyes. Training data included OCT-1000/2000 images from 94 eyes of 94 patients with early OAG (mean deviation > -5.0 dB) and 84 eyes of 84 normal subjects. Testing data included OCT-1000/2000 from 114 eyes of 114 patients with early OAG (mean deviation > -5.0 dB) and 82 eyes of 82 normal subjects. A DL (convolutional neural network) classifier was trained using a pretraining dataset, followed by a second round of training using an independent training dataset. The DL model input features were the 8 × 8 grid macular retinal nerve fiber layer thickness and ganglion cell complex layer thickness from spectral-domain OCT. Diagnostic accuracy was investigated in the testing dataset. For comparison, diagnostic accuracy was also evaluated using the random forests and support vector machine models. The primary outcome measure was the area under the receiver operating characteristic curve (AROC).

Results: The AROC with the DL model was 93.7%. The AROC significantly decreased to between 76.6% and 78.8% without the pretraining process. Significantly smaller AROCs were obtained with random forests and support vector machine models (82.0% and 67.4%, respectively).

Conclusion: A DL model for glaucoma using spectral-domain OCT offers a substantive increase in diagnostic performance.

OCT pour diagnostic différentiel

► Br J Ophthalmol. 2020 Dec;104(12):1717-1723. doi: 10.1136/bjophthalmol-2019-314330.
Epub 2020 Feb 25.

Discriminating glaucomatous and compressive optic neuropathy on spectral-domain optical coherence tomography with deep learning classifier

Jinho Lee ^{1 2}, Jin-Soo Kim ³, Haeng Jin Lee ^{1 4}, Seong-Joon Kim ^{1 4}, Young Kook Kim ^{1 2},
Ki Ho Park ^{1 2}, Jin Wook Jeoung ^{5 2}

Abstract

Background/aims: To assess the performance of a deep learning classifier for differentiation of glaucomatous optic neuropathy (GON) from compressive optic neuropathy (CON) based on ganglion cell-inner plexiform layer (GCIPL) and retinal nerve fibre layer (RNFL) spectral-domain optical coherence tomography (SD-OCT).

Methods: Eighty SD-OCT image sets from 80 eyes of 80 patients with GON along with 81 SD-OCT image sets from 54 eyes of 54 patients with CON were compiled for the study. The bottleneck features extracted from the GCIPL thickness map, GCIPL deviation map, RNFL thickness map and RNFL deviation map were used as predictors for the deep learning classifier. The area under the receiver operating characteristic curve (AUC) was calculated to validate the diagnostic performance. The AUC with the deep learning classifier was compared with those for conventional diagnostic parameters including temporal raphe sign, SD-OCT thickness profile and standard automated perimetry.

Results: The deep learning system achieved an AUC of 0.990 (95% CI 0.982 to 0.999) with a sensitivity of 97.9% and a specificity of 92.6% in a fivefold cross-validation testing, which was significantly larger than the AUCs with the other parameters: 0.804 (95% CI 0.737 to 0.872) with temporal raphe sign, 0.815 (95% CI 0.734 to 0.896) with superonasal GCIPL and 0.776 (95% CI 0.691 to 0.860) with superior GCIPL thicknesses (all $p < 0.001$).

Conclusion: The deep learning classifier can outperform the conventional diagnostic parameters for discrimination of GON and CON on SD-OCT.

IA et Champ visuel

- IA et interprétation des CV
algorithme d'apprentissage sur carte de PSD
capable de différencier des glaucomes débutants

[Ophthalmology](#). 2016 Sep;123(9):1974-80. doi: 10.1016/j.ophtha.2016.05.029. Epub 2016 Jul 7.

