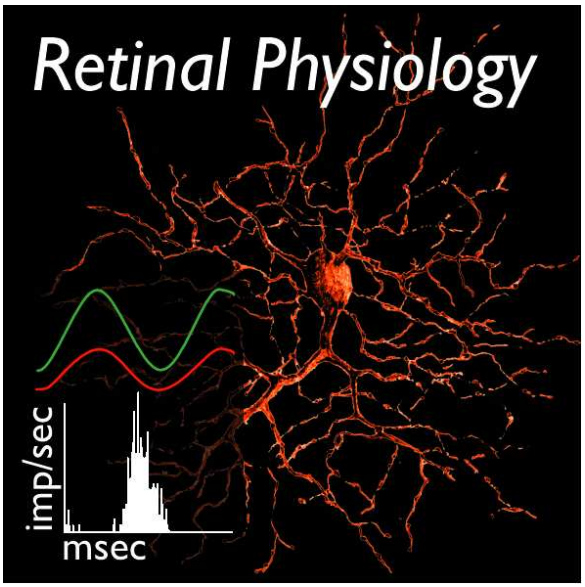
Annual Report 2009 Laboratory for Retinal Physiology

Dept of Ophthalmology, University Hospital Erlangen

Dept. of Animal Physiology, University of Erlangen-Nuremberg



Introduction

The year 2009 has been a year of further restructuring and adjustments to new situations. The Collaborative Research Grant (Sonderforschungsbereich) 539 'Glaucoma including Pseudoexfoliation Syndrome' of the German Research Council (Deutsche Forschungsgemeinschaft, DFG) has expired this year. As a result, new research strategies and funding opportunities have to be explored. Although the Retinal Physiology lab was not involved, the group has been continuously applying for financial support. And this will continue in the next years, which is not an easy job because often only a fraction of application to the DFG is normally financed. As a result, the applications that are submitted have to be of an outstanding quality to be successful. Furthermore, multiple funding opportunities have to be sought also because the extra funds the university receives from the government for successful grants and publiccations are only indirectly available. The Retinal Physiology lab was involved in grants to the DFG, the Elan-Fonds, the German Ministry of Education and Research (Bundesministerium für Bildung und Forschung, BMBF), CAPES (Brazil) and at the European Council. Further applications (to submitted at the DFG, the Fritz Thyssen Foundation, the BBRC (UK) and the Elan-Fonds) are in a more or less advanced state. Partnerships with other departments (in Erlangen, Germany and abroad) and with industry are ongoing and will be continued.

In parallel, it is the task to achieve excellent scientific data, and to publish them in peer reviewed journals. Again the constraints are not always easy. It is getting more and more important that the journal, in which the results are published, have a high impact factor. Although there are lots of discussions concerning the usefulness of the impact factor and although it has often been doubted that it is an objective measure for scientific quality, it has a power in scientific evaluation that can only be compared to the 'Guide Michelin' in gastronomy. The situation is particularly difficult because there are many clefts also between scientists: basic scientists vs. clinical scientists and ophthalmologists; Europe vs. Northern America; different European countries; system's biologists vs. molecular biologists decision makers vs. workers. Furthermore, teaching and administrative obligations need continuous care, energy and time. Within these constraints and because of the high pressures upon individuals it is not always easy to get an appropriate recognition for the scientific originality and quality of the work. I am therefore very glad that the Retinal Physiology lab (properly containing a varying number of members between three and six scientists, including foreign guests) published or is the process of preparing 25 manuscripts in peer reviewed journals.

In conclusion, we have been quite successful in 2009 with achievements of which we can be proud and which were only possible because of the personal commitment of each individual member of the lab **:** Jenny Atorf, Mirella Barboni, Anja Erhardt, Folkert Horn, Astrid Kraus, Barbara Link, Gobinda Pangeni, Markus Raster, Sven Schwichtenberg, Claudio Teixeira. Furthermore many thanks to the external collaborators: Johan Helmut Brandstätter, Manoel da Silva Filho, Anselm Jünemann, Declan McKeefry, Ian Murray, Neil Parry, Michael Scholz, Luiz Carlos Silveira, Ralf Tornow, Dora Fix Ventura. Finally I would to thank Prof. Kruse for general support. It was a fantastic year to work with all you all! I am looking forward to another successful year 2010.

Jan Kremers, Erlangen, December 2009

Project title: Chromatic and luminance signals in the electroretinogram

Goals:

To identify signatures of the parvocellularly based red-green chromatic signal and the magnocellularly based luminance signal in the electroretinogram (ERG). The ERG is a signal that can be used to study the functional integrity of the retina. On the other had the significance of the ERG was relatively limited because the signals of pathways that are transmitted to the brain for visual perception could not be identified in the ERG. In this project, we studied red-green chromatic and luminance signals in the flicker ERG.

Results and Conclusions:

The outputs of red and green light emitting diodes (LEDs) were modulated sinusoidally in counterphase. The proportion of red modulation was varied between 0 (no red only green modulation) and 1 (no green only red modulation). The luminance modulation changed linearly with the proportion of red modulation, was minimal at a characteristic position at which the phase of the luminance modulation changed by 180°. The amplitude and phase of the chromatic modulation was constant for all conditions. It was found that at temporal frequencies of 30 Hz and higher the amplitudes of the first harmonic amplitudes varied in a very similar manner as the luminance, going through a minimum at which the response phase changed by 180°. At 12 Hz the ERG amplitudes and phases were constant similar as the chromatic signal in the stimulus. Repetition of the measurements in a red-green colour blind subject showed that at all temporal frequencies, the ERG was luminance sensitive at all temporal frequencies. This can be attributed to the absence of a red-green chromatic pathway in this subject.

