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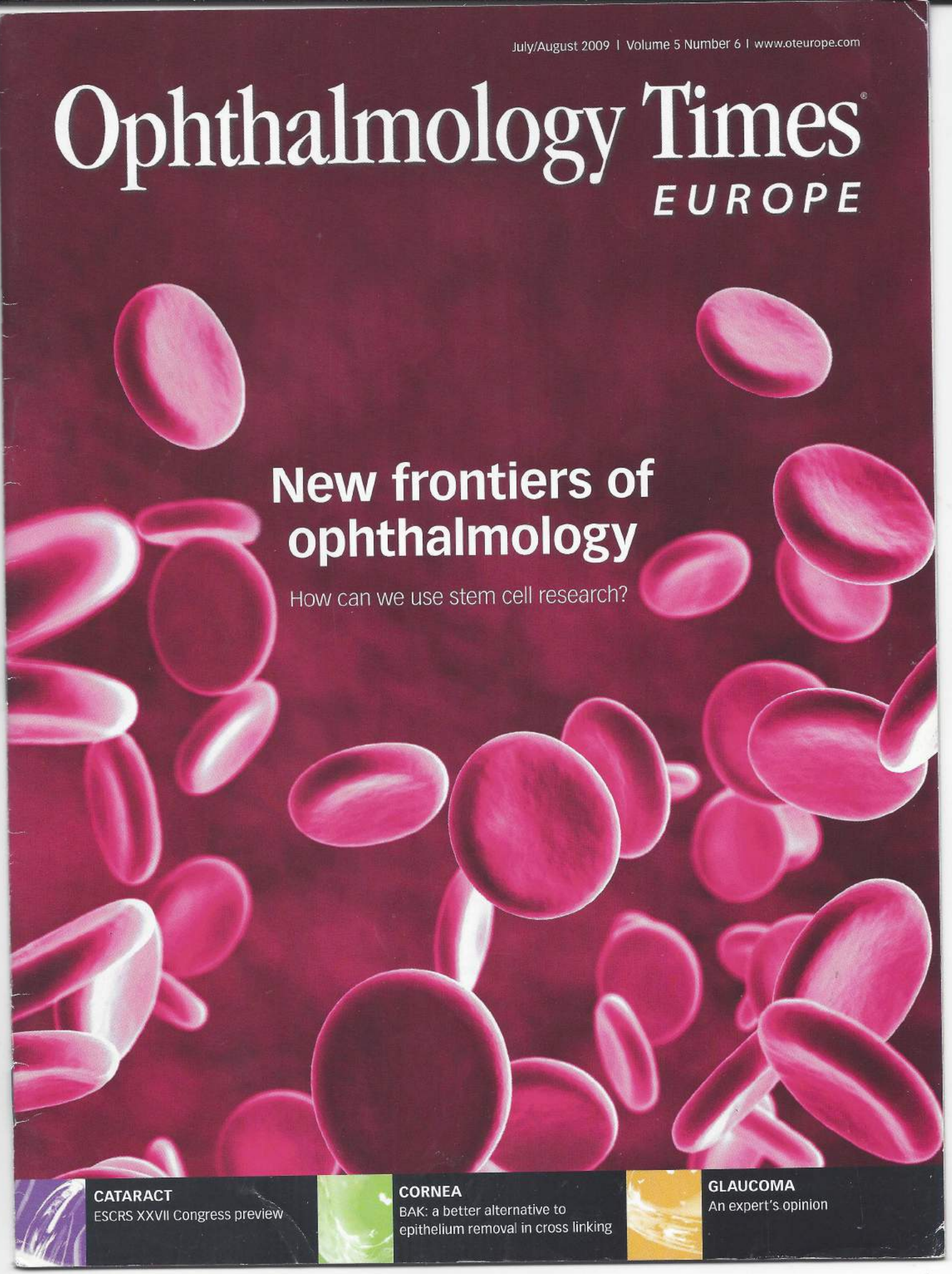

New frontiers of ophthalmology

How can we use stem cell research?

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New frontiers of ophthalmology – Part I

'Regenerative medicine' a treatment able to regenerate ocular tissue

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Stem cells can generally fall into four categories:

- **Totipotent**
- **Pluripotent**
- **Multipotent**
- **Unipotent**

Each individual **totipotent** stem cell has the ability to develop into a full-fledged living body, e.g. the zygote and the blastomere (embryo's first cells).

Pluripotent stem cells maintain their proliferation abilities on a lifelong basis and are divided asymmetrically, as one of the two sister cells continues to be a stem cell whereas the other starts differentiating. In mammals, pluripotent stem cells are present in the embryo node of the blastocyst during re-plantation of the uterus, as well as in embryos and foetuses during development and in adults, albeit limited to some regions of their body.

Totipotent stem cells differ from **pluripotent** stem cells since the latter cannot generate a full-fledged living body, but can specialise in cells able to generate a single organ or apparatus, since they come from one of the three germinative layers.

Multipotent stem cells can specialise only in some types of related cells, for example blood elements, such as red blood cells, white blood cells and blood platelets. **Multipotent** stem cells are also present in the nervous system of adults, as in the retina, which is one of the differentiations of the central nervous system.

Finally, **unipotent** stem cells can generate only a specific type of cell.