**Detecting Preperimetric Glaucoma with Standard
Automated Perimetry Using a Deep Learning
Classifier**

Ryo Asaoka ¹, Hiroshi Murata ², Aiko Iwase ³, Makoto Araie ⁴

- IA et progression : logiciels connus: GPA, VFI

Progression CV

Development and Comparison of Machine Learning Algorithms to Determine Visual Field Progression

Osamah Saeedi¹, Michael V Boland², Loris D'Acunto³, Ramya Swamy¹, Vikram Hegde³,
Surabhi Gupta³, Amin Venjara⁴, Joby Tsai¹, Jonathan S Myers⁵, Sarah R Wellik⁶,
Gustavo DeMoraes⁷, Louis R Pasquale^{8 9}, Lucy Q Shen², Yangjiani Li¹⁰, Tobias Elze¹⁰

Abstract

Purpose: To develop and test machine learning classifiers (MLCs) for determining visual field progression.

Methods: In total, 90,713 visual fields from 13,156 eyes were included. Six different progression algorithms (linear regression of mean deviation, linear regression of the visual field index, Advanced Glaucoma Intervention Study algorithm, Collaborative Initial Glaucoma Treatment Study algorithm, pointwise linear regression [PLR], and permutation of PLR) were applied to classify each eye as progressing or stable. Six MLCs were applied (logistic regression, random forest, extreme gradient boosting, support vector classifier, convolutional neural network, fully connected neural network) using a training and testing set. For MLC input, visual fields for a given eye were divided into the first and second half and each location averaged over time within each half. Each algorithm was tested for accuracy, sensitivity, positive predictive value, and class bias with a subset of visual fields labeled by a panel of three experts from 161 eyes.

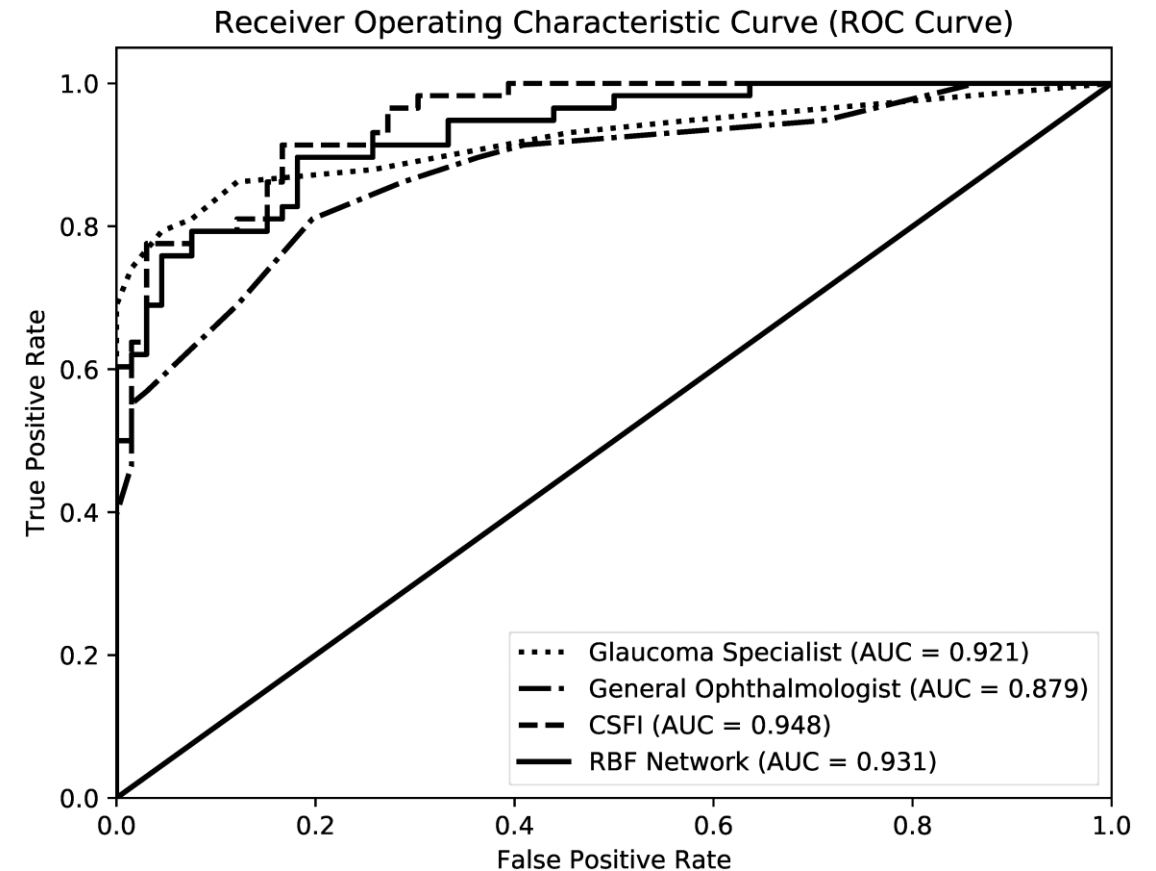
Results: MLCs had similar performance metrics as some of the conventional algorithms and ranged from 87% to 91% accurate with sensitivity ranging from 0.83 to 0.88 and specificity from 0.92 to 0.96. All conventional algorithms showed significant class bias, meaning each individual algorithm was more likely to grade uncertain cases as either progressing or stable ($P \leq 0.01$). Conversely, all MLCs were balanced, meaning they were equally likely to grade uncertain cases as either progressing or stable ($P \geq 0.08$).