From this we conclude that, for the first time, it is possible to record ERG signals that reflect chromatic and luminance signals. This will strongly increase the significance of the ERG because besides being a signal that has a clinical value it can now also be linked to basic and clinical vision science.

Collaborators:

Dr. Barbara Link, Anderson Rodrigues (University of Pará, Belém, Brazil), Prof. Luiz Silveira (University of Pará, Belém, Brazil), Prof Manoel da Silva Filho (University of Pará, Belém, Brazil), Gobinda Pangeni

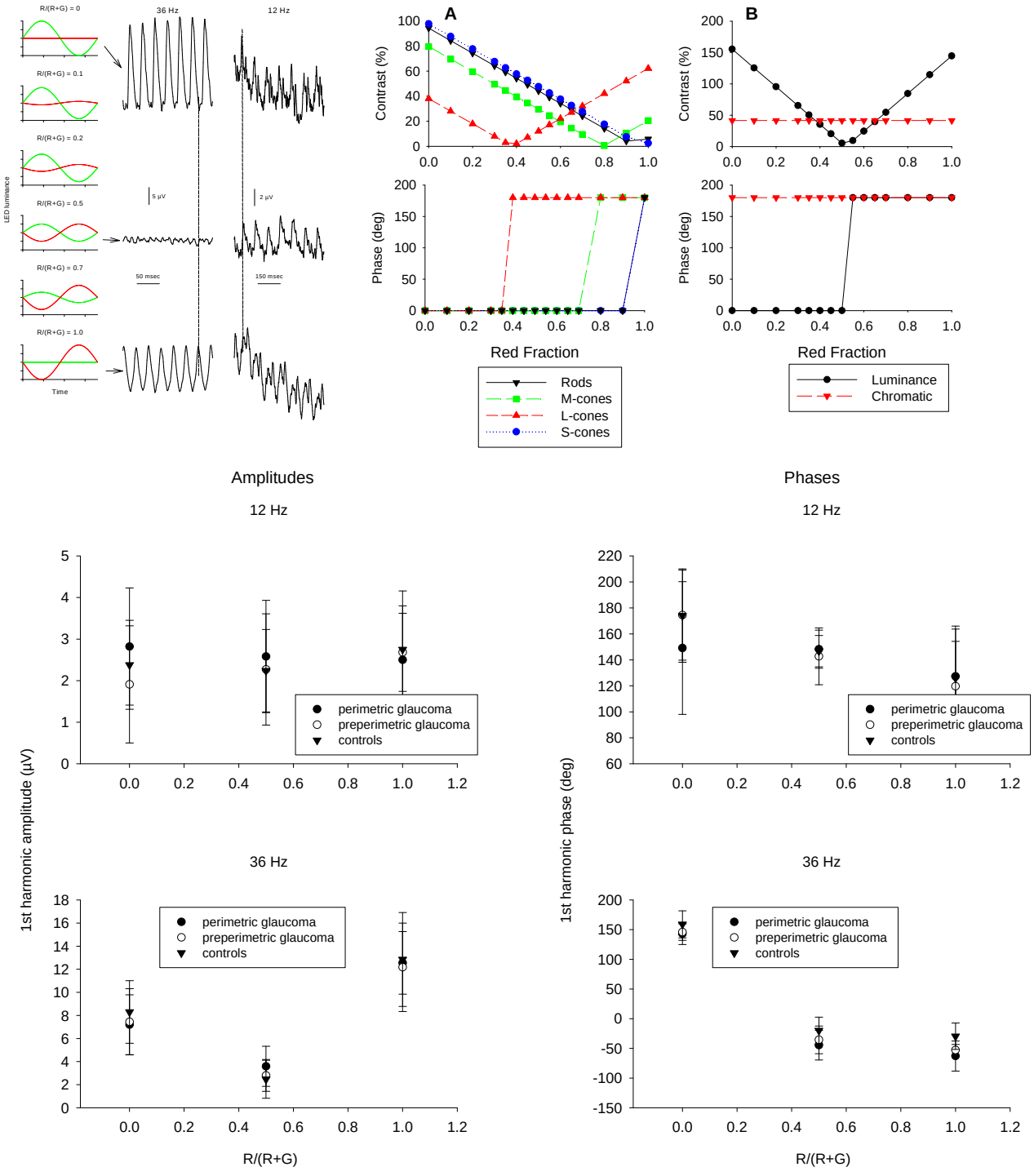
Publications:

J. Kremers, B. Link (2008): Electroretinographic responses that may reflect activity of parvo- and magnocellular post-receptoral visual pathways. J. Vision, 8, 15, 11 doi:10.1167/8.15.11.

J. Kremers, A.R. Rodrigues, L.C.L. Silveira, M. da Silva Filho (2010): Flicker ERGs representing chromaticity and luminance signals. Investigative Ophthalmol Vis Sci., accepted.

Financial support:

DFG Kr 1317/9-1, German Academic Exchange Service (DAAD), CAPES (Brazil)



Project title: Chromatic and luminance signals in the electroretinogram of glaucoma patients

Goals:

In the previous project, we were able to identify ERG signals that reflect chromatic and luminance post-receptoral processing. Glaucoma is a retinal disorder that primarily affects the post-receptoral retinal ganglion cells. In the present project we studied if and how glaucoma changes the ERG signals reflecting chromatic and luminance activity.

