

Joan Arehart-Treichel reports from Sarasota, Fla., at the spring meeting of the Association for Research in Vision and Ophthalmology

CEA antigen can diagnose eye tumors

Carcinoembryonic antigen (CEA) is a glycoprotein, thought to be tumor-specific, that may be of value in the identification of patients with various forms of cancer. Elevated CEA levels have been found in patients with cancer of the colon, lung, breast, prostate, pancreas, stomach and other organs. Now CEA appears to be useful in diagnosing metastatic (spreading) tumors of the eye.

John D. Bullock and Basel Yanes of Wright State University in Dayton, Ohio, have found elevated CEA levels in patients with spreading eye tumors but not in patients with primary eye tumors or with problems simulating eye tumors. The cancers detected have usually spread to the eye from other areas of the body. For instance, one patient who had a breast removed for cancer several years ago was found to have eye problems, and when she was analyzed for CEA her levels were found to be high. As the researchers feared, her breast cancer had spread to her eye.

In the blink of an eye

Eyelids have to do many complex things in order to blink, Marshall G. Doane of the Eye Institute in Boston has found, using a specialized, high-speed camera to make a detailed study of lid motion dynamics during and after subjects blink.

Everyone knows that the upper eyelid comes down during blinking. But Doane and his colleagues were surprised to find that the lower eyelid also moves down during blinking, and that it also "scooches over" sideways toward the nose. What's more, more than half of a subject's blinks are incomplete, and while the globe of the eye is essentially stationary during a blink, it is slightly pushed in. Tremendous blinking variations can also be found in the same subject.

So far Doane and his co-workers have only studied blinking in persons with healthy eyes.

Light and retina renewal

Vision in both humans and animals is due to light chemically and electrically exciting rods and cones (photoreceptor cells) in the retina of the eye. The photoreceptors then excite the optic nerve, which signals the visual cortex in the brain. The visual cortex processes, and passes on to higher brain centers, elements of the image of what the eye has seen.

A photoreceptor cell is a highly specialized nerve cell. It consists of a cell body (inner segment) complete with nucleus, cytoplasm and other normal cell equipment. It has an axon that carries a nerve impulse to the optic nerve. But what really makes the photoreceptor cell unusual is a stack of membrane disks coming off its cell body at the opposite end from where the axon sprouts from the cell body. This appendage is known as the outer segment of the cell. In this segment reside pigment molecules that initiate the visual process.

The photoreceptor cell has still another unusual feature—the ability to frequently renew its hundreds of membrane disks. Although the reason for this renewal is not known, there is increasing evidence suggesting that light influences the renewal process.

For instance, Joe G. Hollyfield and Mary E. Rayburn of Baylor College of Medicine in Texas studied the rate of rod outer segment development in tadpoles under light, dark and cyclic light conditions. They report that the rate of disk production was virtually identical under light-light and light-dark conditions, but was one-third lower in total dark condition. The relatively rapid rate of disk development in total light was found to be due to a reduction in disk loss through shedding and not to higher

rates of disk addition. In contrast, the reduced rate of disk development in total dark was the result of a slower rate of disk elaboration accompanied by an early onset and enhanced rate of shedding activity in darkness.

But how does light influence disk renewal? Because the pineal gland in the brain is known to mediate many light-triggered daily cycles in the body, it was tempting for vision researchers to speculate that light might influence disk renewal via the pineal. Matthew M. LaVail and Patricia Ann Ward of the University of California School of Medicine in San Francisco studied disk shedding in rats whose pineals had been removed and in rats with pineals. However, they were not able to observe any differences in shedding between the two groups of rats. So the means by which light influences disk renewal are still unknown.

Tears as a disease defense

Tears consist of clear saline fluid secreted in small amounts by the lacrimal gland. They are diffused between the eye and eyelids to moisten the parts and to facilitate motion. Tears are also shed during grieving. It now appears that they fill a third function as well—they help protect eyes from disease.

Tears were previously known to contain antibodies, notably IgA. And now Gilbert Yamamoto of Harvard Medical School and his colleagues report the presence of other immune defenders—complement proteins numbers three and four—in tear fluid taken from healthy subjects.

Major causes of blindness

Some primary causes of blindness were discussed by various scientists at a symposium entitled, "Why We Do Not See."

- **Glaucoma** is characterized by elevated pressure in the eyeball and by decreased oxygen and blood flow to the optic nerve. Nearly two million persons in the United States have this blinding disorder, and more than half are not aware of it. In most instances glaucoma can be successfully treated with drops or pills, but it must first be recognized in time by an ophthalmologist.

- **Senile macula degeneration** is the major cause of legal blindness in the United States. (The macula is a yellow spot on the retina, the area of maximum visual acuity.)

- **Corneal damage** can be a genetic condition or can be the result of trauma, cancer, infections, systemic drugs or other causes. Some 400,000 Americans are victims of corneal blindness. (The cornea is the transparent coat of the eyeball that covers the iris and pupil.)

- **Diabetic retinopathy** is retinal damage resulting from diabetes. An estimated 200,000 diabetics in the United States are blind from this condition.

- **Cancers** of the eye may require surgical removal of the eye.

- **Strabismus** (wandering eye) and **amblyopia** (lazy eye) strike one out of every 20 Americans and are two of the worst health problems in ophthalmology. For instance, amblyopia usually occurs because the eye was not used during the first few years of life, and visual acuity is usually arrested at the age at which the eye's visual development was interfered with. Some ophthalmologists advocate surgery early in life for this condition, others do not. In any event, only one percent of U.S. children younger than age five are being screened for amblyopia. One of the benefits of the Head Start program for socially disadvantaged youngsters was that it presented a strong indication to scientists of the prevalence of amblyopia among children.