Conclusions: MLCs showed a moderate to high level of accuracy, sensitivity, and specificity and were more balanced than conventional algorithms.

Combinaison CV et OCT

- 58 patients
- Algorithm and machine learning

Source: Automated algorithms combining structure and function outperform general ophthalmologists in diagnosing glaucoma
Shigueoka L et al 2018



algorithms tested : Bagging (BAG), Naive-Bayes (NB), Multilayer Perceptron (MLP), Radial Basis Function Network (RBF), Random Forest (RAN), Ensemble

Selection (ENS), Classification Tree J48 (CTREE),

Diagnostic

Suivi

Glaucome : 24h/24 - 365 j

Examen à un jour J



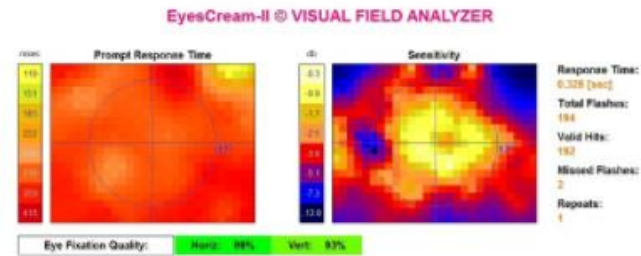
CV sur PC ?

Free Visual Field Test of your Eyes for PC

EyesCream Software provided by EyesAge.org



Free Visual Field Analyzer EyesCream – Eye Test Program as Computer Game



Scan of left eye (visual map) measured by EyesCream-II in just 5 min. The blind spot of the channel for the nerves was already resolved at ca. 17 degree left handside as well as a small makular defect close to the visual center part.

**YOU BELIEVE YOUR EYES ARE PERFECT?
TEST YOUR EYES. NOW!**



[Download EyesCream-II 2.3.2](#)

(with older Internet Explorer IE8 you may need to download twice or 3 times)