Results and Conclusions:

A subset of the stimuli, used in the previous project, was used for measurements in a larger population of normal subjects and glaucoma patients. The outputs of red and green LEDs were modulated in counterphase. The proportion of red modulation was 0 (no red only green modulation) 0.5 (red and green modulation of equal amplitude) and 1 (no green only red modulation). In this project not only the first harmonic (fundamental) components but also the second harmonic components were considered.

The results confirmed the results obtained in the previous project. This was found for normal subjects, perimetric and preperimetric patients. The second harmonic components at 12 Hz showed a behaviour similar as the first harmonic components at 36 Hz, indicating that the second harmonic component may reflect luminance activity at 12 Hz. The amplitudes were similar in the normal subjects and the patients. However, the response phases were different between normals and patients, once more indicating that phase rather than amplitude might be a more sensitive parameter for detecting and monitoring glaucoma disease.

Collaborators:

Dr. Barbara Link, Mirella Barboni (University of São Paulo), Prof. Dora Fix Ventura (University of São Paulo), Gobinda Pangeni

Publications:

B. Link, L. Haeberle, A. Juenemann, J. Kremers: L/M cone ratio in glaucoma patients assessed by electroretinography. In preparation.

M. Barboni, G. Pangeni, D.F. Ventura, J. Kremers: Phase changes in the Luminance and chromaticity reflecting flicker electroretinograms in glaucoma. In preparation.

Financial support:

DFG 1317/9-1, FAPESP (State of São Paulo, Brazil)

Project title: Chromatic and luminance signals in the electroretinogram; Separation in one signal

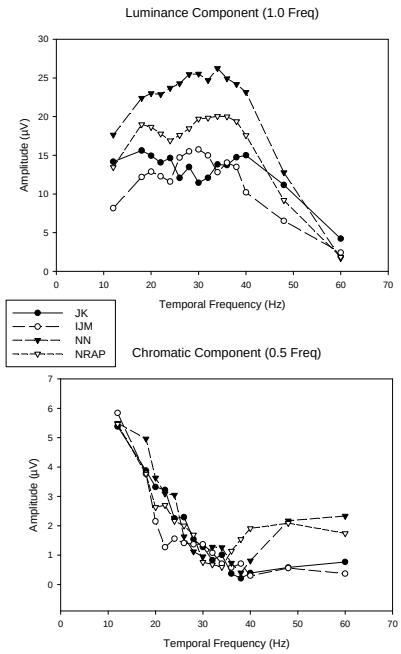
Goals:

To identify signatures of the parvocellularly based red-green chromatic signal and the magnocellularly based luminance signal in the electroretinogram (ERG) using a novel stimulus in which the luminance and chromaticity are simultaneously modulated but with different temporal frequencies.

Results and Conclusions:

The outputs of red and green light emitting diodes (LEDs) were modulated in counterphase, but not sinusoidally, as in the experiments described above. Instead, the red and green LEDs were alternately modulated with raised cosine profiles. The luminance profile of this stimulus was modulated at the stimulus frequency. The chromaticity was modulated at half the stimulus and luminance temporal frequency.

At was found that at high temporal frequencies, the main response was at the stimulus and luminance temporal frequency, indicating that the signals mainly reflect luminance signals. At lower temporal frequencies frequency components at half the stimulus frequency (i.e. chromatic signals) intrude and become bigger as temporal frequency decreases.

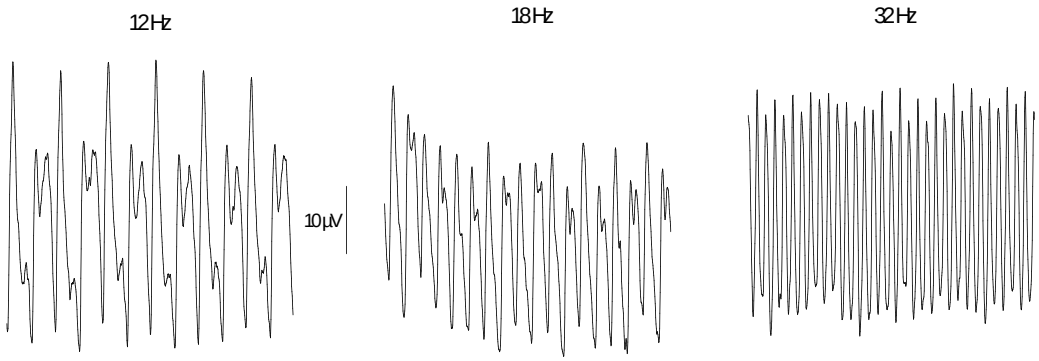


Collaborators:

Dr. Neil Parry (Royal Eye Hospital Manchester), Dr. Ian Murray (University of Manchester), Dr. Declan McKeefry (University of Bradford), Prof Barry Lee (State University New York)

Financial support:

DFG Kr 1317/9-1



Project title: L- and M-cone driven ERG signals at different retinal illuminances

Goals:

It was found that the chromatic adaptation can have influence upon L- and M-cone driven ERGs and upon the measured L-/M-ratio. L-/M-ratios measured with ERGs are related to the numbers of L- and M-cones in the retina, but the influence of adaptation is evidence that the L-/M-ratio in the ERG is not identical to the ratio of L- and M-cone numbers. It is not known what influence luminance adaptation has.

Results and Conclusions:

ERG measurements were performed with a mini-Ganzfeld LED stimulator. The mean retinal illuminance was varied between 500 and 10^4 td. The responses to selective L- and selective M-cone stimulation were measured. In addition, the L- and M-cones were stimulated simultaneously in phase (stimulation means that the excitation in the cones is modulated; in phase stimulation means that they were simultaneously maximally and minimally excited). Cone contrasts (i.e. the stimulus strength for the cones – expressed as modulation of cone excitation normalized to the mean excitation) were equal. The response amplitudes increased with increasing retinal illuminance and the phase increased (i.e. the response delay decreased). The L-/M-ratio did not change strongly. We found indications that the phase difference between L- and M-cone driven responses may be related to the L-/M-ratio. The responses to simultaneous stimulation of L- and M-cones can be accurately explained on the basis of a simple linear interaction between the L- and M-cone driven responses.

