Letters to the Editor

Human eye tissue for research

To the Editor:

Researchers who wish to study human eye material sometimes experience severe difficulties in finding a source of tissue for their laboratory investigations. The recent formation of tissue procurement committees by the Retinitis Pigmentosa Foundation and the National Diabetes Research Interchange attests to the fact that those with special tissue requirements are preparing to meet those needs. The purpose of this editorial is to point out the reasons for the scarcity of human eyes for laboratory studies as well as to suggest ways through which individual researchers can take advantage of the tissue available through local eye banks as a valuable source of research material.

The reasons for a dearth of human eyes for research are many; paramount is the paucity of human donations. The donation of eyes of one who is recently deceased is a very recent custom in the history of medicine and is still the exception rather than the rule. In fact, archeological evidence shows that burying the entire body has been practiced for over 10,000 years. Efforts are now being made within the current generation to reverse this ancient custom by removing certain organs before disposing of the cadaver.

Of course, the primary reasons for seeking eye donations has been the need for corneas for human transplants. This is the basic reason that eye banks began, and their spread has followed closely the need to procure more corneas for keratoplasties. In 1975 for example, members of the Eye Bank Association of America donated 6,500 corneas for surgeons and their patients, whereas they procured over 13,000 corneas in 1980. Although researchers began approaching eye banks early on as a likely source of research tissue, the volume of eyes required was far less than what is needed today.

Some who have studied this problem have concluded that there are more than enough potential donors to supply the need for transplantation and research. Dobell et al.¹ hold that "supply limitations reflect deficiencies in organization, communications, and logistics of organ recovery efforts." To substantiate their claim, the authors note that from 1975 to 1977, 57% of the kidneys procured in the New York/New Jersey region came from 18 hospitals representing only 13% of the area's acute-care beds. Another study searched the charts of 718 decedents in a large teaching hospital² to determine which organs might be suitable for transplants. Although potential kidney donors were only 17 of the sample of decedents (2.4 per hundred deaths), potential pancreas donors were 189 (26.5 per hundred deaths) and potential eye donors were 324 (45.4 per hundred hospital deaths). The experiences of nearly all of the 80 eye banks currently existing in the United States are similar. Very few hospitals give the vast bulk of the eye tissue, and this is a reflection of the organization and motivation for organ retrieval after death. Retrieval of eyes is not only possible but is frequent when this opportunity is offered to the next of kin.

One study conducted in the greater Los Angeles³ area found that 54% of a random sample from a multimillion population area felt positively about giving eyes, kidneys, and heart, while 34% were very favorable to giving the entire body for needed research. However, less than 1% of all deaths provide all tissues for therapy, research, and didactic use. If 54% are willing to give, why do less than 1% actually give? The discrepancy must be because no one is asking for donations or that they are not asking properly.

Although there is considerable need to increase the number of eye donations currently being received, the best sources of eye tissue for research are local eye banks. Even though corneas are utilized for transplantation purposes, the remainder of the eye could be made available for research purposes. The establishment of strong cooperation and communication between researchers and Eye Bank personnel could lead to a means of retrieval of much more human material for laboratory studies. A significant step in establishing effective communication would be for the researcher to visit the local Eye Bank, discuss the project under study, and extend an invitation to the Eye Bank personnel to visit the laboratory.

By far the best way to form a partnership between the Eye Bank and the researcher would be an offer to assist the Eye Bank. This might be an offer to cover some of their expenses or to give a talk at an Eye Bank Board meeting on the current and possible outcomes of the research in question. Even if researchers are not contributing hard dollars to the Eye Bank, they may well assist the eye bank to motivate the Board to procure the funds necessary to cooperate with the research in ques-
The notion that "these eyes were only good for eye tissue research. This implies cooperation, 2. Etheridge EE, Maeser MN, Sicard GA, and Ander-

This might include going with an eye banker to acknowledge their support in one's publications. If the researcher offers to assist the Eye Bank in tissue procurement, a partnership is beginning. The problems we have discussed are not only communication to improve the progress of human problems but opportunities. Our hope is that in-

Such a cooperative program may begin to erase the concept that utilizing human eyes for research is a poor second or third choice to transplantation. The notion that "these eyes were only good for research" because a donor was over 70 years of age or died in the presence of a systemic infection or other kinds of contraindications for grafting are not totally accurate notions. Research leads to pre-

We have focused on the need for two-way communication to improve the progress of human eye tissue research. This implies cooperation, mutual educational effort, sharing with an eye bank the results of one's research findings, and acknowledging their support in one's publications. The problems we have discussed are not only problems but opportunities. Our hope is that interested parties over the next months and years will observe those researchers and eye banks that are enjoying an excellent relationship and will try to learn from them and to emulate them in their own area.

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Molecular shape and effective diffusion radius
To the Editor:
The determination of the pore size of artificial or biological membranes by probe molecules of known dimension is a useful technique. However, one must be careful not to draw the wrong conclusions by using as probes molecules of uncertain shape. Thus Bellhorn, in his recent paper "Per-

meability of blood-ocular barriers of neonatal and adult cats to fluorescein-labeled dextrans of se-

lected molecular sizes" (INVEST OPHTHALMOL VIS SCI 21:282, 1981), assumed that the "effective diffusion radius" (EDR) of the dextran fractions, used by him and before by others as probes, represents the true molecular dimensions of more or less rigid spherical molecules.

The given EDR corresponds to the Stoke's radius of the dextran fractions. The Stoke's radius is the average hydrodynamic radius of a molecule obtained from viscosity and translation diffusion coefficients of the molecule in solution. The Stoke's radius, calculated by well-known formulas, is closest to the true molecular radius when the molecule in solution approaches the shape of a sphere. The deviation is greatest when the mole-

ule has an ellipsoidal shape with an axial ratio larger than 2. Consequently, the greater the dev-

iation from sphericity, the less useful the Stoke's radius of a molecule as a probe for the determina-

tion of the porosity of membranes.

Dextrans are polysaccharides that apparently diffuse across membranes not as spherical particles but as elongated flexible molecules. Thus a dex-

tran fraction of 110,000 molecular weight (Stoke's radius about 68 Å) will penetrate through an arti-

ficial Diaflo membrane (Amicon) that will not allow the diffusion of a globular protein such as myoglobin of 12,400 molecular weight (Stoke's radius about 15 Å). Also, when we used FITC-dextran fractions of molecular weights similar to those used by Bellhorn, their penetration into arti-

ficial hydrogel membranes was not related to the Stoke's radius of the dextran fractions. Our results indicate that dextran fractions behaved in their penetration through pores as flexible rodlike mole-

cules and that the different molecular weight dextran fractions behaved as having similar mole-

cular thicknesses for widely different molecular