Google Custom S Search x

powered by Google

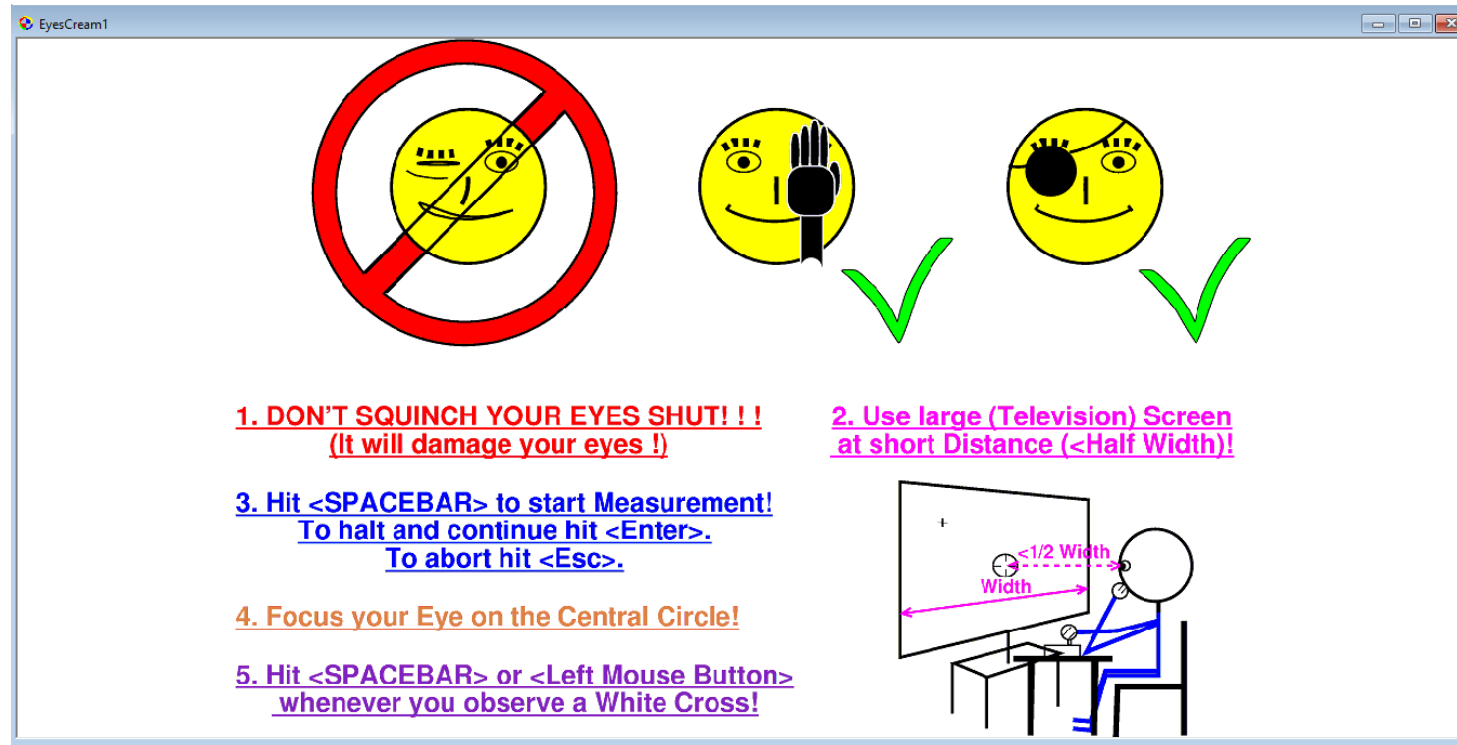
Language



Meta

- Register
- Log in

CV sur PC = ,,,,



The screenshot shows the EyesCream1 software window. At the top, there are three yellow smiley faces. The first face has its eyes squinted and is crossed out with a red circle and a diagonal line. The second face has one eye covered by a hand icon, with a green checkmark next to it. The third face has one eye closed, also with a green checkmark next to it. Below these faces are five numbered instructions in different colors and styles. To the right of the instructions is a diagram of a person sitting at a desk, looking at a large screen. A white cross is on the screen, and two horizontal arrows indicate distances: 'Width' from the screen edge to the cross, and '<1/2 Width' from the cross to the person's eye.