Collaborators:

Dr. Neil Parry (Royal Eye Hospital Manchester), Dr. Ian Murray (University of Manchester), Dr. Declan McKeefry (University of Bradford)

Publications:

J. Kremers, Neil R.A. Parry, Ian J. Murray: The influence of mean retinal illuminance on L- and M-cone driven ERGs. In preparation

Financial support:

Project title: The influence of retinal eccentricity on L- and M-cone driven ERG signals

Goals:

It was found before that the numbers of L- and M-cones may vary with retinal eccentricity. This may influence the measured L-/M-ratio also measured in the ERG. More importantly, there is a discussion in the literature whether chromatic sensitivity decreases with increasing eccentricity. Background is that the receptive fields of parvocellular cells, the physiological basis for red-green colour vision, have a centre-surround structure. It has been proposed that the surrounds receive input from both L- and M-cones in the surround, leading to a loss in cone opponency and to a decreased red-green chromatic sensitivity. If the above proposed hypothesis that the flicker ERG measured at 12 Hz indeed reflects activity of the red-green chromatic channel and part of the parvocellular pathway in the retina, then this ERG may be used to test the hypothesis of mixed cone surrounds at large retinal eccentricities.

Results and Conclusions:

L- and M-cone driven responses were measured at 12 Hz (for ERGs reflecting chromatic activity) and at 36 Hz (for ERGs reflecting luminance activity) using a CRT monitor. The responses were measured to circular stimuli with increasing size and to annuli with the same out diameter as the largest circular stimulus but with increasing ablation of the centre. The 12 Hz ERG responses do not change strongly with retinal eccentricity: the L-/M-ratio was always about 1 and the phase difference remained to be about 180°, which are properties of a perfectly opponent chromatic channel.

The responses at 36Hz showed that when centre or surround were selectively stimulated the L-/M-ratio was smaller than when both are simultaneously stimulated. This is probably related to the fact that the response phase changed strongly in the M-cone driven response but not in the L-cone driven response. As a result M-cone driven responses in the centre and in the periphery cancel each other out when stimulated simultaneously leading to a smaller M-cone driven response and to a larger L-/M-ratio.

It seems that the chromatic channel does not change strongly with retinal eccentricity. The luminance channel displays changes that may be related with a change in M-cone driven responses

Collaborators:

Dr. Declan McKeefry (University of Bradford), Naveen Challa (University of Bradford), Dr. Neil Parry (Royal Eye Hospital Manchester), Dr. Ian Murray (University of Manchester).

Project title: The influence of Chloroquine intake on the multifocal ERG

Goals:

Chloroquine is taken prophylactic against malaria but also as a medicine against arthritis. It has been shown that long-term uptake of chloroquine may affect the central retina, which can be detected with multifocal ERG. In most investigations chloroquine was taken for arthritis. The purpose of the present project is to study whether chloroquine uptake against malaria leads to the same retinal disorders.

Results and Conclusions:

The measurements are performed in northern Brazil, in the state of Pará. In the first part of the project, local patients that are treated with chloroquine for arthritis were measured with the multifocal (mf) ERG to describe the changes in a Brazilian population. In a second part of the project people in local villages that take chloroquine against malaria will be measured with a portable mfERG system.

The results of the first part of the project are in agreement with the literature data, that the central retina is mainly affected by cloroquine intake.

Collaborators:

Markus Raster, Prof. Luiz Silveira, Dr. Folkert Horn, Prof. Anselm Jünemann, Dr. Christoph Kaltwasser.

Publications:

Financial support:

German Academic Exchange Council (DAAD), Staedler Stiftung

Project title: Multifocal ERG responses to rapid On- and Off- sawtooth stimuli.

Goals:

ERG responses to rapid On- and Off-sawtooth stimuli are mainly determined by the rapid change in the stimulus. The responses of a linear system to the two stimuli would be mirror images of each. As a result, the two responses would completely cancel each other when they are summed. Any remaining response after addition is an indication of present non-linearities. Non-linearities are cumulative and therefore responses from the inner retina tend to be more non-linear than responses originating in the outer retina. It is the goal of this project to measure the responses to multifocal sawteeth stimuli, to identify the nonlinearities and to compare the amplitudes of the different response components at different retinal locations with the cone and retinal ganglion cell density at the same location.

Results and Conclusions:

It was found that the responses to On- and Off-sawteeth are quite different and not mirror images of each other, indicating that many non-linearities are present. However, parts of the A-wave-like (N20) responses are cancelled, indicating outer retinal origins. Indeed these early responses display a spatial distribution that resembles that of the cones more strongly than that of the retinal ganglion cells. However, later responses (especially Photopic negative responses; N100) show less cancellation and therefore have more inner retinal origins. In agreement with this proposal the spatial arrangement of these responses resembles that of the retinal ganglion cells.