Depending on their origin, stem cells can also be classified as:

Adult: i.e. coming from the bone marrow of adults, or embryo, when taken from the umbilical cord:

- Adult stem cells are non-specialised cells of a specific tissue and are mainly totipotent. They are currently used for the treatment of several pathologies.
- Embryo stem cells are obtained through culture of the internal cells of a blastocyst (which is present only in embryos).
- Research on embryo stem cells is still taking tentative steps and is of course not without controversy. To obtain a cell line from these cells, it is necessary to destroy a blastocyst, that is an embryo that has not grown beyond 150 cells.

Blood left on the placenta and on the umbilical cord is also a source of adult haemopoietic stem cells. Since 1988, these cells have been used to treat Gunther disease, Hunter syndrome, acute lymphocytic leukemia and many other paediatric pathologies.

Blood is collected from the umbilical cord – during spontaneous labour or C-section alike – by taking a sample from the umbilical vein (in a sterile closed circuit). Then, the volume and the number of white blood cells are calculated, which must not be below 60 ml and 800 millions respectively.

It must be considered that this blood is not analysed directly given the potential presence of infectious agents. In fact, serologic tests are carried out on the parturient during labour and six months after cord donation. However, HLA typing is performed to verify if the donee is compatible with the donor's tissue. HLA typing results are published on global databases, accessible by transplant centres authorised to search for

compatible tissues for their patients. Blood taken from the umbilical cord is deprived of red blood cells and then cryo-preserved for future use at a temperature ranging from -130° to -196° C. Before transplantation, the blood is thawed and once all cryoprotective agents have been filtered, it is administered to the patient intravenously.

Prior to authorisation from the relevant authorities, it is also possible to take blood from the placenta and send it abroad for cryopreservation in private laboratories.

This type of treatment, where stem cells are taken from a donor, is commonly referred to as **heterologous** or **allogenic**.

Conversely, when stem cells are taken from the very same patients on whom they are going to be used, as we normally do in our medical practice, we refer to an autologous treatment.

How are we using this in ophthalmology?

As ophthalmologists, we are using autologous stem cells to treat ocular diseases.

Consequently, we have entered into a therapeutic co-operation and scientific research agreement with the X-Cell Centre, based in Cologne and Düsseldorf, Germany, (a Dutch-American multinational), at the Eduardus-Krankenhaus hospital.

We waited for 25 years before using stem cells for the treatment of ocular diseases and rose to the challenge with great anticipation. The first treatment ever in the history of ophthalmology was carried out at the beginning of February 2008.

An actual treatment with autologous stem cells means a treatment whereby ocular tissues can be regenerated, with the exception of the corneal epithelium, which is already abundantly reproduced in several centres, including the Bank of Corneas in Mestre.

It must be emphasised that the corneal-conjunctival epithelium is a type of tissue, which, more than any others, is spontaneously regenerated with no need of culture further to solution of continuity, burns, etc..

Treatment with autologous adult stem cells

Adult stem cells are taken from the bone marrow, and more specifically from the right or left iliac spine of the iliac bone in a local anaesthesia.

These cells are not specialised and reproduce daily to generate some specific cells: for example, 200 billion red blood cells are generated every day by haemopoietic stem cells, mainly in the spleen and in the bone marrow.

These totipotent stems cells can generate almost any type of

differentiated adult cells, including hepatic, neural, muscular, renal, follicular cells, retinal photo-receptors, etc..

The treatment with "autologous cells" is totally rejection-free, and there is no risk of contracting illnesses, unlike grafts from a donor (heterologous grafts), which notwithstanding controls, may imply a certain degree of risk.

One of the most promising applications of stem cells concerns degenerative or chronic diseases, which affect millions of patients.

Regenerative medicine needs a different approach compared to pharmacology. In fact, we are not talking about drugs as the action of cells is not only physical-anatomical but first and foremost bio-energetic. This type of information is not provided at all over a six-year medical degree course and following postgraduate studies.

It is quite odd that so-called conventional medicine has never considered a key element, that is the difference between a human being and a cadaver, since unlike the latter, the former has the ability to move and to pulse according to existing bio-rhythms, thereby showing that the true difference between the two is a bio-energy quantum.

Consequently, we rely on autologous stem cells as being able to 're-energise' or 'bio-energise' tissues in which they are implanted and subsequently, reproduce dead or damaged cells, recanalise or reconstruct vessels, nerve fibres, retinal photo-receptors, muscular fibers, etc..

Expectations of doctors and patients alike are huge and today we are starting to see the first results, at last.

However, despite these great expectations this treatment is usually misunderstood. People tend to consider it from the standpoint of modern medicine, whereby a missing mass (of cells) (because they are dead, infected or anyway inactive) is replaced by cells biologically performing a specific 'mass action.' This has proven to be inaccurate, since the action of these cells is:

- Bio-resonance: re-activation of stem cells, which are already present in the target organ and in the entire body. Therefore, no ponderal principle is enforced
- Selective and elective replacement of dead or damaged cells
- Bio-energisation of the target organ and the entire body

We still don't know for sure if and when these cells are activated.

We assume that the general bio-energetic conditions of the patient play a key role in the ability of removing dead or damaged cells from the target tissue. This means that the quantum of bio-energy, which can be measured using Amsat and Reflexograph devices, is essential to make these cells perform the biological and bio-energetic role we expect.

For some years now in our centre, we have been using bio-electronic and homotoxicologic medicine to treat the different hypoergic states of the patient, thereby increasing the quantum of vital energy present in the patient himself/herself. The aim is to treat - using only this new medicine – different pathologies where traditional medicine was not able to provide a positive answer.

Using our work, we aim to provide evidence about what can be done in ophthalmology using autologous stem cells.