1. DON'T SQUINCH YOUR EYES SHUT! !!
(It will damage your eyes !)

2. Use large (Television) Screen
at short Distance (<Half Width)!

3. Hit <SPACEBAR> to start Measurement!
To halt and continue hit <Enter>.
To abort hit <Esc>.

4. Focus your Eye on the Central Circle!

5. Hit <SPACEBAR> or <Left Mouse Button>
whenever you observe a White Cross!

Fiabilité – reproductibilité –contrôle de la fixation = ?

Analyse multiple= détection glaucome

- Données démographiques : âge
- OCT
- FO - PIO

➤ [Am J Ophthalmol.](#) 2021 Nov;231:154-169. doi: 10.1016/j.ajo.2021.04.021. Epub 2021 May 2.

Automated Detection of Glaucoma With Interpretable Machine Learning Using Clinical Data and Multimodal Retinal Images

Parmita Mehta ¹, Christine A Petersen ², Joanne C Wen ², Michael R Banitt ², Philip P Chen ²,
Karine D Bojikian ², Catherine Egan ³, Su-In Lee ¹, Magdalena Balazinska ⁴, Aaron Y Lee ²,
Ariel Rokem ⁵, UK Biobank Eye and Vision Consortium

Paramètres multiples: progression du glaucome

- Algorithmes intégrant CV, c/d, PIO, pachymétrie

➤ [Ophthalmology](#). 2021 Jul;128(7):1016-1026. doi: 10.1016/j.ophtha.2020.12.020. Epub 2020 Dec 25.

Assessing Glaucoma Progression Using Machine Learning Trained on Longitudinal Visual Field and Clinical Data

Avyuk Dixit¹, Jithin Yohannan², Michael V Boland³

Abstract

Purpose: Rule-based approaches to determining glaucoma progression from visual fields (VFs) alone are discordant and have tradeoffs. To detect better when glaucoma progression is occurring, we used a longitudinal data set of merged VF and clinical data to assess the performance of a convolutional long short-term memory (LSTM) neural network.

Design: Retrospective analysis of longitudinal clinical and VF data.

Participants: From 2 initial datasets of 672 123 VF results from 213 254 eyes and 350 437 samples of clinical data, persons at the intersection of both datasets with 4 or more VF results and corresponding baseline clinical data (cup-to-disc ratio, central corneal thickness, and intraocular pressure) were included. After exclusion criteria—specifically the removal of VFs with high false-positive and false-negative rates and entries with missing data—were applied to ensure reliable data, 11 242 eyes remained.

Methods: Three commonly used glaucoma progression algorithms (VF index slope, mean deviation slope, and pointwise linear regression) were used to define eyes as stable or progressing. Two machine learning models, one exclusively trained on VF data and another trained on both VF and clinical data, were tested.

Main outcome measures: Area under the receiver operating characteristic curve (AUC) and area under the precision-recall curve (AUPRC) calculated on a held-out test set and mean accuracies from threefold cross-validation were used to compare the performance of the machine learning models.

Results: The convolutional LSTM network demonstrated 91% to 93% accuracy with respect to the different conventional glaucoma progression algorithms given 4 consecutive VF results for each participant. The model that was trained on both VF and clinical data (AUC, 0.89-0.93) showed better diagnostic ability than a model exclusively trained on VF results (AUC, 0.79-0.82; $P < 0.001$).

Conclusions: A convolutional LSTM architecture can capture local and global trends in VFs over time. It is well suited to assessing glaucoma progression because of its ability to extract spatiotemporal features that other algorithms cannot. Supplementing VF results with clinical data improves the model's ability to assess glaucoma progression and better reflects the way clinicians manage data when managing glaucoma.

Et pourquoi pas sur son smart phone !

➤ [Br J Ophthalmol](#). 2022 Apr;106(4):587-592. doi: 10.1136/bjophthalmol-2020-318107.
Epub 2021 Jul 14.