Collaborators:

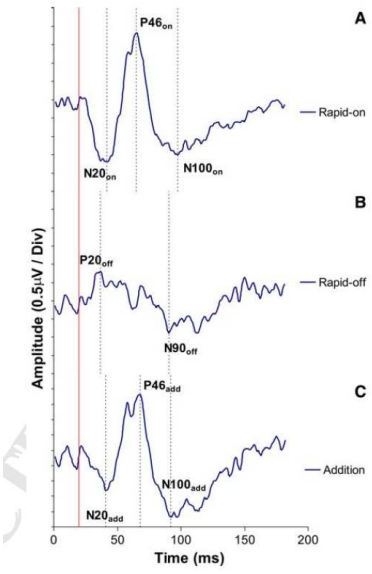
Anderson Rodrigues (University of Pará, Belém, Brazil), Prof. Luiz Silveira (University of Pará, Belém, Brazil), Prof Manoel da Silva Filho (University of Pará, Belém, Brazil), Gobinda Pangeni

Publications:

A.R. Rodrigues, M. da Silva Filho, L.C.L. Silveira, J. Kremers (2010). Spatial distributions of on- and off-responses determined with the multifocal ERG. Doc. Ophthalmol. Accepted.

Financial support:

DFG 1317/9-1, German Academic Exchange Council (DAAD), CAPES (Brazil), International Society for Clinical Electrophysiology in Vision.



Project title: L- and M-cone driven signals in the ERG to sawteeth and square wave stimuli.

Goals:

As mentioned in the previous project, the ERG responses to sawtooth stimuli may be helpful to identify the response components that originate in the inner retina. This may be very useful in diagnosing diseases of the inner retina such as glaucoma. In this project the inner and out retinal response components driven by the L- and the M-cones are analyzed using the summation of On- and Off-responses. The On- and Off-responses were measured with sawtooth and square wave stimuli. The influence of contrast, temporal frequency and interactions of signals originating in different cones are studied.

Results and Conclusions:

We measured the responses to sawtooth and square wave luminance, L-cone isolating, M-cone isolating, S-cone isolating, rod isolating stimuli. Furthermore, the responses to simultaneous stimulation of the L- and the M-cones with equal stimulation strength in both cones (i.e. equal cone contrast) were measured. When simultaneously stimulated the cones were stimulated in phase and in counter-phase.

It was found that the On- and Off-responses and their additions to square wave stimuli are different from the sawtooth responses, indicating different processing of the signals. Possibly adaptation processes play a role. The response amplitudes of the different components decrease with increasing temporal frequencies. With increasing stimulus strength at one temporal frequency the response amplitudes and their implicit times increase. The data indicate that luminance and chromatic signals are processed differently.

The addition of On- and Off-responses reveal response non-linearities. Similar non-linearities may be revealed by the pattern ERG. Thus, this method may be used under conditions at which the optical quality is suboptimal.

Collaborators:

Gobinda Pangeni, Prof. Michael Bach (University of Freiburg), Prof. Wolf Lagrèze (University of Freiburg)

Publications:

Financial support:

DFG 1317/9-1

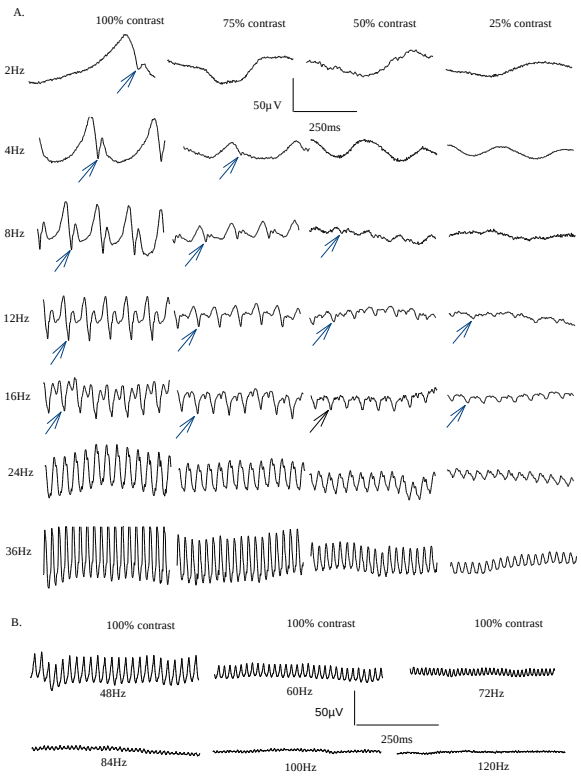
Project title: A new view on the ERG responses to luminance sine waves at different contrasts and different temporal frequencies.

Goals:

The first harmonic component of the ERG response in human subjects and in non-human primates to luminance sine wave stimuli show a conspicuous minimum between 10 and 20 Hz. Concomitant with the minimum in the first harmonic component, the second harmonic component displays a maximum, indicating a frequency doubled response. We revisited the responses to luminance sine wave stimuli but in contrast to previous studies, we included responses at different contrasts. These measurements led to a novel description of the ERG responses to luminance sine wave stimuli.

Results and Conclusions:

We measured the responses to luminance sine waves (white LEDs) at different temporal frequencies and different contrasts. We could confirm the frequency doubled response at frequencies between 10 and 20 Hz as described in the literature. By including response measurements to low contrasts, we were able to describe two response components: one sine-wave response component that was mainly recognizable at frequencies below about 12 Hz. A more 'peaky' component (see arrows) was visible at frequencies above 10 Hz. At lower frequencies, this component could also be detected at high contrast. An algorithm was developed with which the two components could be separated. The frequency doubling was caused by the interaction between these two components.



Collaborators:

Gobinda Pangeni

Publications:

G. Pangeni, J. Kremers: A new interpretation of components in the ERG signals to sine wave luminance stimuli at different temporal frequencies and contrasts. Submitted.

Financial support:

DFG 1317/9-1

Project title: The photopic negative response.