Deep learning-assisted (automatic) diagnosis of glaucoma using a smartphone

Kenichi Nakahara¹, Ryo Asaoka^{2 3 4 5 6}, Masaki Tanito⁷, Naoto Shibata¹, Keita Mitsuhashi¹,
Yuri Fujino^{8 6 7}, Masato Matsuura⁶, Tatsuya Inoue^{6 9}, Keiko Azuma⁶, Ryo Obata⁶,
Hiroshi Murata⁶

Pour l'instant que les glaucomes évolués !

Conclusion: The usefulness of a deep learning algorithm to automatically screen for glaucoma from smartphone-based fundus photographs was validated. The algorithm had a considerable high diagnostic ability, particularly in eyes with advanced glaucoma.

Bases de données accessibles à tous ?

- REFUGE: REtinal Fundus Glaucoma Challenge

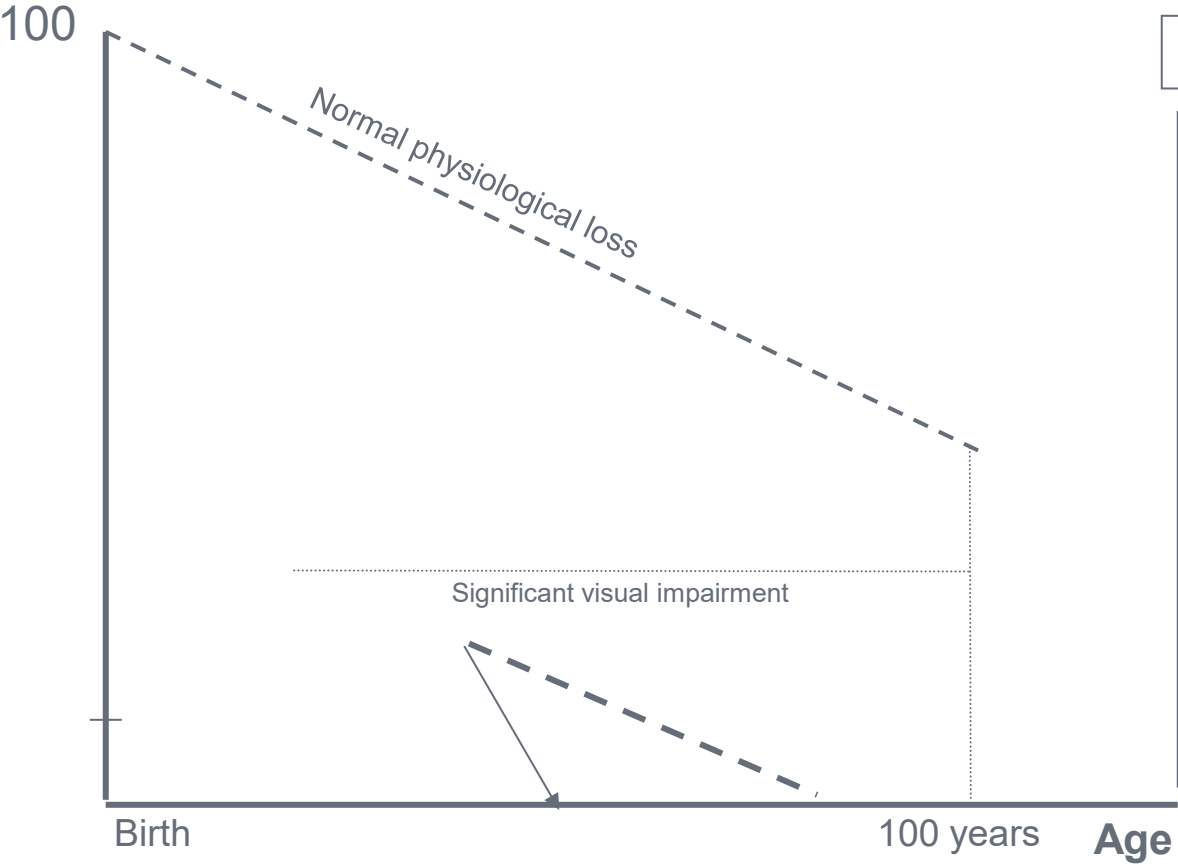


> [Med Image Anal.](#) 2020 Jan;59:101570. doi: 10.1016/j.media.2019.101570. Epub 2019 Oct 8.