Goals:

The photopic negative response is a late negative component of the flash ERG with an implicit time of about 90 ms.

Results and Conclusions:

We measured the responses to luminance sine waves (white LEDs) at different temporal frequencies and different contrasts. We could confirm the frequency doubled response at frequencies between 10 and 20 Hz as described in the literature. By including response measurements to low contrasts, we were able to describe two response components: one sine-wave response component that was mainly recognizable at frequencies below about 12 Hz. A more ‘peaky’ component (see arrows) was visible at frequencies above 10 Hz. At lower frequencies, this component could also be detected at high contrast. An algorithm was developed with which the two components could be separated. The frequency doubling was caused by the interaction between these two components.

Collaborators:

Dr. Folkert Horn, Anja Ehrhardt

Publications:

J. Kremers, M. Jertila, B. Link, A. Ehrhardt, S. Rühl, F. Horn: Spectral characteristics of different response components in the full field flash electroretinogram. In preparation.

Financial support:

DFG 1317/9-1

Project title: Lateral interactions in the perception of luminance flicker. Retinal and cortical origins.

Goals:

The perception of flicker strength in a circular stimulus depends upon the phase of the modulation relative to the phase in a modulating surrounding annulus. Single cells in the lateral geniculate nucleus of marmosets respond in a very similar manner to the same stimuli. On the basis of the similarity we proposed that the origin of this interaction is subcortical and lies in the centre-surround composition of subcortical neurones. This hypothesis was tested in the present project. A subcortical (possibly retinal) signal of the lateral interactions might be helpful in detecting early glaucomatous changes.

Results and Conclusions:

The perceived flicker strength in a circular stimulus was measured when the phase of a surrounding flickering stimulus was varied. The surround stimulus was either presented in the contralateral eye in comparison with the circular stimulus (any interaction has a cortical origin) or in the same eye (an interactions originates in the retina and/or cortex). In the later the interaction was generally larger than when presented in the contralateral eye. This increase in interaction reflects a retinal mechanism. In a second experiment the influence of the size of the surround was measured.

We compared the perceived flicker strengths measured in normal subjects with those of glaucoma patients, who displayed no or minimal perimetrically measured visual losses. It was found that patients did show massive changes in comparison with normal subjects. This psychophysical test might be a very sensitive test for detecting glaucoma or other disorders of the inner retina, because the task depends upon structures of the receptive fields of the cells. Thus rather on being based upon the function or death of a cell it might be based upon more subtle changes of subcellular structures.

Collaborators:

Claudio Teixeira (University of Pará, Belém, Brazil), Gobinda Pangeni, Anthony D’Antona (University of Chicago), Prof. Steve Shevell (University of Chicago)

Publications:

C. Teixeira, J. Kremers: Cortical and subcortical mechanisms in lateral interactions in perceived flicker. In preparation.

Financial support:

German Academic Exchange Service (DAAD), CAPES (Brazil)

Project title: The long term effects of memantine on the retinal function of the DBA/2J mouse.

Goals:

The DBA/2J mouse is considered to be a mouse model for glaucoma in humans: the intraocular pressure increases at an age of about 6 months, at which age also the scotopic flash ERG changes. It was found before that the photopic flicker ERG was changed at an age of 3 months, suggesting that there are different types of functional deficits in the retina of the DBA/2J mouse.

Memantine is a partial NMDA receptor blocker, which blocks the receptor in the open state and therefore is believed only functional at unphysiologically high concentrates of glutamate. Glutamate excitotoxicity is believed to play an important role in neurodegenerations of the retina and the brain. Memantine is used for the treatment of Alzheimer's disease and it has also been discussed as a possible treatment of glaucoma. In the present study, the effects of long-term administration of memantine on the functional integrity of the retina in the DBA/2J mouse have been studied.

Results and Conclusions:

A group of 15 DBA/2J mice received two intra-peritoneal injections of memantine per day on five days per week at ages three to ten months. Scotopic flash ERGs and photopic flicker ERGs were recorded from these animals at ages 3, 6 and 10 months and compared with results of measurements in 5 untreated DBA/2J and 5 C57BL/6 mice. The ERGs in the latter two groups were very similar to those that were measured before in our group. The ERG data in the animals with memantine treatment did not show a difference in comparison with the untreated animals. Only the B-wave in the scotopic ERG were slightly less decreased in the treated animals. From this we conclude that memantine has no or only very small protective affects on the function of the retina in the DBA/2J mouse.

Collaborators:

Jenny Atorf, Dr. Joanna Harazny

Publications:

J. Harazny, M. Scholz, T. Buder, B. Lausen, J. Kremers (2009): Electrophysiological deficits in the retina of the DBA/2J Mouse. Doc Ophthalmol., accepted.

Financial support:

Novartis Institutes for BioMedical Research

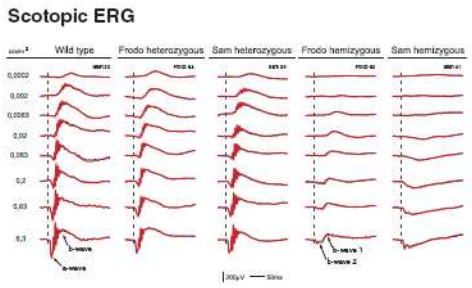
Project title: The ERGs in genetically modified mice with presynaptical voltage dependent Ca^{2+} channels of photoreceptors.