REFUGE Challenge: A unified framework for evaluating automated methods for glaucoma assessment from fundus photographs

José Ignacio Orlando¹, Huazhu Fu², João Barbosa Breda³, Karel van Keer⁴, Deepti R Bathula⁵, Andrés Diaz-Pinto⁶, Ruogu Fang⁷, Pheng-Ann Heng⁸, Jeyoung Kim⁹, JoonHo Lee¹⁰, Joonseok Lee¹⁰, Xiaoxiao Li¹¹, Peng Liu⁷, Shuai Lu¹², Balamurali Murugesan¹³, Valery Naranjo⁶, Sai Samarth R Phay⁵, Sharath M Shankaranarayana¹⁴, Apoorva Sikka⁵, Jaemin Son¹⁵, Anton van den Hengel¹⁶, Shujun Wang⁸, Junyan Wu¹⁷, Zifeng Wu¹⁶, Guanghui Xu¹⁸, Yongli Xu¹², Pengshuai Yin¹⁸, Fei Li¹⁹, Xiulan Zhang²⁰, Yanwu Xu²¹, Hrvoje Bogunović¹

Les données à analyser sont multiples



Diagnostic
FACTEURS
1. ATCD familiaux
2. Pathologies
3. Espérance de vie
4. Valeurs de PIO
5. Pachymétrie
6. Gonioscopie
7. Pigment dispersion/PEX
8. Atteinte du NO
9. Atteinte du CV
10. Progression

willrobotstakemyjob.com

WILL ROBOTS TAKE MY JOB?

[Jobs](#) [About](#) [Rankings](#) [Contact](#)



MongoDB Atlas

MongoDB Atlas is the most reliable cloud database service available. Try now!

ADS VIA CARBON

Enter your job

or show [random example](#)



Mailchimp

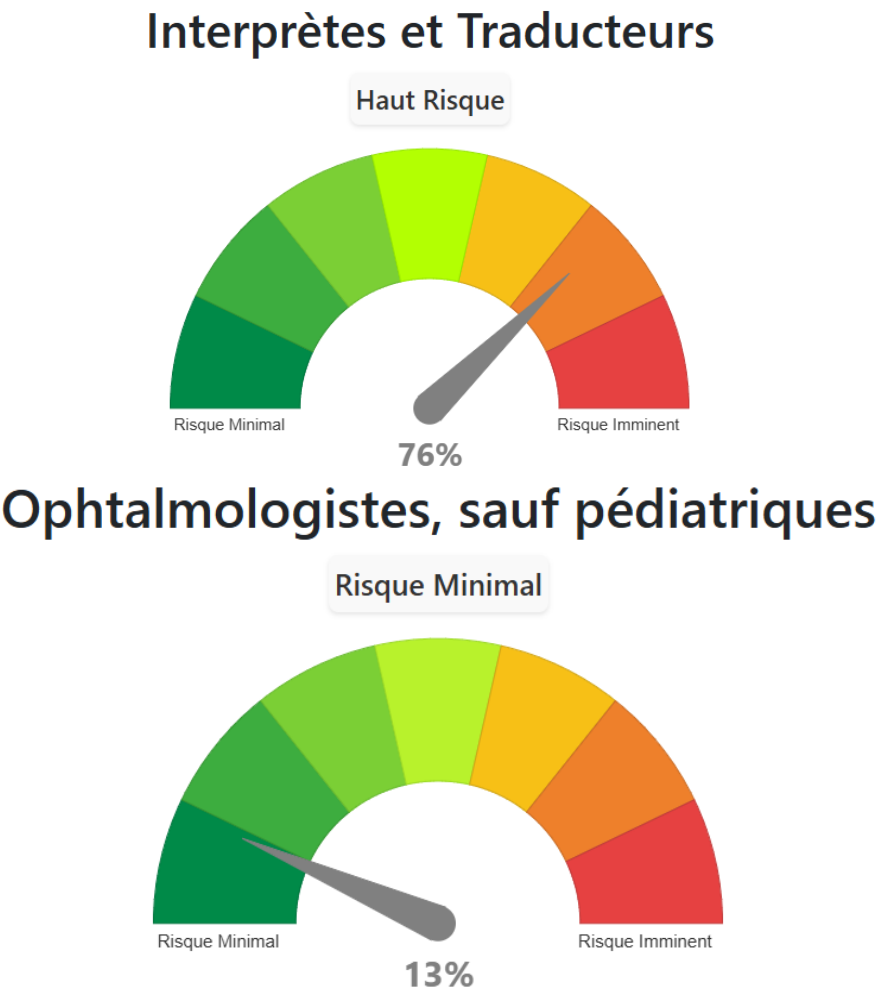
More customers, more complexity. Now what? Market smarter with our pre-built and custom segments. That's what.