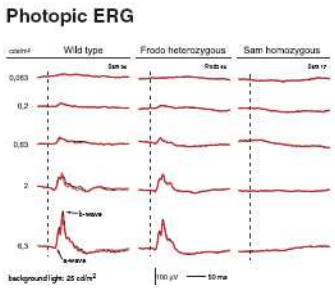
Goals:

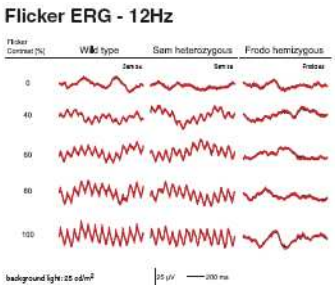
In New Zealand an X-linked genetical defect has been detected in a family of Maoris. This defect leads to a dysfunction of the presynaptical voltage dependent Ca^{2+} channels in the photoreceptors and to congenital stationary night blindness, often concomitant with other retinal disorders. The genetical defect has been introduced in two mouse lines (Frodo and Sam). We studied the functional deficits in these mice and compared these with results in wildtype animals. In addition, the retinae of the animals were studied anatomically.

Results and Conclusions:

The ERGs of the homozygous females and hemizygous males of the two mouse strains (Frodo and Sam) showed major deficits in the scotopic flash ERG, with smaller A-waves and nearly absent B-waves and other components with post-receptoral origins. The heterozygous females showed responses that were intermediate between the wildtype and the homozygous females. Similar results were obtained with photopic flash ERG and the photopic flicker ERG. The results are in line with the anatomical data which showed severe changes in the homo- and hemizygous animals; heterozygous animals displayed mosaics of altered and normal retinal areas.







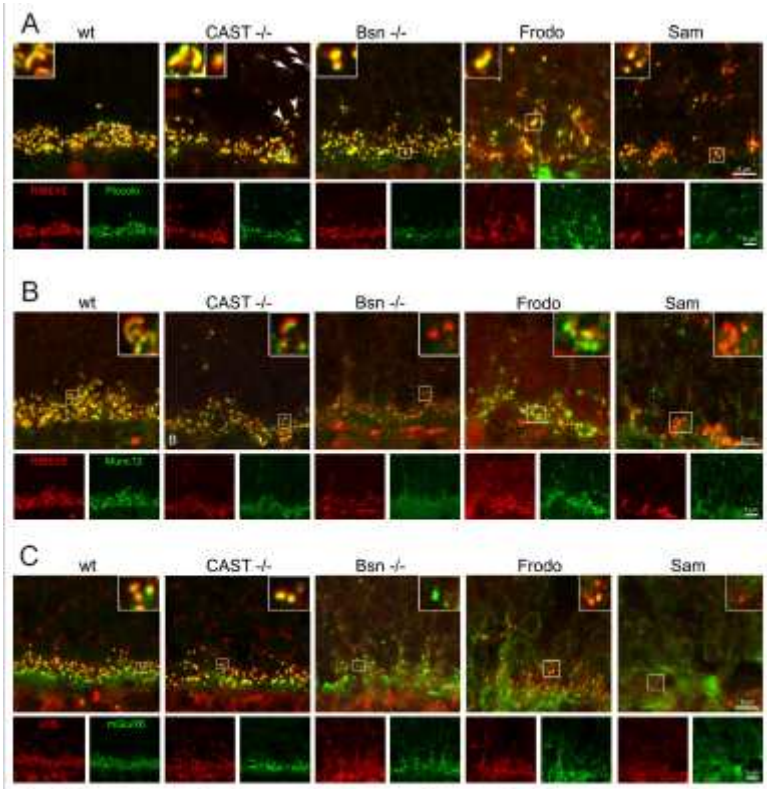


Fig. 2 Comparison of rod synaptic structure from wt, CAST-/-, Bsn-/- and Cacna1f mutants. (A) Wt synaptic ribbons, stained with RIBEYE and Piccolo antibodies, possess a typical aro-shaped structure not visible in Bsn and Sam mutants. CAST-/- ribbons and in rare cases Frodo ribbons display an intermediate structure. (B,C) While in CAST-/- mutants the localization of the arciform density protein Munc 13, the postsynaptic calcium channel (α1S) and the metabotrobic glutamate receptor (mGluR6) is similar to wt these proteins are mislocalized to a different degree in Bsn, Frodo and Sam mutants.

(courtesy of Specht and tom Dieck)

There is a good agreement between the anatomical, genetical, biochemical and electrophysiological data. The genetical deficits lead to a complete loss of function of the presynaptical voltage dependent Ca^{2+} channels. As a result, the signal transmission from the photoreceptors to the bipolar cells is disrupted. In heterozygous animals there are signs of Lionization so that retinal areas with loss of function and with normal function are interlocated leading to mosaics of retinal patches that can function normally (as seen in the anatomy) and which show ERGs that are intermediate between normal and completely defective as seen in the homo- and hemizygous animals.

Collaborators:

Jenny Atorf, Dana Specht, Suzanne Tom Dieck (Max Planck Institute for Biophysical Chemistry), Marion Maw (University of Otago, New Zealand), Johan Helmut Brandstätter (Dept. of Animal Physiology, Erlangen)

Publications:

Financial support:

Project title: Multifocal ERG measurements in the mouse with funduscopic control

Goals:

With a new multifocal screen build in a HRT device it is possible to stimulate the mouse retina while have visual control of the mouse retina. This setup can be used to obtain a spatial arrangement of the retinal responses.

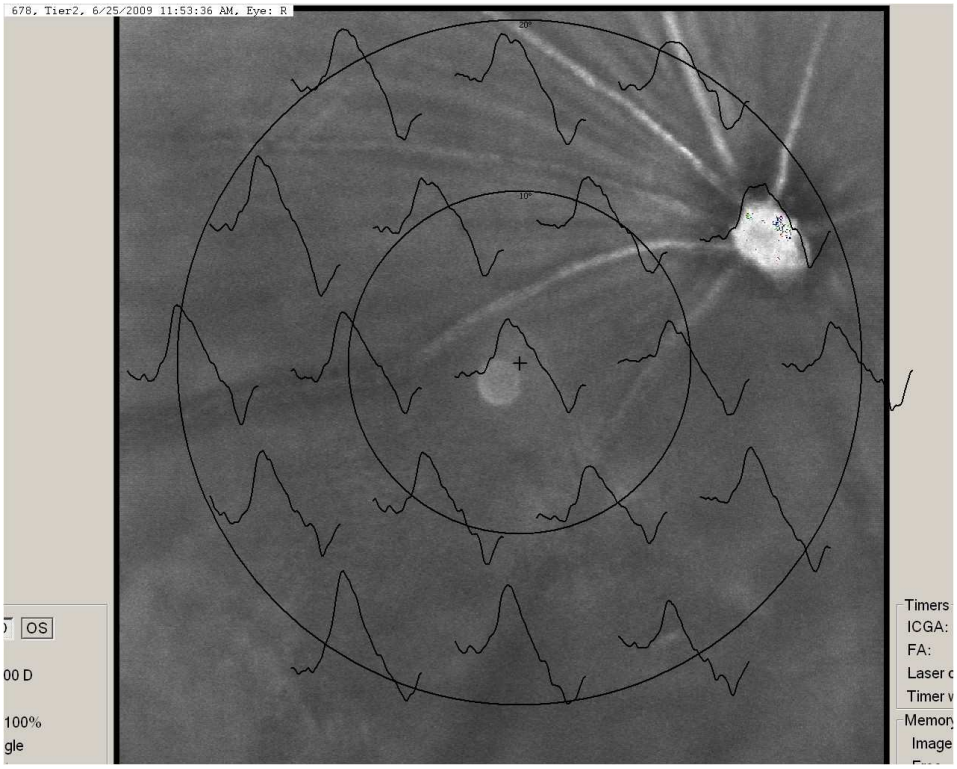
Results and Conclusions:

Measurements were performed in a several mice. It was possible to measure ERG responses which were different for different retinal locations. These measurements can be used to measure local functional defects in animals in which only parts of the retina are altered.

Collaborators:

Jenny Atorf, Hanna Regus-Leidig (Dept. of Animal Physiology, Erlangen), Johan Helmut Brandstätter (Dept. of Animal Physiology, Erlangen)

Financial support:



Project title: Public Private Partnerships in European Ophthalmology and Vision Research

Goals:

The goal of this project is to bring together academic and industrial partners for future scientific collaborations, to inform about important issues (intellectual properties, clinical studies, contract research etc.) and to identify the medical needs (patient organisations) and scientific wishes.

Results and Conclusions:

Meetings will be organized in which potential academic and industrial partner will be invited.

Collaborators:

Nikki Hafezi, Dr. Thomas Wheeler-Schilling

Publications:

Financial support:

EC-EuroVisionNet

Project title: Improvement of signal quality of multifocal electro-physiological tests (ERG, VEP) by eye-tracking.

Goals:

Multifocal (mf) tests such as ERG and VEP require good patient collaboration to achieve reliable results. Often, in patients who need for example a mfERG recording, visual function is impaired. Thus, stable fixation cannot be maintained during the whole examination. Eye movements are the consequence. In conventional systems, the algorithm is interrupted by each eye movement, resulting in prolonged examination times and reduced quality of the result. An eye-tracking system as it is used in many other ophthalmological systems may help to minimise these problems. Thus, the aim of the present work is the development and application of an eye-tracking system in electrophysiology.

Results and Conclusions:

System is under construction (FH Giessen-Friedberg).

Collaborators:

Barbara Link, Jan Kremers, Folkert Horn, Roberta Dominke (FH Giessen), Michael Kreutzer (FH Giessen), Klaus Wüst (FH Giessen), Klaus Rinn (FH Giessen), Joachim Finger (Fa. Roland-Consult).

Financial support:

Project title: Influence of topically applied tropicamide eye drops on intraocular pressure and ocular pulsatile amplitude measured with the dynamic contour tonometer (Pascal®).

Goals:

Anti-glaucomatous drugs are known to alter intraocular pressure (IOP) and ocular pulsatile amplitude (OPA) as measured with the dynamic contour tonometer (Pascal®). The influence of other drugs routinely applied in ophthalmological departments on IOP and OPA is not known. In the present study, the influence of tropicamide on IOP and OPA in healthy subjects is studied.

Results and Conclusions:

First results show a significantly increased OPA 15 minutes after application of tropicamide (DOG 2007). The study is being continued.

Collaborators:

Barbara Link, Ralph Tornow, Anselm Jünemann

Publications:

DOG 2007 (Poster).

Project title: Perimetry with Octopus 500 and Octopus 900, comparison of results.

Goals:

The diagnosis of glaucoma is based on the evaluation of the optic nerve head and the visual field. Thus, the recording of the accurate visual field is fundamental. The purpose of this study is to compare the results of two commercially availably perimeters, the “Octopus 500” and the “Octopus 900”.

Results and Conclusions:

The results of both devices are not statistically significant. Thus, in clinical routine it is possible to replace the older Octopus 500 by the later Octopus 900. An important improvement of the Octopus 900 is the reduced examination time, which reduces the fatigue effect on the patient and leads thus to a more reliable result.

Collaborators:

Christian Kozich, Barbara Link, Folkert Horn, Jan Kremers, Anselm Jünemann, Matthias Monhart (HaagStreit®).