Hotjar

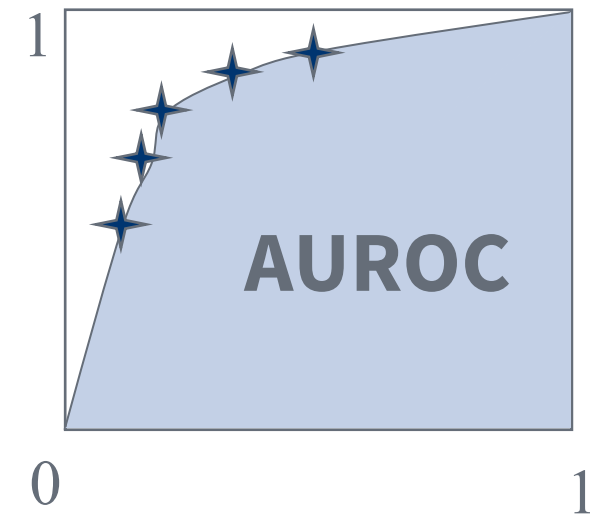
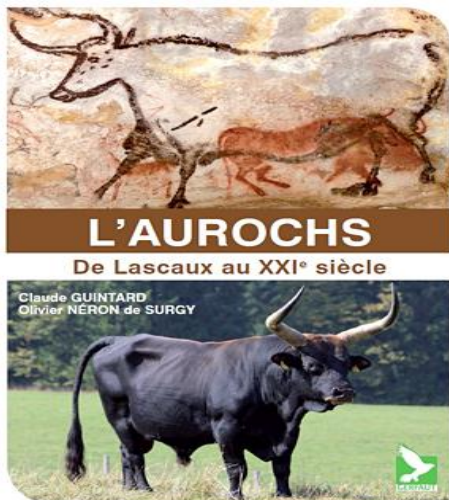
See how your visitors are really using your website.

ad



IA: les limites

- Comment l'IA interprète = le fonctionnement des modèles de DL a-t-il une pertinence clinique et physiopathologique
- Remplacer une erreur humaine par une erreur de machine ou d'étiquetage
- Aspects juridiques, médico légaux
- AUROC: le veau d'or de l'IA ?



Conclusion

- IA = Incontournable Amélioration
- Réorganisation du temps médical
- Contact reste indispensable avec le patient = analyser le contexte - expliquer - rassurer- relativiser

L'IA ne remplacera pas les ophtalmologistes mais les ophtalmologistes qui utilisent l'IA remplaceront peut être ceux qui ne l'utilisent pas .

N'oublier personne : nous soignons des patients

COMMENT ÇA !
Y'A UN MALADE
DERRIÈRE L'OEIL
ET ON NE M'AVAIT
RIEN DIT!!!



GABS.